MASTER BUILDING SPECIFICATION
DOCUMENT 00010
TABLE OF CONTENTS

INTRODUCTORY INFORMATION

00010  TABLE OF CONTENTS

DIVISION 01 – GENERAL REQUIREMENTS

DIVISION 02 – SITE WORK

02050  DEMOLITION
02230  CLEARING AND GRUBBING
02231  TREE PROTECTION
02240  DEWATERING
02250  EXCAVATION SUPPORT SYSTEMS
02282  SOIL TREATMENT FOR TERMITE CONTROL
02300  EARTHWORK
02310  GRADING
02316  EXCAVATING, BACKFILLING AND COMPACTING FOR PAVEMENT
02317  EXCAVATING, BACKFILLING AND COMPACTING FOR STRUCTURE
02318  EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES
02372  STORM WATER POLLUTION PREVENTION
02375  CAST-IN-PLACE DRILLED PILES
02505  BITUMINOUS SURFACING
02506  CONCRETE WHEEL BUMPERS
02510  WATER DISTRIBUTION
02517  PORTLAND CEMENT CONCRETE PAVING
02523  LANDSCAPE BOULDER
02536  PRE-CAST CONCRETE CLARIFIERS
02580  TELECOMMUNICATIONS TOWER
02620  STORM DRAINAGE SYSTEMS
02667  SITE WATER DISTRIBUTION
02687  NATURAL GAS DISTRIBUTION
02720  BASE COURSE
02730  SANITARY SEWERAGE SYSTEMS
02745  ASPHALTIC CONCRETE PAVING
02764  PAVEMENT JOINT SEALANTS
02780  INTERLOCKING CONCRETE PAVING
02810  IRRIGATION
02824  ORNAMENTAL ALUMINUM BI-PARTING GATES
02826  ORNAMENTAL ALUMINUM SWING GATES
02831  CHAIN LINK FENCES AND GATES
02836  SLIDING GATES AND OPERATORS
02840  PARKING APPURTEANCES
02847  DECOMPOSED GRANITE PATHS
02856  PRE-CAST CONCRETE FENCING
02870  SITE FURNISHING
02871  BICYCLE RACKS
02900  LANDSCAPE PLANTING
02910  PLANT PROTECTION AND PRUNING
<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>02920</td>
<td>LANDSCAPE MAINTENANCE</td>
</tr>
<tr>
<td>02951</td>
<td>PALM PLANTING</td>
</tr>
<tr>
<td>02955</td>
<td>BOLLARDS (CONCRETE FILLED PIPE)</td>
</tr>
</tbody>
</table>

**DIVISION 03 – CONCRETE**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>03100</td>
<td>CONCRETE FORMWORK</td>
</tr>
<tr>
<td>03106</td>
<td>UNDER SLAB VAPOR / METHANE MEMBRANE BARRIER</td>
</tr>
<tr>
<td>03200</td>
<td>CONCRETE REINFORCEMENT</td>
</tr>
<tr>
<td>03230</td>
<td>UNBONDED POST – TENSIONING</td>
</tr>
<tr>
<td>03300</td>
<td>CAST-IN-PLACE CONCRETE</td>
</tr>
<tr>
<td>03302</td>
<td>UNDER SLAB VAPOR BARRIER / RETARDER</td>
</tr>
<tr>
<td>03331</td>
<td>CAST-IN-PLACE ARCHITECTURAL CONCRETE</td>
</tr>
<tr>
<td>03371</td>
<td>SHOTCRETE</td>
</tr>
<tr>
<td>03521</td>
<td>LIGHTWEIGHT INSULATING CONCRETE</td>
</tr>
</tbody>
</table>

**DIVISION 04 – MASONRY**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>04220</td>
<td>CONCRETE BLOCK MASONRY</td>
</tr>
<tr>
<td>04860</td>
<td>STONE VENEER ASSEMBLIES</td>
</tr>
</tbody>
</table>

**DIVISION 05 – METALS**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>05120</td>
<td>STRUCTURAL STEEL</td>
</tr>
<tr>
<td>05121</td>
<td>ARCHITECTURALLY – EXPOSED STRUCTURAL STEEL</td>
</tr>
<tr>
<td>05210</td>
<td>STEEL JOISTS</td>
</tr>
<tr>
<td>05300</td>
<td>METAL DECK</td>
</tr>
<tr>
<td>05310</td>
<td>ACOUSTICAL METAL DECKING</td>
</tr>
<tr>
<td>05311</td>
<td>STEEL DECK</td>
</tr>
<tr>
<td>05410</td>
<td>EXTERIOR LIGHT GAUGE MEAL FRAMING</td>
</tr>
<tr>
<td>05500</td>
<td>METAL FABRICATIONS</td>
</tr>
<tr>
<td>05504</td>
<td>WELDED OR CRIMPED WINE MESH PANELS AND DOORS</td>
</tr>
<tr>
<td>05506</td>
<td>SPECIAL FABRICATION AND TRANSFER DOOR ASSEMBLIES</td>
</tr>
<tr>
<td>05510</td>
<td>STEEL STAIRS</td>
</tr>
<tr>
<td>05515</td>
<td>FIXED ALUMINUM LADDERS</td>
</tr>
<tr>
<td>05521</td>
<td>PIPE AND TUBE RAILINGS</td>
</tr>
<tr>
<td>05523</td>
<td>DECORATIVE GLASS RAILINGS</td>
</tr>
<tr>
<td>05525</td>
<td>PIPE RAILINGS</td>
</tr>
<tr>
<td>05530</td>
<td>GRATINGS</td>
</tr>
<tr>
<td>05533</td>
<td>PAINTED STEEL CANOPIES</td>
</tr>
<tr>
<td>05538</td>
<td>STEEL SECURITY GRILLES AND GATES</td>
</tr>
<tr>
<td>05554</td>
<td>TRAFFIC GRADE GRATINGS</td>
</tr>
<tr>
<td>05716</td>
<td>LOUVERED SWING GATES</td>
</tr>
</tbody>
</table>

**DIVISION 06 – WOOD AND PLASTIC**

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>06100</td>
<td>ROUGH CARPENTRY</td>
</tr>
<tr>
<td>06200</td>
<td>FINISH CARPENTRY</td>
</tr>
<tr>
<td>06400</td>
<td>ARCHITECTURAL WOODWORK</td>
</tr>
<tr>
<td>06425</td>
<td>SOLID COMPOSITE COUNTERTOP WORK SURFACES</td>
</tr>
<tr>
<td>06622</td>
<td>SOLID SURFACING</td>
</tr>
</tbody>
</table>
DIVISION 07 – THERMAL AND MOISTURE PROTECTION

071311 TILE WATERPROOFING
071353 SHOWER PAN WATERPROOFING
071413 HOT FLUID-APPLIED WATERPROOFING
071406 COLD FLUID-APPLIED TRAFFIC COATINGS
071713 BENTONITE WATERPROOFING
071716 COMPOSITE SHEET WATERPROOFING
071912 WATER-REPELLENT COATING
072116 BUILDING INSULATION
072613 WATER VAPOR TESTING AND CONTROL
073113 ASPHALT SHINGLES
073213 CLAY ROOFING TILES
074143 COMPOSITE METAL PANELS
075219 MODIFIED BITUMEN SHEET ROOFING
075554 SINGLE-PLY THERMOPLASTIC MEMBRANE ROOFING
077213 PRE-FABRICATED CURBS AND SUPPORT
079200 SEALANTS AND CAULKING

DIVISION 08 – DOORS AND WINDOWS

08110 STEEL DOORS AND FRAMES
08120 ALUMINUM DOORS AND FRAMES
08210 WOOD DOORS
08305 ACCESS PANELS AND FRAMES
08311 ACCESS DOORS
08331 COILING STEEL DOORS
08338 AS OVERHEAD COILING COUNTER SHUTTERS
08410 ALUMINUM ENTRANCES AND STOREFRONTS
08510 STEEL WINDOWS
08520a ALUMINUM WINDOWS
08586 ALUMINUM SECURITY WINDOWS
08621 PLASTIC SKYLIGHTS
08625 METAL FRAMED SKYLIGHTS
08630 METAL FRAME SKYLIGHTS
08710 DOOR HARDWARE
08715 AUTOMATIC SWING DOOR OPERATORS
08800 GLAZING
08900 EXTERIOR GLAZED ASSEMBLIES AND ENTRANCES
08920 GLAZED ALUMINUM CURTAIN WALL

DIVISION 09 – FINISHES

09108 INTERIOR LIGHT GAUGE METAL FRAMING
09197 PLASTER REVEAL MOLDINGS
09225 GREY ACRYLIC FINISH STEEL TROWELED PLASTER
09257 EXPANDED METAL MESH BEHIND DRYWALL
09559 CEMENTITIOUS TILE BACKERBOARDS
09260 GYPSUM BOARD SYSTEMS
09310 CERAMIC TILE
09500 ACOUSTICAL PANEL CEILINGS
09547 WOOD SUSPENDED CEILINGS
09549 PANEL GRILLE SUSPENDED WOOD CEILING SYSTEM
09623 RESILIENT FOAM SPORTS FLOORING
09624 VAPOR EMISSION AND ALKALINITY TESTING FOR FOAM SPORTS FLOORING
09653 RUBBER BASE
09671 RESINOUS FLOORING
09680 CARPETING
09762 FLUID APPLIED QUARTZ CHIP FLOORING
09778 SOLID PHENOLIC WALL PANELING
09817 HIGH-BUILD FIBERGLASS REINFORCED GLAZED COATING
09819 HIGH-BUILD THERMOSETTING POLYESTER GLAZED COATING
09841 CO-POLYMER FACED ACOUSTICAL PANELS
09860 ANTI GRAFFITI COATING
09900 PAINTING
09901 CONCRETE STAINING
09902 CLEAR CONCRETE FLOOR SEALER

DIVISION 10 - SPECIALTIES

10101 MARKERBOARD AND TACKBOARD ASSEMBLIES
10155 STAINLESS STEEL TOILET PARTITIONS
10170 SOLID COMPOSITE TOILET PARTITIONS
10205 GALVANIZED WALL LOUVERS
10248 ROLL FORMED ALUMINUM SCREENS
10350 FLAGPOLES
10440 SIGNS
10442 CAST BRONZE BUILDING PLAQUE
10445 MONUMENT SIGN
10501 METAL LOCKERS
10520 FIRE EXTINGUISHERS, CABINETS AND ACCESSORIES
10671 METAL STORAGE SHELVING
10701 LOCKER ROOM BENCHES
10704 PASS THRU EVIDENCE LOCKERS
10800 TOILET ROOM ACCESSORIES
10910 BABY DIAPERING STATION

DIVISION 11 - EQUIPMENT

11012 EQUIPMENT FOR CONFINED SPACE ENTRY
11021 VAULT DOOR AND DAY GATE
11022 SERVICE WINDOW – BULLET RESISTANT
11130 PROTECTION SCREEN
11132 MOTORIZED PROJECTION SCREEN
11150 PARKING CONTROL EQUIPMENT
11160 LOADING DOCK EQUIPMENT
11170 AUTOMOTIVE MAINTENANCE EQUIPMENT
11196 STEEL DETENTION SCREEN
11410 FOOD SERVICE COOKING EQUIPMENT
11411 FOOD SERVICE WAREWASHING EQUIPMENT
11415 FOOD SERVICES SELF-CONTAINED REFRIGERATION EQUIPMENT
11460 UNIT KITCHEN

DIVISION 12 – FURNISHING

12345 SOLID COMPOSITE CASEWORK
12356 METAL KITCHEN CASEWORK
12485 FOOT GRILLES
12491 HORIZONTAL VENETIAL BLINDS
12494 ROLLER SHADES
12520 MANUAL CHAIN OPERATED WINDOW SHADES
12614 MULTIPLE USE FIXED SEATING
12690 ENTRANCE MATS

DIVISION 13 – SPECIAL CONSTRUCTION

133421 CAR WASH

DIVISION 14 – CONVEYING SYSTEMS

14120 ELECTRIC DUMBWAITERS (DRUM TYPE_)
14121 ELECTRIC DUMBWAITERS (GEARED TRACTION)
14132 NON-PERSONNEL TRACTION ELEVATOR
14133 NON-PERSONNEL HYDRAULIC ELEVATOR
14210 ELECTRIC TRACTION ELEVATORS
14240 HYDRAULIC ELEVATORS
14325 VERTICAL TRANSPORTATION MAINTENANCE
14560 GRAVITY CHUTES (TRASH)
14561 GRAVITY CHUTES (LINEN)

DIVISION 15 – MECHANICAL

15010 BASIC MECHANICAL REQUIREMENTS
15030 ELECTRICAL REQUIREMENTS FOR MECHANICAL EQUIPMENT
15050 BASIC MECHANICAL MATERIALS AND METHODS
15060 HANGERS AND SUPPORTS
15100 VALVES
15125 PIPE EXPANSION JOINTS
15135 METERS AND GAGES
15190 MECHANICAL IDENTIFICATION
15240 SEISMIC RESTRAINTS AND VIBRATION ISOLATION
15250 MECHANICAL INSULATION
15330 FIRE PROTECTION
15350 PREACTION SPRINKLER SYSTEMS
15400 PLUMBING
15410 PLUMBING PIPING
15440 PLUMBING FIXTURES
15453 PUMPS
15480 WATER TREATMENT EQUIPMENT
15481 COMPRESSED AIR SYSTEM
15490 SPECIAL SYSTEM
15491 AUTOMOTIVE FUEL STORAGE AND DISPENSING
15492 CLARIFIER
15500 HEATING AND AIR CONDITIONING PIPING SYSTEMS
15550 HEATING EQUIPMENT
15850 AIR CONDITIONING AND AIR HANDLING EQUIPMENT
15851 SPECIALTY DUCT SYSTEM
15880 AIR TRANSMISSION AND AIR DISTRIBUTION SYSTEMS
15970 TEMPERATURE CONTROL SYSTEMS
15975 ENVIRONMENTAL CONTROL SYSTEMS
15990 TESTING, ADJUSTING AND BALANCING

DIVISION 16 – ELECTRICAL

16050 ELECTRIC MATERIALS AND METHODS
16070 ELECTRIC EQUIPMENT CONNECTIONS
16100 EQUIPMENT NOISE VIBRATION SEISMIC
16110 RACEWAYS AND BOXES
16114 CABLE TRAYS
16118 DUCTBANK
16120 CONDUCTORS AND CABLES
16140 WIRING DEVICES
16190 SUPPORTING DEVICES
16195 ELECTRIC IDENTIFICATION
16400 POWER SYSTEM STUDY
16421 UTILITY SERVICE ENTRANCE
16441 SWITCHBOARDS
16442 POWER METERS
16452 GROUNDING
16460 DRY-TYPE TRANSFORMERS
16470 PANEL BOARDS
16475 FUSES
16476 DISCONNECT SWITCHES AND CIRCUIT BREAKERS
16481 MOTOR CONTROLLERS
16482 MOTOR CONTROL CENTERS
16511 LIGHTING
16520 LIGHTING CONTROL SYSTEM
16600 AUTO TRANSFER SWITCHES
16621 PACKAGED ENGINE GENERATOR
16631 LIGHTING INVERTER
16721 FIRE ALARM SYSTEMS

DIVISION 17 – TECHNOLOGY

17000 SECURITY ELECTRONIC GENERAL PROVISIONS
17010 RACEWAYS
17020 CONDUCTORS
17030 COMPUTERS
17040 GROUNDING AND SURGE PROTECTION
17050L CABINETS AND ENCLOSURES
17120 FIBER OPTIC CABLE SYSTEM
17150 DOOR CONTROL SYSTEM
17160 PROGRAMMABLE LOGIC CONTROLLERS
17170 SECURITY MONITORING AND CONTROL SYSTEM
17200 CLOSED CIRCUIT TELEVISION SYSTEM
17210 DIGITAL VIDEO RECORDING SYSTEM
17250 SITE INTERCOMMUNICATIONS SYSTEM
17260 DEDICATED INTERCOM AND GENERAL PAGING SYSTEM
17300 CONTROL PANELS AND CONSOLES
17350 ACCESS CONTROL SYSTEM
17360 WATCHTOUR SYSTEM
17380 VIDEO VISITATION SYSTEM
17500 WEAPON DETECTION SYSTEM
17600 PERSONAL ALARM SYSTEM
17700 TELEVISION DISTRIBUTION SYSTEM
17800 VEHICLE DETECTORS
17850 ELEVATORS CONTROL INTERFACE
17860 UTILITY CONTROL INTERFACES
17900 UNINTERRUPTIBLE POWER SYSTEMS
PART 1 - GENERAL

1.1 SUMMARY

A. Carefully demolish all existing structures and improvements indicated or noted on the Contract Drawings to be demolished and remove them from the premises.

B. Related Work Sections:

1. Documents affecting work of this Section include, but are necessarily limited to the GENERAL CONDITIONS, and Sections in GENERAL REQUIREMENTS of DIVISION 1 of these Specifications.

2. Construction Waste Management Work in Section 01028

3. Other Sitework in Division 2.

4. Concrete Work in Section 03300.

1.2 QUALITY ASSURANCE

A. Labor: Use adequate numbers of skilled laborers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Codes and Regulations: Comply with all applicable Government Codes and Regulations, of City of Los Angeles especially meeting safety standards and regulations of CAL/OSHA. Provide additional measures, added materials and devices as may be needed as directed by the City Engineer or the Consultant, at no added cost to the City.

1.3 MISCELLANEOUS GENERAL REQUIREMENTS

A. General: Comply with the following as specified in the General Conditions and Division 1.

1. Erection and maintenance of protections.

2. Dust Control.

3. Repair of Damages.


B. Notifications Concerning Utilities: All Utility Companies owning conduit, pipes and sewers running to and from City properties to be notified to make arrangements for their removal or capping in accordance with instructions from the City Engineer or the Consultant.

1. Notify the City (310-217-8363) when utilities should be turned off or vacated for demolition purposes.
2. Repair damaged or broken existing utilities subject to the approval of the City Engineer or the Consultant at no added cost to the City.

C. Protection of Site Improvements: As required by approved methods as and authorized by the City Engineer or the Consultant as follows as applicable:
   1. Protect all existing improvements that are to remain in-place.
   2. Remove all protections when work is completed and when authorized by the City Engineer or the Consultant.

D. Repair of Damage:
   1. The Contractor shall repair any damage to existing improvements that may have been caused by his or her operations outside the scope of work of this Section, at no cost to the City.
   2. Methods: Repair or replace existing damaged improvements with new materials as necessary for restoration of damaged areas or surfaces to a condition equal to and matching that existing prior to damage occurrence, to the full satisfaction and approval of the Owner (City) or its authorized representative.

E. Scheduling of Work Operations: Submit demolition and removal schedule and procedures to the City Engineer or the Consultant within 15 days after date of City-Contractor Agreement.

F. Non-Interference: Conduct demolition and removal operations in a manner to minimize interference with City Park operations in adjacent areas. Maintain protected egress and access at all times during Contracted Work operations.

G. Control the generation of dust by wetting down materials that are susceptible to the production of particulate matter. Use an approved dust palliative where appropriate.

1.4 WORK PLAN

A. Submit a demolition work plan to the City Engineer in accordance with Section 01330. The procedures planned and proposed for the accomplishment of the work. The procedures shall provide for safe conduct of the work, careful removal and protection of property which is to remain undisturbed, coordination with other work in progress, and timely disconnection of utility services.

B. The plan shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 SITE CONDITIONS

A. Examine the Job-site areas and conditions under which work of this Section will be performed.
B. Correct conditions detrimental to timely and proper completion of Contracted Work as
directed by the City Engineer or the Consultant. Do not proceed with Contracted Work
until detrimental conditions have been corrected.

3.2 DEMOLITION

A. Prior to start of demolition operations carefully study the Contract Drawings and these
Specifications. In the company of the City Engineer, City authorized representative or the
Consultant, visit the job-site as necessary to further verify the extent of the work to be
performed under this Contract.

B. Discovery of Hazardous Substances: Conform to provisions of the GENERAL
CONDITIONS. The City will initiate a hazardous materials survey prior to award of
contract.

C. Coordination: Fully coordinate work of this Section with other Contracted Work
operations so as not to interfere with City Park operations on the job-site.

3.3 REPLACEMENTS

A. In the event of demolition of items not so scheduled to be demolished or removed,
promptly replace such items to the approval of the City Engineer, authorized
representative or Consultant, at no added cost to the City.

3.4 CLEAN-UP AND DISPOSAL

A. Comply with applicable provisions specified in Section 01710 in DIVISION 1 GENERAL
REQUIREMENTS of these Specifications.

3.5 BURNING

A. The use of burning at the project site for the disposal of refuse and debris will not be
permitted.

3.6 USE OF EXPLOSIVES

A. Use of explosives will not be permitted.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. The work includes clearing and grubbing areas within the boundary limits shown on the plans or staked by the Surveyor. This work also includes protecting from harm all trees, bushes, shrubs or other objects selected to remain.

1. “Clearing” means removing and disposing of all unwanted material from the surface such as trees, brush, down timber or other natural materials.

2. “Grubbing” means removing and disposing of all unwanted vegetative matter from the underground such as sod, stumps, roots, buried logs or other debris.

3. “Debris” means all non-usable natural material produced by clearing and grubbing.

1.2 STANDARD SPECIFICATIONS

A. All work to be performed and materials to be used shall be in accordance with the Standard Specifications for Public Works Construction, latest edition and supplements.

B. The Contractor shall have one copy of the Standard Specifications at the job site.

C. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

PART 2 - PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 DISPOSAL

A. Disposal shall be in conformance with local jurisdiction requirements.

3.2 CLEARING

A. The Contractor shall:

1. Fell trees only within the area to be cleared.

2. Leave standing any trees or native growth indicated by the City Engineer.

3. Trim all trees to be left standing to the height specified by the Engineer, neatly cutting all limbs close to the tree trunk.

4. Thin clumps of native growth as the City Engineer may direct.

5. Protect, by fencing if necessary, all trees or native growth from any damage caused by construction operations.
3.3 GRUBBING

A. The Contractor shall:

1. Grub deep enough to remove all stumps, large roots, buried logs and other vegetative material.

2. Grub all areas:

3. Indicated by the Architect.

4. To be excavated.

5. Where sub-drainage trenches will be dug, unsuitable material removed or structures built.

6. Upon which embankments will be placed.

END OF SECTION
SECTION 02231
TREE PROTECTION

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

A. The requirements of the "General Provisions of the Contract" and of Division 1, "General Requirements", shall apply to all work of this Section with the same force and effect as though repeated in full herein.

1.2 SUMMARY

A. Work included: All labor, materials, equipment, and services necessary to protect trees which are within the Limits of Construction, Permanent Drainage Easements, Permanent Needs Line, and Temporary Construction Easement Lines and which are indicated to remain. Remove trees which have been damaged beyond repair, as determined by the Owner or its designee, and furnish and install replacement trees of a size to match existing.

B. Related Work:
   1. Irrigation System - Section 02810
   2. Landscape Planting - Section 02900

1.3 TREE SPECIALIST

A. All tree protection and maintenance, including watering, pruning, fertilizing, and pest control, shall be done by, or under the supervision of, licensed Arborist or equally qualified Tree Specialist to be approved by the City Engineer or its designee. Cost of Arborist shall be borne by the Contractor.

1.4 SUBMITTALS

A. Before the beginning of any construction activities, submit to the City Engineer for approval a drawing showing locations of plants to be protected in place, and the proposed method of protection. Provide estimated height, caliper, and two photographs of each plant to be protected, clearly showing the structure and appearance of each plant.

1.5 GUARANTEE

A. Trees protected in place shall be guaranteed as to acceptable growth, appearance, and health through the construction period, and for a period of one year after the beginning of the project maintenance period.

PART 2 - PRODUCTS

2.1 WATER - Potable.

2.2 FENCING MATERIALS - Contractor's selection with City Engineer or its designee's acceptance.

2.3 STRAW, HAY AND SOD

A. Provide clean material, free from debris, noxious weeds, and ingredients, insects and pests detrimental to plant growth.
2.4 TOPSOIL
   A. Provide fertile, friable, natural loam having an acceptable pH level and free from alkali, weed seed, mold, fungus, excessive clay content, large rocks, nematodes, insects and other pests detrimental to plant growth.

2.5 FERTILIZER - Commercial grade 10-10-5.

2.6 TREE ROOT PROTECTION
   A. Provide burlap root wrap.
   B. Provide root wound dressing that is a waterproof, antiseptic, elastic compound, free from substances harmful to trees and shrubs, such as Walter E. Clark and Son Company's "Tree-Kote" or approved equivalent.
   C. Use of gravel and/or broken stone for protecting roots of existing trees and shrubs is not allowed.

PART 3 - EXECUTION

3.1 PROHIBIT - traffic and storage of materials within the drip lines of trees and shrubs which are indicated to be salvaged or to remain.

3.2 ERECT FENCES - around the trees and shrubs which are indicated to remain, a minimum of six feet outside the drip line of such trees and shrubs unless otherwise noted on the drawings. Erect fence areas within the drip line of trees on adjacent property which overhang the Contract site.

3.3 PROVIDE TREE ROOT PROTECTION as indicated and as follows:
   A. Protect roots from flooding, erosion and excessive wetting resulting from dewatering operations, run-off and spillage, or drainage of solutions containing materials which would be deleterious to tree roots. Area of tree-root protection is that which is within the drip line.
   B. Cut tree roots whose greatest cross-section is larger than one inch and which will remain exposed during excavation operations. Coat wounds with root wound dressing and wrap the root stub with wet burlap.
   C. Jack or tunnel spaces for utilities by hand if utilities are indicated to be within drip line of trees. Do not cut tap roots and main lateral roots. Cut smaller roots, which interfere with the Work, with sharp pruning instruments and wrap the root stub with wet burlap until backfilled.
   D. If excavations are indicated to be within drip lines of trees, excavate by hand and provide sheeting. Expose roots with narrow-tine spading forks and by combing of soil. If large, main lateral roots are encountered, expose those roots beyond excavation limits and bend and relocate without breaking. Do not allow exposed roots to dry out before permanent backfill is placed; either cover roots with earth or pack with peat moss and wrap with burlap. Water, keep moist, and temporarily support and protect roots from damage until they have been permanently relocated and covered with backfill.
   E. If existing grade around trees is above the finish grade, accomplish excavation within drip line by hand. Cut exposed roots approximately three inches below elevation of finish grade. Engage a qualified Arborist to recommend procedures to compensate for loss of roots, such as pruning of branches and stimulation of root growth.
F. All construction around existing trees to remain shall be observed by the Arborist. Daily reports of observations and recommendations shall be forwarded to the Owner.

END OF SECTION
PART 1 – GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

A. This Section includes construction dewatering.

B. Related Sections include the following:

1. Division 2 Section "Earthwork" for excavating, backfilling, and site grading.

2. Division 2 Section "Earthwork Support and Protection."

1.3 Performance Requirements

A. Dewatering Performance:  Design, provide, test, operate, monitor, and maintain a dewatering system of sufficient scope, size, and capacity to control groundwater flow into excavations and permit construction to proceed on dry, stable subgrades.

1. Work includes removing dewatering system when no longer needed.

2. Maintain dewatering operations to ensure erosion is controlled, stability of excavations and constructed slopes is maintained, and flooding of excavation and damage to structures and utilities are prevented.

3. Prevent surface water from entering excavations by grading, dikes, or other means.

4. Accomplish dewatering without damaging existing buildings and utilities adjacent to excavation.

5. Identify steps to minimize the volume, monitor and pre-treat dewatering effluent to improve its quality prior to disposal.

1.4 Submittals

A. Shop Drawings: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of headers and discharge lines; and means of discharge and disposal of water.

1. Include a written report outlining control procedures to be adopted if dewatering problems arise.
2. If retaining "Performance Requirements" Article, retain subparagraph below to meet requirements of authorities having jurisdiction or to follow customary practice in Project's location.

3. Include Shop Drawings signed and sealed by a California registered professional engineer responsible for their preparation.

B. Dewatering Plan: Submit Dewatering Plan to the Bureau of Sanitation (BOS), Regional Water Quality Control Board and National Pollutant Discharge Elimination System (NPDES) for plan check review, approval and permit. Steps shall be identified to minimize the volume, to monitor and pre-treated to improve the quality of dewatering effluent prior to disposal.

C. BOS Industrial Waste Permit: Obtain a BOS Industrial Waste Permit for disposing dewatering effluent into sanitary sewers. Sewers are primary disposal sites for dewatering effluent. Disposal into storm drains may only be used as a last resort and will be heavily regulated.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by dewatering operations.

F. Record drawings at Project closeout identifying and locating capped utilities and other subsurface structural, electrical, or mechanical conditions.

1.5 Quality Assurance

A. Installer Qualifications: Engage an experienced installer to assume engineering responsibility and perform dewatering who has specialized in installing dewatering systems similar to those required for this Project and with a record of successful in-service performance.

B. Professional Engineer Qualifications: A California registered professional engineer who is experienced in providing engineering services for designing dewatering systems that are similar to those indicated for this Project in material, design, and extent.

1. Engineering Responsibility: Engage a qualified professional engineer to prepare or supervise the preparation of data for the dewatering system including drawings, testing program, test result interpretation, and comprehensive engineering analysis that shows the system's compliance with specified requirements.

C. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.

1.6 Project Conditions
A. Existing Utilities: Do not interrupt utilities serving facilities occupied by the Owner or others unless permitted in writing by the Architect and then only after arranging to provide temporary utility services according to requirements indicated.

B. Project Site Information: A geotechnical report has been prepared for this Project and is attached to the Project Specifications for information only. The opinions expressed in this report are those of the geotechnical engineer and represent interpretations of the subsoil conditions, tests, and results of analyses conducted by the geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.

1. Make additional test borings and conduct other exploratory operations as necessary.

C. Survey adjacent structures and improvements, employing a qualified professional engineer or surveyor, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During dewatering, resurvey benchmarks weekly, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Architect if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 – PRODUCTS

NOT USED

PART 3 - EXECUTION

3.1 Preparation

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.

2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by governing regulations.

3.2 Dewatering
A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

B. Before excavation below ground-water level, place system into operation to lower water to specified level, a minimum of three feet below the bottom of planned excavations, and then operate it continuously until drains, sewers, and structures have been constructed and fill materials have been placed, or until dewatering is no longer required.

C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Dispose of water removed from excavations in a manner to avoid endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner to avoid inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

E. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on a continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense.

1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes per the current requirements of City of Los Angeles.

F. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

Excavation support systems

Monitoring excavation support system and adjacent constructions for settlement and
damage.

B. Related work: Other sections of Division 2 for earthwork.

1.2 SYSTEM DESCRIPTION

A. General:

1. Excavation support systems are not fully detailed on the Drawings, which are
diagrammatic and show design intent of finished profiles, shapes and forms

2. Specifications are of the performance type and include the minimum
requirements of the excavation support system without limiting the Contractor to
methods of achieving such performance.

B. Survey of existing conditions:

1. Employ California licensed surveyor or civil engineer to make a survey of existing
adjacent structures and improvements

a. Establish precise elevations at fixed points to act as benchmarks

b. Clearly identify benchmarks and record existing elevations

2. Photographs conditions encountered to highlight defects in existing construction.
Notify the City Engineer and registered City’s of adjacent properties in writing
when the
survey is to be made and photographs taken so they may have representatives
present.

a. Have those representatives’ present sign the survey and photographs as
witnesses.

b. Upon completion of this work, make a similar examination of the
properties originally surveyed, giving similar notice to all interested
parties so they may be present during the final examination of the
properties. Send a record of the original and final examinations to all
concerned parties.

C. Design requirements:

Engineer, fabricate, furnish, and install, excavation support systems to meet or
exceed the criteria indicated and specified, to conform to the profiles indicated
and to other requirements of the Contract Documents, to satisfy applicable
governing codes and regulations, to retain excavations during construction and to
prevent movement of adjacent construction.

2. Prepare and submit shop drawings, specifications, calculations, and any other
supporting data required for review and approval, to the authorities having
jurisdiction, and pay fees incurred prior to beginning installation.

3. Engineering calculations for these assemblies shall bear the signature and seal
of a California-licensed professional engineer.

D. Performance requirements:

1. Soil design pressure:
   a. Base soil design pressures on the recommendations of the geotechnical
      investigation referenced in Section 00320.
   b. Make additional test borings and conduct other exploratory operations
      necessary for excavation support and protection.
   c. Include consideration for site soil conditions encountered, depth of
      excavation, procedures, type of excavation support systems proposed,
      water level conditions and perimeter site conditions relating to structures,
      utilities and street surcharges.

2. Design stresses:
   a. Steel: Base design stresses on those permitted by the AISC,
      Specification for the Design, Fabrication and Erection of Structural Steel
      for Buildings of the Manual of Steel Construction.
   b. Lumber: Base design stresses on the allowable stresses permitted by
      WWPA or WCLIB for the grade and species of wood to be used

1.3 SUBMITTALS

A. General: Submittals indicated below are informational submittals reviewed for
determining the effect of excavation support systems on permanent construction.

   1. Informational submittals do not require approval.

   2. Review of informational submittals does not relieve the Contractor of his
      responsibility for design, construction, maintenance and monitoring, or for
      adequate and safe installation of excavation support systems required for the
      Work.

B. Data:

   1. Before beginning the work of this section, submit surveyor’s monitoring plan
      indicating proposed method of monitoring excavation support systems.

   2. Submit a step-by-step description of the installation of the excavation support
      system components. Contractor will not be permitted to deviate from the
      procedures once they have been approved by the appropriate authorities having
      jurisdiction, except in case of emergencies.
C. Shop drawings:

1. Submit large scale, dimensioned drawings showing materials, profiles, joints, methods of fabrication and anchorage details. Label individual components and indicate sizes, weights, design loads, required clearances, and methods of field installation.

2. Furnish isometric drawings for conditions too difficult to illustrate in 2 dimensions.

3. Coordinate the shop drawings with the work of other trades that are part of, or will be incorporated into, the work of this section. Indicate work to be performed by other trades, including adjacent and abutting materials that are to be secured to this work.

D. Qualification statements: Submit a list of projects of similar design and complexity completed by the installer within the past 5 years.

E. Closeout submittals: Submit record drawings clearly showing the location and dimension of those portions of the excavation support system to be permanently left in place.

1.4 QUALITY ASSURANCE

A. Installer’s qualifications: Firm and individuals with a minimum 5 consecutive years experience in the fabrication and erection of excavation support systems on projects similar in material, design, complexity and extent to this Project, and whose work has resulted in applications with a record of successful in-service performance.

B. Certifications: Mark each piece of wood delivered to the job site with identification certifying its conformance with one of the AWPA pressure treatment standards specified below.

1.5 PROJECT CONDITIONS

Existing conditions: Do not interrupt utilities serving facilities occupied by the City or others unless permitted in writing by the City Engineer, and then only after arranging to provide temporary utility services according to requirements indicated.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: As required by the design of the excavation support system.
   Lumber: Wood members to be left permanently in place shall be pressure-treated in compliance with AWPA U-1 or T-1.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and measurements affecting the work of this Section at the project site.
   Field-verify measurements affecting the work of this Section.
Correct conditions detrimental to the proper and timely completion of this work before proceeding with installation.

3.2 PREPARATION

A. Protection: Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

3.3 INSTALLATION

A. Install excavation support systems without damaging existing buildings, pavements, and other improvements adjacent to excavation.

B. Install excavation support systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from City and authorities having jurisdiction.

2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

C. Locate excavation support systems clear of permanent construction so that forming and finishing of concrete surfaces is not impeded.

3.4 SOLDIER BEAMS AND LAGGING

A. Install steel soldier beams before starting excavation.

1. Space soldier beams at regular intervals not to exceed allowable flexural strength of wood lagging.

2. Accurately align exposed faces of flanges to vary not more than 2 inches from a horizontal line and not more than 1:120 out of vertical alignment.

B. Install wood lagging within flanges of soldier beams as excavation proceeds.

1. Trim excavation as required to install lagging.

2. Fill voids behind lagging with soil, and compact.

3.5 TIEBACKS

A. Drill, install, grout, and tension tiebacks into position.

B. Test load-carrying capacity of each tieback and replace and retest deficient tiebacks.

1. Test loading shall be observed by a qualified professional engineer responsible for design of excavation support and protection system.

C. Maintain tiebacks in place until permanent construction is able to withstand lateral earth and hydrostatic pressures.

3.6 REMOVAL AND REPAIRS
A. Leave excavation support systems permanently in place.

3.7 FIELD QUALITY CONTROL

A. Employ a California-licensed surveyor or civil engineer to regularly resurvey benchmarks specified above during installation of excavation support systems.

1. Maintain an accurate log of surveyed elevations and positions for comparison with original elevations and positions.

2. If changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction, promptly notify City Engineer and immediately take steps to remedy the situation.

B. Employ a California-licensed surveyor or civil engineer to design, construct and maintain an on-going monitoring system of the horizontal and vertical deflections of the excavation support systems.

1. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open.

2. Maintain accuracy within 1/100 of a foot and keep records in a readily understandable form, such as a tabular form of both the net and total deflections (both horizontal and vertical) of each solder pile.

   a. If deflections exceed one inch at any location, notify the design engineer and immediately take steps to remedy the situation.

   b. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.

3. Record both vertical and horizontal movements of excavation support systems on a weekly basis and submit the results to the design engineer and to the City.

END OF SECTION
SECTION 02282
SOIL TREATMENT FOR TERMITE CONTROL

PART 1   GENERAL

1.1   SUMMARY
A. Provide soil treatment for termite control, under all concrete building slabs on grade.
B. LEED Goals: Not used.

1.2   SUBMITTALS
A. Product Data: Submit manufacturer's technical data and application instructions.

1.3   QUALITY ASSURANCE
A. In addition to requirements of these specifications, comply with manufacturer's instructions and recommendations for work, including preparation of substrate and application.
B. Engage a professional pest control operator, licensed in accordance with regulations of the State of California for application of soil treatment solution.
C. Use only termiticides that are approved by the California Department of Food and Agriculture, which bear a Federal registration number of the U.S. Environmental Protection Agency, and are on the California approved list.

1.4   JOB CONDITIONS
A. Restrictions: Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.
B. To ensure penetration, do not apply soil treatment to excessively wet soils or during inclement weather. Comply with handling and application instructions of the soil toxicant manufacturer.

1.5   SPECIFIC PRODUCT WARRANTY
A. Furnish written warranty certifying that applied soil termiticide treatment will prevent infestation of subterranean termites and, that if subterranean termite activity is discovered during warranty period, Contractor will re-treat soil and repair or replace damage caused by termite infestation. Provide warranty for a period of 2 years from date of treatment, signed by Applicator and Contractor.

PART 2   PRODUCTS

2.1   SOIL TREATMENT SOLUTION
A. Use an emulsible concentrate termiticide for dilution with water, specially formulated to prevent infestation by termites. Fuel oil will not be permitted as a dilutent. Provide a solution consisting of one of following products (or equal):

1. Premise 75 - (A/I) Imidacloprid/Chloronicotinyl.
2. Talstar Termiticide – (A/I) Bifenthrin in dilution 0.06%.
3. Firstline GT Termite Bait Station – (A/I) N-Ethyl Perfluorooctanesulfonide 0.01%.
4. Dragnet SFR – (I/A) Permethrin in dilution 0.5%.
5. Termidor SC – (A/I) Fipronil in dilution 0.125%
6. Other solutions may be used as recommended by Applicator if also acceptable to Architect and approved for intended application by local authorities. Use only soil treatment solutions which are not injurious to planting.

PART 3 EXECUTION

3.1 APPLICATION

A. Surface Preparation: Remove foreign matter which could decrease effectiveness of treatment on areas to be treated. Loosen, rake and level soil to be treated, except previously compacted areas under slabs and foundations. Toxicants may be applied before placement of compacted fill under slabs, if recommended by toxicant manufacturer.

B. Formulation, treatment, storage and disposal of termiticide shall be in accordance with label directions. Water for formulating shall be drawn only from a hose fitted with a backflow preventer meeting local plumbing codes.

C. Apply treatment solution with a low pressure coarse spray.

D. Establish a vertical termiticide barrier under slab in critical areas such as inside of foundation walls, both sides of partition walls, and around plumbing and other utility conduits.

E. Under slab-on-grade structures, treat soil before concrete slabs are placed, using the rates of application recommended by the manufacturer of the termiticide.

F. At grade beams, treat all surfaces with individual attention to the perimeters and outside edges of the beam.

G. At expansion joints, control joints, and areas where slabs will be penetrated, apply termiticide at double the rate used in the field of the slab.

H. Post signs in areas of application to warn workers that soil termiticide treatment has been applied. Remove signs when areas are covered by other construction.

I. Reapply soil treatment solution to areas disturbed by subsequent excavation, landscape grading, or other construction activities following application.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED WORK

A. Description: Perform earthwork necessary to complete site clearing, excavating, filling, and grading, including preparation of sub-grade for building and structures, and in accordance with Contract Documents.

B. Standard Specifications

1. Work to be performed and materials to be used shall be in accordance with the Standard Specifications for Public Works Construction, latest edition and supplements.

2. The Contractor shall have one copy of the Standard Specifications at the job site.

3. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

1.2 DEFINITIONS

A. Classified Excavation: Removal and disposal of materials not defined as rock.

B. Unclassified Excavation: Removal and disposal of materials encountered regardless of nature of materials, including rock.

C. Unauthorized Excavation: Removal of materials beyond indicated sub-grade elevations or dimensions without Architect's authorization. No payment will be made for unauthorized excavation or remedial work.

D. Authorized Additional Excavation: Removal of material authorized by Architect based on determination by Testing Agency that the material is soil not capable of supporting design load, or otherwise unsuitable material. Payment will be made for authorized additional excavation and remedial work in accordance with applicable provisions of Contract Documents.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements.

1. Excavation Work: Perform in compliance with applicable requirements of laws, codes, ordinances and regulations of Federal, State, County, and Municipal authorities having jurisdiction over work.

2. Shoring and Bracing: Comply with requirements of County and Municipal Codes having jurisdiction over work. Secure approval by authorities administering this code before proceeding with work.
3. When such laws, codes or ordinances contain more stringent requirements than Contract Documents, the more stringent requirements govern.

1.4 REFERENCES

A. Except as modified by governing codes and by Contract Documents, comply with applicable provisions and recommendations of the following:

1. ANSI A10.2 "Safety Code for Building Construction".
2. AASHTO "American Association of State Highway and Transportation Officials".
3. Part 1926, subpart P, "Excavation, Trenching and Shoring", CONSTRUCTION SAFETY AND HEALTH REGULATIONS (OSHA), including Sections relative to protection of public; sheet piling, shoring and bracing; trenches and excavating equipment.
4. Cal/OSHA

1.5 PROJECT CONDITIONS

A. Examine site, Drawings, records of existing utilities and construction, record of test borings, and subsurface exploration report available from City. Records of test borings are for information only and are not guaranteed to represent all conditions that will be encountered.

1.6 PROTECTION

A. Retain services of qualified Consultant licensed in the State of California, at the approval of City Engineer, to advise on construction techniques involved in work, including design, checking and approving of temporary bracing, sheeting, shoring, underpinning and other items pertinent to work, and encountered during prosecution of work. Consultant shall be primarily concerned with construction methods, which will prevent settlement or damage to surrounding structures, sidewalks, embankments, utilities and roads on City Engineer's property and adjoining property.

B. Existing Utilities:

1. Maintain existing utilities that are to remain in service. Before excavating over or adjacent to existing utilities, notify City Engineer to ensure protective work will be coordinated and performed in accordance with City’s requirements. If existing service lines, utilities and utility structures, which are to remain in service, are uncovered or encountered during these operations, safeguard and protect from damage.

2. Within limits of excavation, remove existing piping, subsoil drainage systems, conduit, manholes and relocated items, which are to be abandoned. Plug open ends of utilities to remain with concrete.

3. Re-route existing subsoil drains which obstruct work around new construction, or incorporate them into new drainage systems.

4. Consult Architect immediately for directions, should uncharted or incorrectly charted piping or other utilities be encountered during excavation. Cooperate with City Engineer and public and private utility companies in keeping their
respective services, utilities and facilities in operation. If damaged, repair utilities to satisfaction of City engineer.

C. Existing Facilities: Protect and maintain in satisfactory manner, existing pavements, curbs, gutters, structures, conduits, fences, walls and other facilities to remain above and below grade. Restore facilities damaged by construction operations.

D. Pumping and Draining: Excavate areas in such manner as to afford adequate drainage. Control grading in vicinity of excavated areas so ground surface will slope to prevent water running into excavated areas. Until work is completed, remove water from areas of construction that may interfere with proper performance of work or that may result in damage to the soil sub-grade and provide sumps, pumps, well points, electric power and attendance required for this purpose on a 24 hour basis if necessary. Protect construction from water during construction, including prevention of erosion of completed work during construction and until permanent drainage and erosion controls are operational. Repair adjoining properties, facilities and streets damaged due to improper protection.

PART 2 - PRODUCTS

2.1 MATERIALS

A. All fill and backfill materials shall conform to the recommendations of section 8.3.3 of the URS Geotechnical Report for the subject project dated July 11, 2003 referenced in section 00320 and any supplemental reports.

PART 3 - EXECUTION

3.1 PREPARATION

A. Reference Points: Provide and maintain throughout construction, benchmarks and other reference points on and off site.

B. Site Preparation: Clean areas within Contract Limit Lines as required. Remove trees (except trees indicated to remain or to be relocated), shrubs and vegetation. Prior to removal of trees or other existing items, verify removal with City Engineer in writing.

1. Remove existing concrete, masonry, rubble, and paving to a depth of at least 24 inches below sub-grade in paved and graded areas. In areas to be paved, spread leveling courses of crushed material acceptable to City Engineer over surface of remaining rubble and compact with vibrating compactors. Provide additional crushed material and compact as required to produce a dense uniform surface. Lift thickness, measured before compaction, shall not exceed 8 inches. Refer to paragraphs FILLING for material and compaction requirements of the subgrade.

2. Remove rubble beneath areas where building slabs are to be supported on grade. Remove abandoned slabs, footings, foundation walls, pits, manholes, conduit, pipes and other existing below-grade construction that may obstruct new work. Demolish and remove such obstructions as required to provide at least 24 inches horizontal and vertical clearance from new construction, including excavation and placement of engineered fill beneath footing and slabs-on-grade.

3. Beneath areas where building slabs, walks and paving are supported on grade, excavate existing fill soils and loose, soft, or disturbed natural soils and replace with properly compacted fill per the recommendations of the URS Geotechnical
C. Fill above described areas to sub-grade with acceptable material as specified in the Geotechnical Report.

3.2 EXCAVATION

A. Excavation for General Grading: In addition to requirements for clearing, excavate to subgrades indicated on grading plan. Fill and compact excavations made below elevations indicated unless authorized by City Engineer, as specified for filling and compacting at no additional cost to the City.

1. All uncertified fills within the footprint of structures shall be over excavated and replaced with structural fill. The geotechnical investigation reports fills soils were generally encountered in the upper 7-feet. Excavations to remove fill shall extend laterally outside the foundation footprint, a distance equal to the depth of excavation or at least 5-feet, whichever is greater. Over excavation shall be prepared per the recommendations of the URS Geotechnical Report dated July 11, 2003, under the direct supervision of the Geotechnical Engineering Division (GED).

3.3 ROCK EXCAVATION

A. Rock Estimate: Should rock be encountered, total amount of rock in place to be excavated shall be determined as hereinafter specified. Adjustment for excavation of such rock will be made as provided by Contract Documents.

B. Rock Classification: Rock is classified as solid rock in ledges, bedded deposits or cannot be removed with a 3/4 cubic yard capacity power shovel without drilling and blasting, and boulders having volume of more than 1/2 cubic yard. Rocks over 6 inches shall be removed.

C. Rock Survey: Before excavating material which Contractor may claim as rock excavation, uncover and expose material to permit accurate measurements and notify Architect before proceeding. No payment will be allowed for rock or cemented materials, which have not been uncovered and measured as specified, nor for boulders that have not been separated from earthwork for proper measurements. Material uncovered shall then be cross-sectioned and measured and quantities within rock payment lines hereinafter specified shall be computed and certified by a registered professional engineer or registered land surveyor engaged and paid for by Contractor.

1. Submit complete current records of quantities of rock excavated, methods of excavation used, and extent of labor and equipment involved, date and sign record by professional engineer or land surveyor, and send copies to Architect for approval. Such records shall also include plot plans at suitable scale, showing elevations and other measurements of rock excavation and location and measurements of computed volumes of boulders encountered. Provide labor and equipment necessary to make these records. No payment will be considered for rock, which has been removed without obtaining required data.

3.4 FILLING
A. Materials for fills shall consist of acceptable material, as specified in Paragraph, MATERIALS, obtained from required excavation on site, or from borrow sources. Materials shall be reviewed by the Geotechnical Engineering Division (GED).

B. Utilization of Excavated materials: Suitable excavated material, as specified in the Paragraph MATERIALS, may be used in formation of fills and for backfilling. Separate unsuitable material from material that is suitable for fill. Separate material suitable for fill under slabs and paving and for backfill from material that is only suitable for general grading.

C. Borrow: Acceptable borrow shall consist of suitable material specified in the paragraph MATERIALS. Submit representative samples of each type of borrow material to the Geotechnical Engineering Division (GED) for approval prior to importing to site.

D. Fill under Building Slabs and Structural Members: At a minimum, 2-feet of compacted granular fill shall be placed under slab-on-grade. Place fill materials in horizontal loose layers; spread, mix and place in such manner as to produce uniform thickness of material. Start placement in deepest area and progress approximately parallel to finished grade. Layers shall not exceed 8 inches in thickness prior to compaction.

1. Do not place fill material on areas where free water is standing, or on surfaces that have not been approved by the Geotechnical Engineering Division (GED).

E. Compaction: Compact each layer of fill with acceptable equipment to achieve the following minimum percentages of maximum dry density at the moisture content specified in these Specifications. All fill shall be compacted to a minimum of 90% relative compaction (ASTM D1557); structural fill containing less than 15% clay (finer than 0.005 mm) shall be compacted to 95% relative compaction (ASTM D1557). Compaction or consolidations by soaking or jetting with water are not acceptable alternative methods to utilization of mechanical equipment.

F. Moisture Control for Fill and Sub-grade

1. Maintain moisture content by wetting or drying manipulation. Suspend compacting operations when satisfactory results cannot be obtained because of rain or other unsatisfactory conditions.

2. Sprinkle with water fill and sub-grade material which does not contain sufficient moisture to be compacted in accordance with requirements of Specifications.

3. Dry fill and sub-grade material containing excess moisture prior to or during compaction to moisture content not greater than two percentage points (3%) above optimum. Reduce moisture content of material which displays pronounced elasticity or deformation under action of loaded rubber tired conveyances to optimum if necessary to secure stability. For sub-grade material, these requirements for maximum moisture apply at time of compaction of sub-grade. Subgrade and fill soils shall not be allowed to dry/or crack and shall be kept moist (between optimum and three percent above optimum moisture content) until covered with subsequent construction.

G. Fill Under Areas of General Grading: Obtain material for fill from excavation or from borrow sources as specified.

1. Place fill in 8-inch layers (maximum) to suitable elevation above sub-grade to provide for anticipated settlement to elevation indicated. Moisture condition and compact layers as specified in the Geotechnical Report.
3.5 QUALITY CONTROL

A. General Requirements
   1. The Geotechnical Engineering Division (GED) will perform tests and prepare and submit reports specified in this section.
   2. The Geotechnical Engineering Division (GED) will conduct and interpret tests; state in reports whether test results indicate conformance with Contract Document requirements, and note deviations.

B. Tests: Soils Testing Laboratory will perform tests herein specified and additional tests required, and submit test reports to Architect including the following:
   1. Optimum Moisture-Maximum Density curve shall be supplied by the Soils Testing Laboratory. Determine maximum densities by ASTM D1557.
   2. Import material shall conform to the recommendations of the July 11, 2003 URS Geotechnical Report and any supplemental reports. Import material shall be tested and approved by GED prior to importing to the job site. Up to three days of testing are required before approval of soils.

C. Sub-grade and Fill Layers: The Geotechnical Engineering Division (GED) shall approve sub-grades and fill layers before construction of further work thereon. Tests of sub-grades and fill layers will be taken as follows:
   1. Make at least one field density test of sub-grade for every 500 cubic yard minimum or when specified by the Soils Testing Laboratory.
   2. Backfill: Take field density tests along walls at 150 foot maximum centers at elevations to be determined but no greater than two feet vertical intervals.

D. Cooperate with the Geotechnical Engineering Division (GED) in performance of required tests.

E. If, in the City Engineer’s opinion, based on the Geotechnical Engineering Division’s reports, fill that has been placed is found to be below specified density, Architect will require additional compaction and testing at Contractor’s expense.

F. Any GED approval of earthwork, including over excavation bottoms and footing excavations, are voided by rain and will therefore require supplemental approval by GED.

3.6 DISPOSAL OF EXCAVATED MATERIALS

A. Dispose of the following material off City’s property:
   1. Unsuitable excavated materials.
   2. Excess excavated material.
   3. Stripped topsoil which is not being stockpiled for future work, unless disposition on site is directed by City Engineer.

B. Do not burn material resulting from clearing and grubbing operations on site. Remove from City Engineer's property.
SECTION 02310
GRADING

PART 1 GENERAL

1.1 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:
   1. General exterior grading, cutting and filling, including grading for building area, paving, planting areas, banks and hillsides.
   2. The requirements of the Soils Report are included as part of this Section.

C. Related Sections:
   1. Section 02230: Site Clearing.

1.2 SYSTEM DESCRIPTION

A. General:
   1. Fees: Pay as required by authorities having jurisdiction over the area.
   2. Bonds: Post as required by authorities having jurisdiction over the area.
   3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.
   4. Before grading, contact Underground Service Alert of Southern California (USASC) for information on buried utilities and pipelines.

1.3 QUALITY ASSURANCE

A. Equipment: Use equipment adequate in size, capacity, and numbers to accomplish the work of this Section in a timely manner.

B. In addition to complying with governmental agencies having jurisdiction, comply with the directions of the Soil Engineer.

C. Comply with applicable provisions of Section 300 of the "Standard Specifications for Public Works Construction" and Standard Plan, City of Los Angeles" NOTICE TO CONTRACTORS - COMPREHENSIVE."
D. Required: In addition to the requirements specified herein, and in applicable Section of DIVISION 1 - GENERAL REQUIREMENTS, of these specifications, the Contractor shall perform all work in accordance with the permit requirements of the Los Angeles Department of Public Works, Building and Safety Division and no additional compensation will be allowed therefore.

E. Required: The Contractor shall fully coordinate the grading operations of this Section with that of other trades involved and with the City Department of Public Works.

PART 2 PRODUCTS

2.1 MATERIALS

A. Materials shall conform to requirements specified in this and related sections mentioned above.

1. In Landscape (planting area) fill shall not be saline or contain anything that would prevent normal plant growth. See Landscaping Section for verification of required or approved fill material.

2. Fill material is subject to the final approval of the City.

PART 3 EXECUTION

3.1 PREPARATION

A. Protect and maintain installed stakes until their removal is required for the Work. Provide replacement grade or location stakes lost or disturbed.

B. Install grade stakes and compare to indicated grades. If discrepancies are found between existing grades and grades indicated on Drawings, do not proceed until discrepancies are resolved.

3.2 ROUGH AND FINE GRADING

A. Rough grade area sufficiently high to require cutting by fine grading:

1. Grade area for bituminous surfacing and other paving to the indicated grades, equal to the section of the indicated base and pavement.

2. Slope banks to required finish grades as cut progresses or leave cuts full and finish grade by mechanical equipment to provide grades and soil densities indicated on the Drawings.

3. Rough grade, fill and compact banks beyond indicated finish grades. Finish grade banks and slopes to indicated grades and specified soil densities.

4. Grade Only Areas: In areas not indicated to receive pavement, rough grade to approximate finish grades and then scarify, moisten and roll to obtain required density and indicated finish grades.

5. Tolerances: Finish grades shall be within a tolerance of 0.05 inch per foot above or below grades indicated. Provide an average grade as indicated.
B. Base or Subgrade:

1. After subgrade has been constructed to approximate required grades, scarify to a depth of the dimension indicated in Geotechnical Report:
   a. After scarifying, process loosened material to a finely divided condition and adjust moisture content to optimum condition by addition of water, addition and blending of dry suitable material, or by drying of existing material.
   b. Subgrade material shall be compacted by tamping, sheepsfoot rollers or pneumatic tire rollers. Required relative compaction shall be 95 percent minimum for the top 6 inches below subgrade.
   c. Install base course in accordance with Section 02319: Base Course.

2. Tolerance of completed grades of base or subgrade shall not vary more than 0.03 inch per foot from grades indicated. Provide an average grade as indicated.

3.3 SHORING

A. Provide shoring as necessary to properly and safely support earth sides of excavations, and existing curbs, sidewalks, gutter, drives and stairs, against movement and collapse.

B. Design and Calculations: Provide in accordance with requirement of governing California Building Code and Safety Orders of State of California, Division of Industrial Safety; Title 8, Subchapter 4, Article 6, Sections 1530 and 1541.

C. Remove shoring upon completion of the Work of this section or when no longer needed unless required otherwise by authorities having jurisdiction.

3.4 EXCESS MATERIAL DISPOSAL

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.5 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION
SECTION 02316
EXCAVATING, BACKFILLING AND COMPACTING FOR PAVEMENT

PART 1  GENERAL

1.1  SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:
   1. Excavating, backfill, and compacting for paved areas.
   2. Installation of fill materials.
   3. All earthwork, including over-excavation of unsuitable soils, moisture conditioning, placement and compaction of fill and backfill materials shall be performed in accordance with the requirements of the geotechnical engineering report dated August 14, 2003 and any supplemental geotechnical reports for the project.

C. Related Sections:
   1. Section 02310: Grading.
   2. Section 02318: Excavating, Backfilling and Compacting for Utilities.
   3. Section 02319: Base Course.

1.2  SYSTEM DESCRIPTION

A. Import and Export of Earth Materials:
   1. Fees: Pay as required by authorities having jurisdiction over the area.
   2. Bonds: Post as required by authorities having jurisdiction over the area.
   3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.3  SUBMITTALS

A. Imported Soils: A geotechnical engineer, retained by the Owner as an Owner Consultant, shall obtain initial product Sample for testing in accordance with the terms of sub-section 3.5 of this section.

B. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:
   1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials:
      a. Fill and Backfill Materials
      b. Base Materials
2. LEED Credit MRc5.1: Provide manufacturer name and location data for the
following materials:
   a. Fill and Backfill Materials
   b. Base Materials

3. LEED Credit MRc5.2: Provide data from the manufacturer indicating the
sources, including source name and locations, of raw materials used to fabricate
the following materials. If different raw material sources are used the
manufacturer shall provide a breakdown based on percentage of weight of
materials used in the product for each different raw material sources used:
   a. Fill and Backfill Materials
   b. Base Materials

1.4 QUALITY ASSURANCE
   A. Comply with Standard Specifications for Public Works Construction, current edition,
      except as modified herein.
   B. Sampling, testing, and certification of imported and/or exported soils shall be performed
      in accordance with CBC.

1.5 PROJECT CONDITIONS
   A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or
      uniformity of soil conditions over the Project site.
   B. A copy of the foundation investigation and soils report is available for examination at the
      Architect’s office during regular office hours of Architect.

PART 2 PRODUCTS

2.1 FILL AND BACKFILL MATERIALS
   A. Fill and backfill materials shall be previously excavated materials or imported fill material,
      free of clods and stones larger than 3 inches, foreign materials, vegetable growths, sod,
      expansive soils, rubbish and debris. Material shall conform to these specified
      requirements and related sections.
   B. Fill material exhibiting a wide variation in consistency and/or moisture content shall be
      blended and/or aerated to stabilize and upgrade the material.
   C. Imported Fill Material:
      1. Provide suitable materials obtained from Project site excavations for earthwork
         and fill materials. If excavated materials are not of suitable quality or sufficient
         quantity, import additional materials as necessary.
      2. Imported fill shall be a granular material with sufficient binder to form a firm and
         stable unyielding subgrade and shall not have more than 35 percent of fines
         passing 200 mesh sieve. Material shall have an expansion index of less than 20.
         Imported material shall be clean and free of rubbish, debris, and toxic or
         hazardous contaminants. Adobe or clay soils are not permitted.
D. Other Fill Materials: Brick rubble and broken concrete originating from the Project site may be legally disposed of off the Project site or incorporated in fill, if reviewed by a geotechnical engineer, retained by the Owner as an Owner Consultant. Unless otherwise required, no such materials may be imported from outside the Project site.

E. Permeable Backfill:

1. Provide permeable backfill material behind retaining structures consisting of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations of these materials conforming to the following gradations:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 inch (19mm)</td>
<td>100</td>
</tr>
<tr>
<td>3/8 inch (10mm)</td>
<td>80-100</td>
</tr>
<tr>
<td>No. 1000-8</td>
<td>0-8</td>
</tr>
<tr>
<td>No. 2000-3</td>
<td>0-3</td>
</tr>
</tbody>
</table>

2. Those portions of fill material passing a No. 4 sieve shall provide a sand equivalent of at least 60.

3. Provided backing for weep-holes shall consist of 2 cu. ft. of aggregate in burlap sacks, securely tied. Aggregate shall conform to requirements for No. 3 concrete aggregate as specified in subsection 200-1.4 of the Standard Specifications for Public Works Construction.

4. Permeable Backfill Alternate Materials: Instead of the materials specified for retaining structures backfill, a drainage matting system such as Miradrain by Mirafi, Inc., or equal, may be provided if reviewed and approved by the Geotechnical Engineer.

PART 3 EXECUTION

3.1 SITE PREPARATION

A. Clear the Project site of all obstacles.

3.2 PROTECTION

A. Protect and guard excavations against danger to life, limb, and property as required by, but not limited to, OSHA regulations.

B. Protect adjacent existing improvements including landscaping against damage.

3.3 EXISTING UTILITY LINES

A. Protect existing utility lines from damage or displacement.

B. Remove conduits or pipes not in service, exposed during Work, unless a minimum cover of 2 feet is provided. Remove concrete, clay or other non-metallic pipe over 8 inches in diameter, unless otherwise indicated.

3.4 EXCAVATION

A. Unclassified Excavations: Comply with the Standard Specifications for Public Works Construction, Section 300: “Earthwork,” except as modified herein.
3.5 FILL

A. Unclassified Fill and Compaction: Comply with the Standard Specifications for Public Works Construction, Section 300: “Earthwork,” except as modified herein.

B. Provide fill materials as specified in Part 2 – Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.

C. In addition to the requirements of this section, import and/or exported materials shall comply with the requirements of CBC.

D. Imported fill materials shall be sampled by a geotechnical engineer, retained by the Owner as an Owner Consultant, for compliance with the requirements of Part 2 of this section.

E. The geotechnical engineer, retained by the Owner as an Owner Consultant, shall submit all samples to an approved independent approved testing laboratory for testing.

F. Initial sampling shall be performed by the geotechnical engineer, retained by the Owner as an Owner Consultant, before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and/or entity responsible for the source site. The geotechnical engineer, retained by the Owner as an Owner Consultant, shall obtain both the initial and additional samples from the identified site and shall submit all samples to the approved independent testing laboratory for testing.

G. The independent approved testing laboratory shall perform the required tests and report results of all tests noting if the tested material passed or failed such tests and shall furnish copies to the Owner, Engineer, and Architect. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, Title 24, CCR and the Owner. Upon completion of the Work of this section, the independent testing laboratory and geotechnical engineer shall submit a verified report to the Owner as required by Title 24, CCR.

H. Bills of lading or equivalent documentation will be submitted to the Owner on a daily basis.

I. Upon completion of import operations, provide the Owner a certification statement attesting that all imported material has been obtained from the identified source site.

3.6 INSTALLATION OF MATERIALS

A. Fill or backfill materials shall be installed in horizontal layers of 6 inches, unless otherwise required. Each layer shall be evenly placed and moistened or aerated as necessary. Unless otherwise reviewed by the geotechnical engineer, retained by the Owner as an Owner Consultant, each layer of fill material shall cover the length and width of the area to be filled before the next layer of material is installed. Top surface of each layer shall be installed to an approximate level with a crown or crossfall of at least 1 in 50, but no more than 1 in 20. Provide adequate drainage at all times during construction of the Work of this section.

3.7 COMPACTING

A. Each layer of fill material shall be compacted by tamping, sheepsfoot rollers, or pneumatic-tired rollers to provide specified relative compaction. At inaccessible locations,
provide specified compaction by manually held, operated and directed compaction equipment.

B. Unless otherwise indicated, compact each layer of earth fill to a relative compaction of at least 95 percent.

C. When fill materials, or a combination of fill materials, are encountered or provided which develop densely packed surfaces as a result of installation or compacting operations, scarify each compacted layer before installing the next succeeding layer.

3.8 INSPECTION AND TESTING

A. The geotechnical engineer, retained by the Owner as an Owner Consultant, will inspect and test excavations, sample material quality as required in Part 2, and observe installation and compaction of fill materials.

B. The geotechnical engineer, retained by the Owner as an Owner Consultant, will sample imported fill materials from their designated source before delivery to the Project site.

C. Installation of backfill shall be observed by the geotechnical engineer, retained by the Owner as an Owner Consultant.

D. The geotechnical engineer, retained by the Owner as an Owner Consultant, will inspect and test excavation Work before the installation of fill and/or other materials.

E. Compaction: Test compaction in accordance with ASTM D 1557.

3.9 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.10 CLEANING

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION
SECTION 02317
EXCAVATING, BACKFILLING AND COMPACTING FOR STRUCTURES

PART 1 GENERAL

1.1 SUMMARY
A. Provisions of Division 01 apply to this section.
B. Section Includes:
   1. Excavating, backfilling, and compacting for buildings and structures.
   2. Fill materials.
   3. All earthwork, including over-excavation of unsuitable soils, moisture conditioning, placement and compaction of fill and backfill materials shall be performed in accordance with the requirements of the geotechnical engineering report dated August 14, 2003 and any supplemental geotechnical reports dated August 20, 2004, September 27, 2004, and October 8, 2004.
C. Related Sections:
   1. Section 02310: Grading.
   2. Section 02318: Excavating, Backfilling and Compacting for Utilities.

1.2 SYSTEM DESCRIPTION
A. Import and Export of Earth Materials:
   1. Fees: Pay as required by authorities having jurisdiction over the area.
   2. Bonds: Post as required by authorities having jurisdiction over the area.
   3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.3 SUBMITTALS
A. Imported Soils: A geotechnical engineer, retained by the Owner as a Owner Consultant, shall obtain initial product Sample for testing in accordance with the terms of sub-section 3.5 of this section.
B. Shoring calculations as required in sub-section 3.3 of this section.
C. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:
   1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials:
      a. Fill and Backfill Materials
2. LEED Credit MRc5.1: Provide manufacturer name and location data for the following materials:
   a. Fill and Backfill Materials

3. LEED Credit MRc5.2: Provide data from the manufacturer indicating the sources, including source name and locations, of raw materials used to fabricate the following materials. If different raw material sources are used the manufacturer shall provide a breakdown based on percentage of weight of materials used in the product for each different raw materials source used:
   a. Fill and Backfill Materials

1.4 QUALITY ASSURANCE
   A. Comply with the following as a minimum requirement: Standard Specifications for Public Works Construction, current edition, except as modified herein.
   B. Sampling, testing, and certification of imported and/or exported soils shall be performed in accordance with CBC.

1.5 PROJECT CONDITIONS
   A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.
   B. A copy of the foundation investigation and soils report is available for examination at the Architect's office during regular office hours of Architect.

PART 2 PRODUCTS

2.1 FILL AND BACKFILL MATERIALS
   A. Fill and backfill materials shall be a granular material previously removed from excavation, or imported fill material, free of large clods and stones larger than 3 inches, foreign materials, vegetable growths, sod, expansive soils, rubbish and debris. Material shall conform to these specified requirements and related sections.
   B. Fill material exhibiting a wide variation in consistency and or moisture content shall be blended and/or aerated to stabilize and upgrade the material.
   C. Imported Fill Material:
      1. Provide suitable materials obtained from Project site excavations for earthwork and fill materials. If excavated materials are not of suitable quality or sufficient quantity, import additional materials as necessary.
      2. Imported fill shall be a granular material with sufficient binder to form a firm and stable unyielding subgrade and shall not have more than 35 percent of fines passing 200 mesh sieve. Material shall have an expansion index of less than 20. Imported material shall be clean and free of rubbish, debris and toxic or hazardous contaminants. Adobe or clay soils are not permitted.
   D. Other Fill Materials: Brick rubble and broken concrete originating from the Project site may be legally disposed of off the Project site, or incorporated in fill, if reviewed and approved by the geotechnical engineer, retained by the Owner as an Owner Consultant.
Unless otherwise provided, no such materials may be imported from outside the Project site.

E. Permeable Backfill:

1. Provide permeable backfill material behind retaining structures consisting of gravel, crushed gravel, crushed rock, natural sands, manufactured sand, or combinations of these materials conforming to the following gradations:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percentage Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/4 inch</td>
<td>100</td>
</tr>
<tr>
<td>3/8 inch</td>
<td>0-100</td>
</tr>
<tr>
<td>No. 100</td>
<td>0-8</td>
</tr>
<tr>
<td>No. 200</td>
<td>0-3</td>
</tr>
</tbody>
</table>

2. Those portions of fill material passing a No. 4 sieve shall provide a sand equivalent of at least 60.

3. Provided backing for weep-holes shall consist of 2 cu. ft. of aggregate in burlap sacks, securely tied. Aggregate shall conform to requirements for No. 3 concrete aggregate as specified in subsection 200-1.4 of the Standard Specifications for Public Works Construction.

4. Permeable Backfill Alternate Materials: Instead of the materials specified for retaining structures backfill, a drainage matting system such as Miradrain by Mirafi, Inc., or equal, may be provided if reviewed by the Architect.

PART 3 EXECUTION

3.1 SITE PREPARATION

A. Clear the Project site of all obstacles.

3.2 PROTECTION

A. Protect and guard excavations against danger to life, limb, and property as required by, but not limited to, CAL-OSHA regulations.

B. Protect adjacent existing improvements including landscaping against damage.

C. Shore, crib, or lag excavations and earthen banks as necessary to prevent caving-in, erosion or gullying of sides.

D. Divert or de-water excavations until concrete is placed, forms are removed, and backfilling is complete.

3.3 SHORING

A. Provide shoring as necessary to properly and safely support earth sides of excavations, curbs, sidewalks, gutter, drives and stairs, against movement and collapse.

B. Design and Calculations: Provide in accordance with requirement of governing California Building Code and Safety Orders of State of California, Division of Industrial Safety, Title 8, Subchapter 4, Article 6, Sections 1530 and 1541.
C. Remove shoring upon completion of Work, or when no longer needed, unless otherwise required by authorities having jurisdiction over the Work.

3.4 EXCAVATION

A. Form sides of footings, pads, grade beams, and slab foundations, unless otherwise indicated. Provide excavations of sufficient size to permit installation and removal of forms and other Work as required.

B. Machine-drill excavation for round footings to size and depth indicated. Provide a collar or casing, or other adequate protection, to exclude dirt and debris. Protect excavations with plank covers until concrete is placed.

C. Provide excavation bottoms level and free from loose material. Excavate to indicated or required elevations of undisturbed earth.

D. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. If soil becomes soft, soggy, or saturated, excavate to firm undisturbed soil and fill as required. Slope adjacent grades away from excavations to minimize entry of water.

E. Calculate excavation quantities based on elevations or depths indicated on Drawings.

F. Provide 2000 psi concrete for backfill of over-excavated areas to indicated or required elevations.

3.5 IMPORT/EXPORT OF MATERIALS

A. Provide fill materials as specified in Part 2- Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.

B. In addition to the requirements of this section, import and/or exported materials shall comply with the requirements of CBC.

C. Imported fill materials shall be sampled by the geotechnical engineer, retained by the Owner as an Owner Consultant, for compliance with the requirements of Part 2 of this section.

D. The geotechnical engineer, retained by the Owner as an Owner Consultant, shall submit all samples to an approved independent testing laboratory for testing.

E. Initial sampling shall be performed by a geotechnical engineer, retained by the Owner as an Owner Consultant, before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and/or entity responsible for the source site. The geotechnical engineer, retained by the Owner as an Owner Consultant, shall obtain both the initial sample and additional samples from the identified site and shall submit all samples to the approved independent testing laboratory for testing.

F. The geotechnical engineer, retained by the Owner as an Owner Consultant, shall perform additional sampling during import operations. If the total quantity of import is determined to be greater than 1000 cubic yards of material, one sample shall be obtained and submitted for testing for each 250 cubic yards of imported material. If the total quantity of import is determined to be less than 1000 yards, one sample shall be obtained and submitted for testing for each 100 cubic yards of imported material.
G. The independent approved testing laboratory shall perform the required tests and report results of all tests noting if the tested material passed or failed such tests and shall furnish copies to the Owner, Engineer and Architect. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, Title 24, CCR and the Owner. Upon completion of the Work of this section, the independent testing laboratory and geotechnical engineer shall submit a verified report to the Owner as required by Title 24, CCR.

H. Bills of lading or equivalent documentation will be submitted to the Owner on a daily basis.

I. Upon completion of import operations, provide the Owner a certification statement attesting that all imported material has been obtained from the identified source site.

3.6 BACKFILLING

A. After concrete has been placed, forms removed and concrete Work inspected, backfill excavations to indicated or required grades. Backfill simultaneously on each side of walls or grade beams. Remove rubbish, debris, and other waste materials from excavations before placing backfill.

B. Before installing any backfill, adequately cure concrete and provide bracing to stabilize structures. Protect waterproofing or dampproofing against damage during backfilling operations with required protection board. Remove bracing as backfill operation progresses.

C. Do not furnish or install expansive soils for below grade building walls.

D. Install each layer of material in a not to exceed thickness of 6 inches, unless otherwise required.

E. Rigidly control the amount of water to be installed to provide optimum moisture content for type of fill material furnished. Do not over-saturate or compact by flooding or jetting.

F. Install wall backfill before installing railings and fences on walls.

G. Impervious backfill materials shall be installed in layers along with and by the same methods specified for structure backfill. Impervious backfill materials shall be at the approximate grade and elevation and where exposed to erosion, shall be covered with at least a 12 inch layer of fill material as reviewed by the geotechnical engineer, retained by the Owner as an Owner Consultant.

H. Install weep hole drainage at the backside of walls so the backing completely covers the weep holes, is horizontally centered and extends at least 12 inches above the bottom of the weep opening. Provide an 8 inch square section of 1/4 inch galvanized or aluminum screen, with a minimum wire diameter of 0.03 inch, and install at the backside of each weep hole before installing the backfill material.

I. Where a reviewed drainage matting system is provided instead of permeable backfill for retaining structures, install in accordance with the manufacturer recommendations.
3.7 COMPACTING

A. Compact each layer of fill material by tamping, sheepsfoot rollers or pneumatic-tired rollers, to such extent as to provide specified relative compaction. At inaccessible locations, compact to specified requirements with hand-held, operated and directed compaction equipment.

B. Unless otherwise indicated, compact each layer of fill material to a relative compaction of at least 95 percent.

C. Do not compact by flooding or jetting.

D. When fill materials, or a combination of fill materials, are encountered or provided which develop densely packed surfaces as a result of installation or compacting operations, scarify each layer of compacted fill before installing the next succeeding layer.

3.8 INSPECTION AND TESTING

A. The geotechnical engineer, retained by the Owner as an Owner Consultant, will inspect and test excavations, sample material quality as required in Part 2, and observe installation and compaction of fill materials.

B. The geotechnical engineer, retained by the Owner as an Owner Consultant, will sample imported fill materials from their designated source before delivery to the Project site.

C. Installation of backfill shall be observed by the geotechnical engineer, retained by the Owner as an Owner Consultant.

D. The geotechnical engineer, retained by the Owner as an Owner Consultant, will inspect and test excavation Work before the installation of fill and/or other materials.

E. Compaction: Test compaction in accordance with ASTM D 1557.

F. The Owner will inspect foundation excavations when completed and ready for forms, after forms are in place and before first placement of concrete.

3.9 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.10 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION
SECTION 02318
EXCAVATING, BACKFILLING AND COMPACTING FOR UTILITIES

PART 1   GENERAL

1.1 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Excavating, backfilling, and compacting utility trenches such as water, gas, irrigation, storm drain, sewer lines, concrete-encased conduits, and manholes, vaults, valve boxes, catch basins, underground tanks, thrust blocks, yard boxes, pull boxes and other utility appurtenances.

2. All earthwork, including over-excavation of unsuitable soils, moisture conditioning, placement and compaction of fill and backfill materials shall be performed in accordance with the requirements of the geotechnical engineering report dated August 14, 2003 and any supplemental geotechnical reports for the project.

C. Related Sections:

1. Section 02310: Grading.
2. Section 02316: Excavating, Backfilling and Compacting for Pavement.

1.2 SYSTEM DESCRIPTION

A. Import and Export of Earth Materials:

1. Fees: Pay as required by authorities having jurisdiction over the area.
2. Bonds: Post as required by authorities having jurisdiction over the area.
3. Haul Routes and Restrictions: Comply with requirements of authorities having jurisdiction over the area.

1.3 SUBMITTALS

A. Imported Soil: A geotechnical engineer, retained by the Owner as an Owner Consultant, shall obtain initial product Sample for testing in accordance with the terms of sub-section 3.5 of this section.

B. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:

1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials:

   a. Materials (Bedding and Backfill)
2. LEED Credit MRc5.1: Provide manufacturer name and location data for the following materials:
   a. Materials (Bedding and Backfill)

3. LEED Credit MRc5.2: Provide data from the manufacturer indicating the sources, including source name and locations, of raw materials used to fabricate the following materials. If different raw material sources are used the manufacturer shall provide a breakdown based on percentage of weight of materials used in the product for each different raw materials source used:
   a. Materials (Bedding and Backfill)

1.4 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement: Standard Specifications for Public Works construction, current edition except as modified herein.

B. Sampling, testing, and certification of imported and/or exported soils shall be performed in accordance with CBC.

1.5 PROJECT CONDITIONS

A. Information on Drawings or in soils report does not constitute a guarantee of accuracy or uniformity of soil conditions over the Project site.

B. A copy of the foundation investigation and soils report is available for examination at the Architect’s office during regular business hours of Architect.

PART 2 PRODUCTS

2.1 MATERIALS

A. Bedding material from trench bottom to one foot above the pipe:
   1. Sand, gravel, crushed aggregate or native free-draining granular material providing a sand equivalent of at least 30 or a coefficient of permeability greater than 1.4 inches per hour.
   2. Sand complying with the Specifications for cement concrete aggregates.

B. Backfill Materials:
   1. Excavated trench material to be installed for backfilling shall be clean, free of large clods, and stones larger than 2-1/2 inches in any dimension.
   2. Cement-sand slurry shall be provided with 1 sack of cement per cubic yard of the mixture.
   3. Imported Fill Material: Imported fill material shall be a granular material with sufficient binder to form a firm and stable unyielding subgrade and shall not have more than 35 percent of fines passing a 200 mesh sieve. Material shall have an expansion index of less than 20. Imported materials shall be clean and free of rubbish, debris, and toxic or hazardous contaminants. Adobe or clay soils are not permitted.
PART 3 EXECUTION

3.1 GENERAL

A. Before excavation, contact the "Underground Service Alert of Southern California" (USASC) for information on buried utilities and pipelines.

B. Barricade trenches, ditches, pits, sumps, and similar Work outside the barricaded working area with chain link fence in accordance with Cal-OSHA standards and requirements.

C. Saw-cut concrete or bituminous paving for trench installation.

D. Trenches over 5 feet in depth shall conform to the Construction Safety Orders of the California Division of Industrial Safety.

E. Where indicated and/or required to excavate in lawn areas, protect adjoining lawn areas outside of the Work area. Replace or install removed sod upon completion of backfill by installing sod level with adjacent lawns. If installation of removed sod fails, furnish sod and install to match existing lawns.

F. Backfill over excavations to the required elevations with earth, gravel, sand, or concrete and compact as required. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. Slope adjacent grades away from excavations to minimize entry of water.

G. Do not install piping lengthwise under concrete walks without review by the Architect.

H. Do not excavate trenches parallel to footings closer than 18 inches from the face of the footing or below a plane having a downward slope of 2 horizontal to one vertical, from a line 9 inches above bottom of footings.

1. Unless otherwise indicated on Drawings, depth of excavations outside the buildings shall allow for a minimum coverage above top of pipe, tank, or conduit measured from the lowest adjoining finished grade, as follows:

   Steel Pipe 24 inches below finished grade
   Copper Water Tube 18 inches below finished grade
   Cast-Iron Pressure Pipe 36 inches below finished grade
   Plastic Pipe (other than waste) 30 inches below finished grade
   Tanks or other structures 36 inches below finished grade
   Soil, Sewer & Storm Drain minimum 18 inches below finished grade, and as required for proper pitch and traffic load. (Install polypropylene sewer pipe with at least 24 inches coverage)
   Irrigation Pipe: nonpressure pipe - 12 inches, pressure pipe - 24 inches

2. Trench width shall provide ample space for fitting and joining. Excavate for piping bells and fittings, bell and spigot pipe and other fittings.
I. Unless indicated otherwise, excavate trenches to the required depths for utilities, such as pipes, conduit and tanks, with minimum allowances of 6 inches at the bottom and 6 inches at the sides for bedding of unprotected piping or as required for concrete encasement of conduits as indicated on Drawings. Grade bottom of trenches to a uniform smooth surface. Remove loose soil from the excavation before installing sand bedding or concrete encasement.

J. Provide excavations free from standing water by pumping, draining, or providing protection against water intrusion. If soil becomes soft, soggy, or saturated, excavate to firm undisturbed soil and fill as required. Slope adjacent grades away from excavations to minimize entry of water.

K. Provide a minimum clear dimension of 2 inches from sides of wall excavation to outer surfaces of buried pipes or conduits installed in the same trench or outside surfaces of containers and/or tanks.

L. Do not install backfill until required inspections and testing is completed.

M. Backfill electrical or other excavated utility trenches located outside of barricaded installation areas within 24 hours after inspection by the Owner.

N. Install backfill materials in layers not exceeding 4 inches in thickness and compact to 95 percent of the maximum density.

O. If materials excavated from the Project site are not permitted for trench backfill in paved areas, backfill trenches with a cement-sand slurry mix. Install backfill to an elevation of the existing undisturbed grade plus one inch.

P. Install and compact sand bedding to provide a uniform full length bearing under piping and conduits.

Q. Where portions of existing structures, walks, paving, or other improvements are removed or cut for piping or conduit installation, replace the material with equal quality, finished to match adjoining existing improvements.

3.2 IMPORT/EXPORT OF MATERIALS

A. Provide fill materials as specified in Part 2- Products. If excavated materials from the Project site are not of required quality or sufficient quantity, import additional materials as necessary.

B. In addition to the requirements of this section, import and/or exported materials shall comply with the requirements of CBC.

C. Imported fill materials shall be sampled by a geotechnical engineer, retained by the Owner as an Owner Consultant, for compliance with the requirements of Part 2 of this section.

D. The geotechnical engineer, retained by the Owner as an Owner Consultant, shall perform the tests by utilizing an independent approved testing laboratory.

E. Initial sampling shall be performed by the geotechnical engineer, retained by the Owner as an Owner Consultant, before importing material to the Project site. Identify the location of the source site in addition to the address, name of the person and/or entity responsible for the source site. The geotechnical engineer, retained by the Owner as an Owner
Consultant, shall obtain both the initial sample and additional samples from the identified site and shall submit all samples to the approved independent testing laboratory.

F. The independent approved testing laboratory shall perform the required tests and report results of all tests noting if the tested material passed or failed such tests and shall furnish copies to the Owner, Engineer, and Architect. Report shall state tests were conducted under the responsible charge of a licensed State of California professional engineer and the material was tested in accordance with applicable provisions of the Contract Documents, Title 24, CCR and the Owner. Upon completion of the Work of this section, the independent testing laboratory and geotechnical engineer shall submit a verified report to the Owner as required by Title 24, CCR.

G. Bills of lading or equivalent documentation will be submitted to the Owner on a daily basis.

H. Upon completion of import operations, provide the Owner a certification statement attesting that all imported material has been obtained from the identified source site.

3.3 INSPECTION AND TESTING

A. The geotechnical engineer, retained by the Owner as an Owner Consultant, will inspect and test excavations, sample material quality as required in Part 2, observe installation and compaction of fill materials.

B. Compaction test shall be performed in accordance with ASTM D 1557."

3.4 PROTECTION

A. Protect the Work of this section until Substantial Completion.

3.5 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

END OF SECTION
PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Preparation, implementation and monitoring of Storm Water Pollution Prevention Plan (SWPPP) for the purpose of preventing the discharge of pollutants from the Project site into receiving waters. This includes the elimination of pollution discharges such as improper dumping, spills or leakage from storage tanks or transfer areas.

B. Compliance with local, state and federal regulations.

C. Payment of application and annual fees required by the State Water Resources Control Board (SWRCB) until the date of Substantial Completion.

D. Certification that the Project has met all of the conditions of the General Construction Activity Storm Water Permit (GCASP).

1.02 RELATED SECTIONS

A. Section 01300: Submittals
B. Section 01500: Construction Facilities and Temporary Controls
C. Section 01700: Contract Closeout

PART 2 - PRODUCTS

2.01 MATERIALS


PART 3 - EXECUTION

3.01 QUALITY ASSURANCE

A. Comply with the following as a minimum requirement:


3.02 PREPARATION AND SUBMITTAL

A. Prepare and submit to the OWNER, within fourteen (14) days after the Effective Date of the Contract, four (4) copies of the Storm Water Pollution Prevention Plan (SWPPP) as required to comply with storm water pollution regulations for the Project site.
B. Prepare Notice of Intent application. Submit application and application fee made payable to: State Water Resources Control Board. Instructions for completing the application can be found on the State Water Resources Control Board web site. http://www.swrcb.ca.gov/stormwtr/gen_const.html#const_permit

C. Prepare SWPPP by following the format in Chapter 2 of the BMP Handbook. The publication is available from the following publications or websites:

- Blue Print Service
  1700 Jefferson Street
  Oakland, CA 94612
  Cashier’s Office
  Los Angeles County Department of Public Works
  900 S. Fremont Avenue
  Alhambra, CA 91803

OR:
Download Instructions from the City of Los Angeles Stormwater Website (Part A-Construction Activities):
http://www.lastormwater.org/

Download Instructions from the State Water Resources Control Board Web Site:
http://www.swrcb.ca.gov/stormwtr/gen_const.html#const_permit

D. Where land disturbance is less than one (1) acre a SWPPP is not required, however any BMP’s indicated in the BMP Handbook required to prevent or minimize storm water pollution shall be implemented at no cost to OWNER.

3.03 IMPLEMENTATION

A. Install perimeter controls prior to starting Work at the Project site.

B. Contain on-site storm water on the Project site. Do not drain on-site water directly into the storm drain.

C. Designate trained personnel for the proper implementation of the SWPPP.

D. Revise SWPPP to suit changing Project site conditions and also when properly installed systems are ineffective.

E. Upon Substantial Completion:
   1. Leave storm water pollution prevention controls in place when required for post-construction storm water management and remove those that are not needed as determined by OWNER. OWNER will maintain prevention controls left in place.
   2. Provide Site Monitoring Reports, SWPPP revisions, Compliance Certifications and related documents to OWNER. Post-construction storm water operation and the management plan as mentioned in the compliance certifications are considered to be in place at Final Completion.
3.04 MONITORING

A. Conduct examination of pollution prevention controls on a monthly basis, as well as before and after each storm and each day during extended storm events. Prepare and maintain, at the Project site, a log of each inspection using Site Monitoring Report forms. Notify to RWQCB within 30 days if there is any noncompliance.

3.05 LIABILITIES AND PENALTIES

A. Review of the SWPPP and inspection log by OWNER shall not relieve CONTRACTOR from liabilities arising from non-compliance of storm water pollution regulations.

B. Payment of penalties for non-compliance by CONTRACTOR shall be the sole responsibility of CONTRACTOR.

C. Compliance with the Clean Water Act pertaining is the sole responsibility of CONTRACTOR. Any fine against OWNER due to non-compliance by CONTRACTOR, OWNER shall recover all costs of the fine by appropriate assessment.

3.06 CHANGE OF INFORMATION

A. Submit to OWNER completed NOI Form for change of information (Construction Site Information and Material Handling/Management Practices).

3.07 ATTACHMENTS

A. Attachment A - Compliance Certification.

B. Attachment B - Site Monitoring Report.

END OF SECTION
ANNUAL CERTIFICATION

I certify the Project has met the following conditions: All elements of the Storm Water Pollution Prevention Plan are in place; construction materials and equipment maintenance waste have been disposed of properly; and the Project site is in compliance with all local storm water management requirements including erosion/sediment control requirements, and the appropriate use permits have been obtained.

CONTRACTOR:

R:

Print Name: __________________________________________ Title: __________________________

Signature: __________________________________________ Date: __________________________

FINAL COMPLETION CERTIFICATION

I certify the Project has been completed and the following conditions have been met: All elements of the Storm Water Pollution Prevention Plan have been completed; construction materials and equipment maintenance waste have been disposed of properly; the Project site is in compliance with all local storm water management requirements including erosion/sediment control requirements and the appropriate use permits have been obtained; and a post-construction storm water operation, and management plan is in place.

CONTRACTOR:

R:

Print Name: __________________________________________ Title: __________________________

Signature: __________________________________________ Date: __________________________
I. Type of Examination: (Use one form for each type of examination):

☐ Prior to Anticipated Storm Event
☐ After Actual Storm Event
☐ Monthly

Date Examined: ___________

II. Check the response for each SWPPP question below:

1. Do you have an approved Storm Water Pollution Prevention Plan (SWPPP) and a BMP Handbook on the Project site? YES ☐ ☐ NO
2. Does your SWPPP incorporate an up-to-date erosion control plan? ☐ ☐
3. Is the erosion control installed per plan? ☐ ☐
4. Is the Work at a stage where the erosion control plan can not be constructed, is the erosion control at the Maximum Extent Practicable for the stage you are in? ☐ ☐
5. Did you observe the presence of any floating materials such as oil, grease, pieces of wood, paper, etc., odor, toxics, and/or sediments? ☐ ☐
6. If yes, what is it that you observed? ___________

III. Check the status of the following items as observed:

<table>
<thead>
<tr>
<th>SWPPP Items</th>
<th>Acceptable</th>
<th>Not Acceptable</th>
<th>Repairs Required</th>
<th>Date Repairs Completed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. De-silting Basins (Cleaned)</td>
<td>☐</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>2. Water Quality Basin</td>
<td></td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>3. Silt Fences</td>
<td></td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>4. Hay bales/ Check dams/ Sandbags</td>
<td></td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>5. Berms and Dikes</td>
<td></td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
<tr>
<td>6. Sand/Gravel Inlet</td>
<td>☐</td>
<td>--</td>
<td>--</td>
<td></td>
</tr>
</tbody>
</table>
IV. Describe any problems or required repairs checked above and the necessary actions needed:

<table>
<thead>
<tr>
<th>Item</th>
<th>Description of Problem or Required Repair</th>
<th>Action Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Examination Performed by CONTRACTOR:

By (Print Name, Title and Sign) ____________________________ Date ____________

Verified by IOR:

Print Name, Title and Sign ____________________________ Date ____________

END OF ATTACHMENTS
PART 1 - GENERAL

1.1 DESCRIPTION

A. Principal Work in this Section:
   1. Provide cast-in-place drilled piles, complete, in accordance with Contract Documents.

B. Related Work Specified Elsewhere
   1. Section 03200 - Concrete Reinforcement
   2. Section 03300 - Cast-In-Place Concrete.
   3. Section 03310 - Concrete Testing and Inspection.

1.2 SYSTEM DESCRIPTION

A. Work Includes, but is not limited to, the following:
   1. Excavation for drilled piles, including soil and rock excavation, removal of existing concrete slabs, foundations and other obstructions as required.
   2. Dewatering by pumping and drainage.
   3. Steel shells including temporary steel liners as required. Protection of the tops of holes to prevent caving and material entering the hole.
   4. Reinforcing steel, furnishing and installing reinforcing steel including reinforcing extending above top of shaft and dowels, as required.
   5. Concrete for drilled piles, including mix designs with required supporting testing, furnishing and placing.
   6. Disposal of excavated materials.
   7. Establishing surveyed elevations and surveyed locations from established building line monuments which will be furnished and installed by a registered land surveyor.
   8. Maintaining diameters of shafts.
   9. Maintaining top of shaft elevations including removal of laitance.
   10. Excavation and filling of trial drilled piles excavation in advance of production drilling for the purpose of review by Contractor and Owner's Geotechnical Consultant of caving potential, equipment suitability, etc.

1.3 QUALITY ASSURANCE
A. Quality Assurance: Prepare and execute Quality Assurance program including concrete mix designs, materials report, sampling, and detailed shop drawings for reinforcing which provide no opportunity to complete unsatisfactory cast-in-place drilled pile work. Perform retesting or evaluation by Quality Control personnel due to deficient work, and similar work at no additional cost to Owner.

B. Quality Control: Cast-in-place drilled piles work may be subject to evaluation and tests in shop and field by others. Evaluations and testing undertaken by others is strictly for random evaluation. Extent, duration and amount of testing or evaluation is entirely at discretion of others. Use of testing services, or execution of testing or evaluation service by others shall in no way relieve Contractor’s sole responsibility to furnish materials and construction in full compliance with Contract Documents.

C. Qualifications
   1. Contractor engaging work of this section shall have minimum fifteen years experience in work of similar scope and nature to that specified.
   2. Contractor shall employ labor and supervisory personnel at least equally experienced in work of similar scope and nature to that specified.

D. Consultants
   1. Contractor’s Soils Consultant: Contractor shall retain at his own expense, the services of a qualified Soils Consultant unless similarly qualified personnel are members of Contractor’s staff to advise him on construction techniques involved in this work, including the design, checking and approval of temporary liners and other items pertinent to the work and construction methods for solution of problems which may be encountered during the prosecution of work. Consultant shall be primarily concerned with construction methods which will result in finished piles of quality and strength called for on the drawings and in these specifications and with methods which will prevent settlement and/or damage to surrounding structures, roads, utilities, embankment, etc., both within property lines and on adjoining properties.
   2. Owner’s Geotechnical Consultant: Owner has retained services of Los Angeles City, Geotechnical Engineering Division to make test borings and subsurface exploration reports including foundation recommendations.

E. Testing Agencies
   1. Inspection/Testing: Coordinate and provide ample notification for inspection and testing agencies and Geotechnical Consultant, so excavation, reinforcing and concrete work occurs in a continuous operation.
   2. Contractor’s Concrete Testing Agency: Contractor shall employ at his own expense, testing laboratory acceptable to Architect, to design concrete mixes, conduct tests and submit reports as are hereinafter specified.
3. Owner's Geotechnical Consultant: Owner will retain, at his own expense, a geotechnical consultant, to conduct tests and inspections of soil conditions and submit reports as are hereinafter specified. Owner's geotechnical consultant will be responsible for inspections and for conducting and interpreting tests. Inspection will take the form of full-time inspection of pile excavation and concreting operations.

4. Owner's Concrete Testing Agency: Owner will retain at his own expense, a testing laboratory, to perform concrete and reinforcing quality control inspection and testing as hereinafter specified.

1.4 REFERENCES

A. Except as modified by governing codes and Contract Documents, comply with applicable provisions and recommendations of the following:

1. ACI
2. ASTM
3. PCA

1.5 SUBMITTALS

A. Product Data: Submit Product Data and installation instructions for the following items in accordance with Section - SUBMITTALS. Include laboratory test reports and such other data required to show compliance with Contract Documents.

1. Fly ash.
2. Plasticizing admixture.
3. Aggregate for stone concrete, including sodium sulfate soundness test (ASTM C88) and sieve analysis.
4. Reinforcing steel.
5. Portland cement (including certified mill test reports).

B. Shop Drawings: Submit Shop Drawings for the following items in accordance with Section - SUBMITTALS.

1. Provide Shop Drawings which show details and layouts of reinforcing steel in accordance with Section 03200- Concrete Reinforcing. All tie reinforcing shall have 135 degree hooks around vertical reinforcing at each end of each tie or each piece of continuously wound tie. Vertical reinforcing shall be positioned around pile to clear and coordinate with grade beam reinforcing and anchor bolts/column dowels.

C. Furnish to the Owner's Geotechnical Consultant one copy of detailed descriptions of construction procedures, equipment, temporary liners used and drilling methods.

D. Certificates of Site Examination: Submit, before proceeding with the work, one copy of certification in acceptable form stating that careful examination has been made of the site, existing structures, records of utility lines, test boring records, subsurface exploration reports by the Geotechnical Consultant, drawings and specifications, signed by the Contractor's Soil Consultant (if any), the Installer and the Contractor.
E. Test Reports: Test and inspection reports shall be submitted in accordance with Section QUALITY CONTROL by the following testing agencies; with one copy to Contractor and others as indicated.

1. Contractor's Concrete Testing Agency
   a. Report and certification of aggregate for stone concrete, including sodium sulfate soundness test (ASTM C 88) and sieve analysis. (may be omitted if available from manufacturer).
   b. Concrete design mix reports, listing all mixes required together with test results.

2. Owner's Concrete Testing Agency
   a. Concrete test reports, indicating slump and test strengths at 7 days, 28 days and 56 days (if required) for test samples obtained, together with pertinent information and certification of compliance with strength requirements.
   b. Ready-Mix Plant Inspection Reports, showing location of plant; mix number and strength; proportioning; source, type and amount of cement; admixtures; aggregates; water added and total water used; slump; air content; capacity and condition of mixing trucks; per cent of capacity loading practice; condition of batching equipment; period of inspection and number and size of batches observed.

3. Owner's Geotechnical Consultant:
   a. Certified, "Drilled Piles Field Record" for each pile recording actual geotechnical data, including the actual elevation of bottom, elevation of bearing strata, final center line location of top, variation of shaft from plumb, result of all test performed, seepage of water, variation of shaft diameters (from those shown), and description of bearing strata over the length of piles shaft. If rock is encountered, indicate depth to rock, rock slope and socket depth. Specific confirmation of the allowable load for the pile shall be included.

4. Record drawings: Update record drawings, specified in Division 1, to incorporate the above information.

1.6 PROJECT CONDITIONS

A. Environmental Conditions

1. Contractor shall examine the site, drawings, records of existing utilities and construction, record of tests borings, and subsurface exploration reports to determine conditions under which the piles will be installed. Records of test borings are for information only and are not guaranteed to represent all conditions that will be encountered.

2. An investigation of the soils has been made for the site which contains partial information on existing conditions and potential conditions on site for drilled piles work. The intent of these specifications is to include all recommendations given in the report and subsequent amendments, except where the Contract Documents are specifically more stringent.
B. Protection

1. During excavation of piles, openings shall be properly protected and covered when work is not in progress. Suitable fences, lights, etc., shall be provided as required. Contractor shall provide a protective cage or casing for inspection and testing of piles and to protect workmen during hand excavation or other operations requiring entry into shaft. The Contractor shall provide access down hole with proper safety equipment for the Owner’s Geotechnical Consultant. Coordinate with the Geotechnical Consultant for required safety apparatus, prior to inspection. Holes shall be covered and protected, with casing in place, while tests are being made. Shells as required for construction loads shall satisfy safety requirements of the construction and regulatory agencies. Contractor shall have adequate gas detection devices on site at all times with personnel trained in their proper use. Contractor shall make tests for gas or noxious fumes prior to entry into the shaft and provide continuous monitoring when men are required to be in the shafts.

2. Contractor, piles installer, and Contractor's Soils Consultant shall take particular measures when drilling and constructing along existing buildings. Take all necessary measures to brace, shore, underpin and any other work or sequences to ensure maintaining the strength, stability and cause no damage to existing buildings.

3. Prior to any excavation adjacent to the existing building, record and photograph all existing conditions and send a report to the Owner. Monitor by measurement and record and photograph on a regular basis during construction and send reports to the Owner.

C. Contractor's bid shall be based on construction of piles to length shown on the drawings. Adjustment will be made on net variation of total quantities, based on the design dimensions for shafts. There will be no additional compensation for excavation or concrete due to overcutting or over lengthening of shafts (i.e., in any dimension) resulting from machine methods of excavation, or any other cause.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement: ASTM C150, Type II normal Portland cements.

B. Fly Ash: ASTM C618.

C. Water Reducing and Plasticizing Admixture: ASTM C494, type and quantity recommended by manufacturer depending upon conditions at project site.

D. Aggregate for Stone Concrete shall comply with ASTM C 33 size 467 for placement “in-the-dry" and 3/4 inch maximum for tremie concrete and the following:

1. General: Aggregates when subjected to 5 cycles of sodium sulfate soundness test (ASTM C 88) shall not lose more than 15% by weight. Aggregates for the entire job shall come from the same source unless a change is acceptable to the Architect.

2. Fine Aggregates: Natural or artificial hard, clean sand.
3. Coarse Aggregates: Gravel or crushed rock with clean, hard, uncoated particles.

E. Mixing Water: Clean, fresh and free from deleterious substances which would impair the work.

F. New Billet Steel Bars: ASTM A 615, Grade 60.

G. Temporary Steel Liners: Temporary steel liners shall be constructed of ASTM A36 steel plate. Longitudinal and transverse joints shall be full butt welds forming temporary liners to length and diameter required to control caving of shafts during excavation.

H. Ready-Mixed Concrete: ASTM C94, of strength as shown on drawings.

I. Miscellaneous Materials or Accessories shall be provided as specified hereinafter under the various items of work, as indicated on the drawings, and as required for good construction practice.

2.2 MIX DESIGN

A. Contractor's Concrete Testing agency shall design the mix for each type of concrete required in accordance with the requirements of the specifications and drawings. Strength requirements are as noted on drawings. Design mixes shall obtain strength (as determined by test cylinders) at least 15% higher than specified. Allow a minimum of 40 days prior to placing concrete for this work.

B. The adequacy of the design shall be verified by tests on a minimum of 9 cylinders; 3 tested at 7 days, 3 at 14 days, and 3 at 28 days in accordance with ASTM C192 and C39 and by a slump tests in accordance with ASTM C143.

C. Contractor's Agency shall prepare and submit a complete list of design mixes required for the project, together with test results, to Architect for review before any concrete is placed. Design mixes may be initially submitted for preliminary review with the 7 and 14 day test results but the 28 day test results shall be reported prior to placing concrete.

The mix design submittal shall contain at least the following information: gradations for coarse and fine aggregate, cement type, aggregate sources, cement source, admixture data sheet from manufacturer's brochure, mix proportions, strength test results, actual slump of tested concrete mix, batch plant, etc. The submittal shall be signed by the preparer and the registered Civil Engineer experienced in concrete materials that is responsible for the mix design.

D. Contractor shall immediately notify his Concrete Testing Agency (who prepared the mix design and who is performing QA) as well as the Owner's Concrete Testing Agency and Architect if, at any time during construction, the concrete resulting from the mix design proves to be unsatisfactory for any reason such as: Too much water, lack of sufficient plasticity to prevent segregation, honeycomb, etc.; or insufficient strength. Contractor's Concrete Testing Agency shall modify the design, subject to the Architect's review, until a satisfactory concrete is obtained.
E. Stone Concrete: Proportion in accordance with the following minimum requirements:

<table>
<thead>
<tr>
<th>Design Strength psi</th>
<th>Cement Content* Sacks/Cu.Yd.</th>
<th>Water. Max Gal./Sack</th>
<th>Max.** Slump</th>
</tr>
</thead>
<tbody>
<tr>
<td>4000</td>
<td>5-3/4</td>
<td>5.5</td>
<td>5&quot; min to 7&quot; max per GED</td>
</tr>
</tbody>
</table>

* A plasticizing admixture shall be used and minimum cement requirements may be reduced by 1/2 sack per cu. yd. where a maximum of 75 lbs. of fly ash is substituted per cu. yd.

** Increase slump, provide retardation, etc. as necessary or required for excavation utilizing temporary liners.

F. Tremie Concrete: Proportion in accordance with the following minimum requirements:

<table>
<thead>
<tr>
<th>Design Strength psi</th>
<th>Cement Content</th>
<th>Maximum Slump</th>
</tr>
</thead>
<tbody>
<tr>
<td>5000</td>
<td>705 lbs.</td>
<td>7 to 9 inch</td>
</tr>
</tbody>
</table>

* A plasticizing admixture shall be used and minimum cement requirements may be reduced by 47 lbs. Where a maximum of 75 lbs. of fly ash is substituted.

PART 3 - EXECUTION

3.1 PREPARATION

A. Field Measurements: Verify dimensions before proceeding with work. Obtain field measurements for work required to be accurately fitted to other construction. Be responsible for accuracy of such measurements.

B. Equipment: The Contractor shall use equipment of adequate capacity and proven methods for all drilled piles construction work including rock drilling. Drilling shall be accomplished by means of a power driven rotary bucket or auger type foundation drilling machine designed to excavate a plumb cylindrical shaft.

C. Methods: The drilling sequences and procedures shall be such as to produce negligible loss of ground as well as squeezing of the hole and consequent settlement. The contractor shall develop his construction procedure using the guidelines described and provide a description of the procedure for review and approval by Owner's Geotechnical Consultant.

3.2 INSTALLATION/APPLICATION/ERECTION

A. Excavation

1. General: Excavated materials shall be removed from the site or utilized on the site in locations in accordance with construction activities as required. The area shall at all times be kept clean and free of spoil and other debris which could affect the progress or safety of the work.
2. Piles with Liners: Machine methods shall be used for the excavation of pile shafts. Temporary steel liners must be used if required to prevent caving of soil and to reduce seepage. The diameter of the bore of the hole shall be such as to reduce the annular space between the wall of the hole and the steel liner to a minimum.

a. Liner cutting, loss of temporary liner or portion thereof, extension/addition of piles, etc. shall be at expense of the Contractor.

b. Piles shall not be excavated closer than 4 diameters on center unless adjacent piles have been completed 24 hours.

c. Piles Shafts: Piles shall be founded in and on bearing strata capable of developing the minimum allowable pile capacity specified on the drawings. If test results indicate that the bearing strata is incapable of providing the required allowable capacity values, the shaft length may be advanced as directed by the Owner's Geotechnical Consultant.

d. The Owner's Geotechnical Consultant will perform inspection in order to report quality of bearing strata, penetration into bearing strata, conditions at the bottom and sides of the piles as well as report the confirmation of design allowable pile capacity.

B. Installation

1. Placing Concrete: The following procedure shall be followed for placing concrete "in-the-dry".

a. Do not start placing of concrete until the excavation and reinforcing for the whole unit to be placed has been completed, cleaned and dried, and inspected and approved by the Owner's Geotechnical Consultant.

b. Provide adequate runways, chutes, tremies and other means of conveying concrete into place. Use tremies for placing concrete. Use vertical pipe near the center of the piles extending into the concrete to control concrete placement.

c. Place concrete immediately after mixing, and in no case, more than 60 minutes after water has been added. Continue the depositing of concrete in a continuous operation until completion of the piles to top of shaft, and in no case suspend the placing of concrete of a piles more than 30 minutes. Consolidate the concrete by vibrating the top 25' (7.6 m). Laitance and excess water shall be removed.

d. Concrete for piles shall be placed "in-the-dry" unless placement under bentonite or other equivalent slurry is determined by the Contractor's Consultant to be necessary and confirmed by written approval of the Owners Geotechnical Consultant. Standing water in puddles deeper than one (1) inch, loose soil and debris shall be removed from the bottom of shafts before concrete placement. If placement under slurry is necessary, use tremie concrete mix of 1000 psi higher strength than specified on the drawings which is for "in-the-dry" placement.

e. Place concrete in piles immediately upon complying with the foregoing requirements and receipt of test results confirming that allowable pile embedment and rock quality have been attained.
C. Installation Tolerances

1. The maximum allowable variation of the center of the top of any piles from the required location shall be 4% of the shaft diameter or 3" (75 mm), whichever is less. The shaft shall not be out of plumb by more than 3 inch in 25 feet. If these tolerances are exceeded, additional work shall be performed as directed, at the Contractor's expense.

2. Piles shall have a minimum shaft diameter equal to that shown on the drawings. If the piles diameter is reduced, the Contractor shall design and furnish additional or corrective construction, acceptable to the Architect, to compensate for loss of piles section, at no extra cost. The proposed corrective construction which may include additional piles, caps and grade beams shall be submitted to the Architect for review.

D. Corrective Methods

1. If test results indicate that the soil is not capable of providing the required minimum allowable piles capacity value, the shaft length shall be advanced and the evaluations for capacity repeated, unless other recommendations are made by the Owner's Geotechnical Consultant, with the concurrence of the Architect.

2. Loose materials or free water in quantities sufficient to cause settlement or affect concrete strength, as determined by Owner's Geotechnical Consultant shall be removed from the bottom of the shaft.

3. If water or other conditions are found which make excavation through sand or silt strata dangerous to personnel or such as to cause excessive inflow of silt or sand creating voids outside the piles, the work shall be continued using an acceptable stabilization method or other alternative method, which are demonstrated by trial shaft in either case.

4. If concrete placement is suspended before completion of a pile or a construction joint is required for some other reason, show the detail and elevation of the joint on the as-built drawings.

5. If construction joints are required and the reinforcing cage is not required at the joint location, provide dowels of the same size and configuration as the reinforcing cage, suitably tied, with embedment sufficient to develop and bond strength of the bars.

3.3 FIELD QUALITY MONITORING

A. Bearing Strata: The Owner's Geotechnical Consultant will perform all tests hereinafter specified and any additional tests as may be required, and will prepare test reports:

1. The bottom elevations, bearing, and lengths of piles as shown on the drawings are estimated from the soil boring data. The actual elevations, pile lengths and load capacities shall be determined by the Owner's Geotechnical Consultant.

2. The Contractor shall notify the Owner's Geotechnical Consultant sufficiently in advance to allow inspection of the shaft excavation and evaluation herein specified as soon as the desired level is reached.
3. The Owner's Geotechnical Consultant shall keep an accurate record of each piles excavation.

4. The bottom of the excavation for all piles shall be inspected as necessary by the Owner's Geotechnical Consultant.

5. The completed piles will be evaluated as directed by the Geotechnical Consultant by sonic gamma logging, cross hole logging or other means for voids or other indications of incomplete pile diameter at any elevation. Provide and install a minimum of two tubes in each pile for logging of the diameter and material as directed by the Geotechnical Consultant. Protect the tubes by sealing, filling with water, etc. and flushing out, prior to sonic testing by the Geotechnical Consultant. Provide coring equipment and core the test piles full length to evaluate concrete consistency and strength. Box the core and deliver portions for testing by the Owner's Concrete Testing Agency. Core other piles as directed at no additional cost where sonic testing or other evaluations indicate deficiencies in concrete consistency, strength, etc.

B. Concrete: The Owner's Concrete Testing Agency shall conduct the following tests and inspections during construction and immediately submit reports thereon to the Architect.

1. Compression Tests shall be made for each 100 cu. yds. (75 cu.m) of concrete, or fraction thereof, but not less than one set of cylinders for each day's concrete placement of each concrete type. Make 5 standard 6x12 (15x30 cm) cylinders and test in accordance with ASTM C31 and C39. Test two cylinders at the age of 7 days and two cylinders at the age of 28 days. Keep one cylinder in reserve for 56-day test if 28 day test does not meet requirements. Only one set of tests shall be made from any one batch of concrete and all 5 cylinders shall be made from the same batch. One 7-day cylinder and one 28-day cylinder shall be cured in a pit at the job site to simulate the same curing conditions as the concrete used in the piles. The remaining cylinders shall be cured in the laboratory. Reports of cylinder tests shall state: The location in the structure; laboratory or site curing; compression strength; type of fracture; age at testing; concrete supplier; mix specification strength and any other pertinent information, together with a statement as to whether this concrete complies with the specifications. In addition, one cylinder for 7-day test shall be taken from every truck load.

2. Slump Tests: ASTM C143. Provide a slump cone at the site at all times. Make two (2) test for each 100 cu. yds. (75 cu.m) of concrete, or fraction thereof, but not less than two (2) tests for each day's placement of each type of concrete. Each test shall be from a separate batch.

3. Inspection of Batch Plant operation as required to ensure that concrete delivered to job complies with the specifications and the design mix. Batch plant inspection shall be required once at start of job and thereafter if concrete falls below specification strength or is not satisfactory to the Inspector of Record.
C. Additional Tests: If, in the opinion of the Architect, based on cylinder strengths below specification requirements or visual defects, concrete of poor quality has been placed, additional tests shall be made as directed by the Architect and at the expense of the Contractor. Tests may be compression tests on cored cylinders, ASTM C42, and/or load tests as outlined in ACI 318, Section 202, or as directed by the Architect. Complete continuous coring of piles will be required, at the Contractor's expense, where observation of the concrete placing operations indicates cause for suspicion of the quality of the concrete, presence of voids, segregation or other possible defects in the piles.

1. Probe the top 2’ (60 cm) of fresh concrete at the top of shaft or where concrete placement is delayed to determine consistency. If laitance, foreign matter, or excess water is in evidence, the Contractor shall remove same.

END OF SECTION
SECTION 02505
BITUMINOUS SURFACING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Supply and install paving for parking areas, for in between buildings, around planting, and turf areas as indicated.

1.2 RELATED SECTIONS

A. Section 02210: Grading.
B. Section 02230: Base Course.
C. Section 02575: Pavement Repair.

1.3 REFERENCE STANDARDS


PART 2 - PRODUCTS

2.1 BITUMINOUS MATERIALS

A. Use materials of the class, grade or type indicated on Drawings, conforming to all relevant provisions of Section 203 "Bituminous Materials" of the Standard Specifications for Public Works Construction.

2.2 HEADERS AND STAKES

A. Headers: Redwood, Construction Heart Grade, size 2 x 6, unless otherwise indicated on Drawings.
B. Stakes: 2 x 4 Redwood or 2 x 3 Douglas Fir, Construction Grade.
C. Nails: Common, Galvanized, 12d minimum.

PART 3 - EXECUTION

3.1 HEADERS

A. Install headers along edge of bituminous surfacing where it abuts lawn, dirt or planting area, unless indicated otherwise.
B. Place headers so that bottom has continuous bearing on solid earth. Where excavation for headers is undercut, tamp earth under the header thoroughly. Compact backfill on both sides of header to the density of the adjacent undisturbed earth.
C. Hold headers in place with Redwood or Douglas Fir stakes of length necessary to extend into solid earth a minimum of 12". All stakes shall be of sound material, neatly pointed, driven vertically, and securely nailed to headers. Space stakes, not to exceed 4'-0" on centers with top of stakes set 1" below top of header. Use minimum of 2-12d galvanized common nails through each stake.

D. Remove existing headers where new surfacing is placed to join existing surfacing.

E. Install temporary headers at transverse joints of paving where continuous paving operations are not maintained.

F. Provide additional stakes and anchorage as required to hold headers in place. True to line and grade at Contractor's expense.

3.2 CONSTRUCTION OF ASPHALT CONCRETE PAVEMENT

A. Thickness Of Surfacing: Unless otherwise indicated on Drawings or specified, construct bituminous surfacing to a compacted thickness of 2".

B. Place surfacing material over base course as specified in Base Course: Section 02230.

C. Thoroughly clean, dry and uniformly coat all bituminous surfacing contacting surfaces, such as walls, concrete, masonry, and existing bituminous surfacing, with a film of asphaltic emulsion.

D. Thicken all edges of bituminous surfacing that do not abut walls, concrete, or masonry and edges joining existing bituminous surfacing. Remove headers at existing bituminous surfacing where new bituminous surfacing is to be joined. Thicken edges an additional 2" and taper to the indicated or specified thickness 6" back from such edges.

E. At stairways, join surfacing to first tread or riser below first tread, at an elevation below first riser equal to height of risers of stairway.

F. Provide adequate protection over concrete, planting areas, and other finish work adjacent to areas to receive bituminous surfacing.

G. Placing:

1. Do not place bituminous surfacing when atmospheric temperature is below 40° F.; during fog, or other unsuitable weather conditions. Do not deliver material to site if it cannot be placed and finish-rolled before sundown. Temperature of mixture at time of placing shall not be lower than 260° F. in warm weather nor higher than 320° F. in cold weather.

2. Where 2" or 3" thick surfacing is indicated or specified, place surfacing in one course. Where surfacing is indicated or specified 4" or more in thickness, except for thickened edges, place bituminous surfacing in courses of approximately equal thickness, each course not exceeding 2-1/2" in thickness unless otherwise approved by the Construction Inspector.

H. Stakes or Screeds: Provide grade or screed stakes spaced not more than 15'-0" apart in flow lines with grades of less than 1.00%. Continuous screeds may be used in lieu of stakes.
I. Spreading: Spread bituminous surfacing in a manner to cause least possible handling of mixture. In open areas and wherever practicable, spread by mechanical means using a self-propelled mechanical spreader. In confined or restricted areas, spread mixture with hot shovels and rakes, and smooth with lutes. Spreading may be accomplished by other means, provided method is approved by Construction Inspector.

J. Joints: Make joints between successive runs vertical. Exercise care in connection with construction of joints to ensure that surface of pavement is true to grade and cross section. Lapped joints will not be permitted.

K. Rolling:

1. Finish roll with a self-propelled tandem roller weighing not less than 8 tons. Break down roll with a self-propelled roller weighing between 1-1/2 tons and 8 tons. If more than 500 tons of surfacing are to be placed in a one-hour period, provide an additional 8-ton roller for first 4 hours of work period.

2. Roll in a manner that preserves flow lines and the established finished grades. Break down roll in areas adjacent to flow lines parallel to flow lines. Break down roll as soon as practicable after bituminous surfacing is spread, but not so soon that shoving or cracking of mixture under roller will occur. Continue finish rolling until surfacing is unyielding, true to grade, and meets requirements for smoothness hereinafter specified. Areas that are inaccessible to finish roller may be finish rolled with breakdown roller or tamped with hot tamping irons and smoothed with hot smoothing irons or hand roller.

3. Where bituminous surfacing abuts concrete, masonry, walks or paving, tamp joint smooth, if necessary, as described above to obtain a uniformly even joint, free of differences in elevation. Do all tamping and smoothing while surfacing is still sufficiently hot to properly compact.

4. Compacted bituminous surfacing shall have bulk specific gravity of not less than 2.31 when tested in accordance with "Standard Method of Test for Specific Gravity of Compressed Bituminous Mixtures", ASTM D1186.

3.3 TOLERANCE

A. Smoothness: Surface of bituminous surfacing after rolling, shall be even, smooth and uniform in texture with no voids or rock pockets, free of roller marks or other irregularities, and not varying by more than 0.03', except at local depressions or raised areas as indicated, when a 10'-0" straightedge is placed on surface.

B. Grade: Finished grade shall not vary more than 0.02' above or below designed grade. Variations within prescribed tolerance shall be compensating so that average grade and cross-section are met.

3.4 TESTING

A. After first coat of surface seal has been applied and cured, flood test completed bituminous surfacing in presence of the Construction Inspector. Repair areas of freestanding water or puddles and flood test locally; re-apply surface seal and retest as necessary.
3.5 GUARANTEE

A. In addition to guarantee requirements of the Contract Documents, repair or restore to satisfactory condition any portion of bituminous surfacing and surface seal in which creeping, shoving, cracking, peeling, raveling, softening, or depressed areas which collect water, appear or become evident within one year from date of acceptance.

1. Repair in accordance with requirements of Specification Section 02575: Pavement Repair.

END OF SECTION
SECTION 02506
CONCRETE WHEEL BUMPERS

PART 1   GENERAL

1.1 SUMMARY

A. Furnish and install concrete wheel bumpers (wheel stops) as indicated on the drawings and specified.

B. Product Data: Submit information describing the materials used in the manufacture of the wheel bumpers.

1.2 SUBMITTALS

A. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:

1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials:
   a. Concrete Wheel Bumpers

2. LEED Credit MRc5.1: Provide manufacturer name and location data for the following materials:
   a. Concrete Wheel Bumpers

3. LEED Credit MRc5.2: Provide data from the manufacturer indicating the sources, including source name and locations, of raw materials used to fabricate the following materials. If different raw material sources are used the manufacturer shall provide a breakdown based on percentage of weight of materials used in the product for each different raw materials source used:
   a. Concrete Wheel Bumpers

PART 2   PRODUCTS

2.1 MATERIALS

A. Concrete shall conform to the following:

1. Minimum compressive strength: 4,000 pounds per square inch (psi) minimum at 28 days.

2. Air content: 5 to 8 percent.

3. Size of bumpers shall be as indicated on the drawings.

B. Reinforcing bars shall be deformed billet steel conforming to ASTM A615, Grade 60.

C. Anchor stakes for driving into the ground shall be No. 4 reinforcing bars or steel pipe conforming to ASTM A53.

PART 3  EXECUTION

3.1 INSTALLATION ON ASPHALT PAVEMENTS

A. Secure bumpers in place with steel stakes, two per bumper, driven to at least 1/4-inch below top surface of the bumper, through the pavement and not less than 12 inches into the subgrade.

3.2 INSTALLATION ON PORTLAND CEMENT CONCRETE PAVEMENTS

A. Secure bumpers in place with 2-component epoxy adhesive. Surfaces to receive adhesive to be free of laitance, dirt, loose particles or other foreign matter and shall be completely cured and dry.

B. Slightly roughen the smooth surfaces as recommended by the adhesive manufacturer to provide for proper bond. Properly cure the adhesive after placing of bumper unit.

END OF SECTION
SECTION 02510
WATER DISTRIBUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes piping and specialties for combined potable and fire protection water service outside the building.
B. This Section includes tapping of Los Angeles Department of Water and Power Water Main.
C. Related Sections include the following:
   1. Division 2 Section 02200-Earthwork for trench excavation and backfill.
   2. Division 15 Section 15310-Mechanical for potable and fire protection piping inside the building.

1.3 SYSTEM PERFORMANCE REQUIREMENTS
A. Minimum Working Pressures: The following are minimum pressure requirements for piping and specialties, unless otherwise indicated:

1.4 SUBMITTALS
A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
B. Product Data: For the following:
   1. Pipe and fittings.
   2. Valves.
   3. Fire hydrants.
   4. Fire department connections.
C. Purging and Disinfecting Reports: As specified in "Cleaning" Article in Part 3.

1.5 QUALITY ASSURANCE
A. Comply with the Los Angeles Department of Water and Power standards for potable water-service piping for testing and disinfection.

1.6 DELIVERY, STORAGE, AND HANDLING
A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
   1. Ensure that valves are dry and internally protected against rust and corrosion.
   2. Protect valves against damage to threaded ends and flange faces.
   3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. During Storage: Use precautions for valves, including fire hydrants, according to the following:
   1. Do not remove end protectors, unless necessary for inspection; then reinstall for storage.
   2. Protect from weather. Store indoors and maintain temperature higher than ambient dew-point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.

C. Handling: Use sling to handle valves and fire hydrants whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

1.7 PROJECT CONDITIONS

A. Verify existing utility locations. Contact utility locating service.

B. Verify that it is possible to install water service piping to comply with original design and referenced standards.

C. Site Information: Reports on subsurface condition investigations made during design of Project are available for informational purposes only; data in reports are not intended as representations or warranties of accuracy or continuity of conditions between soil borings. Owner assumes no responsibility for interpretations or conclusions drawn from this information.

1.8 SEQUENCING AND SCHEDULING

A. Coordinate connection to water main with the Los Angeles Department Of Water And Power.

B. Coordinate piping materials, sizes, entry locations, and pressure requirements with building water distribution piping.

C. Coordinate piping materials, sizes, entry locations, and pressure requirements with building fire-protection water piping.

D. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 PIPES AND TUBES
A. General: Applications of the following pipe and tube materials are indicated in Part 3 “Piping Applications” Article.

B. Ductile-Iron, Push-on-Joint Pipe: AWWA C151, with cement-mortar lining and seal coat according to AWWA C104. Include rubber compression gasket according to AWWA C111.

2.2 PIPE AND TUBE FITTINGS

A. General: Applications of the following pipe and tube fitting materials are indicated in Part 3 “Piping Applications” Article.

B. Ductile-Iron, Push-on-Joint Fittings: AWWA C110, ductile-iron or cast-iron; or AWWA C153, ductile-iron, compact type. Include cement-mortar lining and seal coat according to AWWA C104 and rubber compression gaskets according to AWWA C111.

2.3 JOINING MATERIALS

A. General: Applications of the following piping joining materials are indicated in Part 3 “Piping Applications” Article.

B. Ductile-Iron Piping: The following materials apply:

2.4 PIPING SPECIALTIES

A. Dielectric Fittings: Assembly or fitting with insulating material isolating joined dissimilar metals to prevent galvanic action and corrosion.
1. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld-neck end types and matching piping system materials.
2. Dielectric Unions: Factory-fabricated union assembly, designed for 250-psig (1725-kPa) minimum working pressure at 180 deg F (82 deg C). Include insulating material isolating dissimilar metals and ends with inside threads according to ASME B1.20.1.
3. Dielectric Flanges: Factory-fabricated companion-flange assembly, for 150- or 300-psig (1035- or 2070-kPa) minimum pressure to suit system pressures.
4. Dielectric-Flange Insulation Kits: Field-assembled companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
   a. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig (1035- or 2070-kPa) minimum working pressure to suit system pressures.
5. Dielectric Couplings: Galvanized-steel couplings with inert and non-corrosive thermoplastic lining, with threaded ends and 300-psig (2070-kPa) minimum working pressure at 225 deg F (107 deg C).
6. Dielectric Nipples: Electroplated steel nipples with inert and non-corrosive thermoplastic lining, with combination of plain, threaded, or grooved end types and 300-psig (2070-kPa) working pressure at 225 deg F (107 deg C).

2.5 PE ENCASEMENT

A. PE Encasement for Ductile-Iron Piping: ASTM A 674 or AWWA C105, PE film, 0.008-inch (0.20-mm) minimum thickness, tube or sheet.

2.6 VALVES
A. Non-rising-Stem, Resilient-Seated Gate Valves, 3-Inch NPS (DN80) and Larger: AWWA C509, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut. Include 200-psig (1380-kPa) minimum working-pressure design, interior coating according to AWWA C550, and push-on- or mechanical-joint ends.

B. Valve Boxes: Cast-iron box with top section and cover with lettering "WATER", bottom section with base of size to fit over valve and barrel approximately 5 inches (125 mm) in diameter, and adjustable cast-iron extension of length required for depth of bury of valve.

1. Provide steel tee-handle operating wrench with each valve box. Include tee handle with one pointed end, stem of length to operate valve, and socket-fitting valve-operating nut. After installation of valve box cover and after installation of adjacent paving, if any, covers shall be sandblasted or wire-brushed as necessary and painted with bituminous black paint, unless another color is required by the Architect.

C. Indicator Posts: UL 789, FM-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of bury of valve. Posts above and including connection to riser shall be sandblasted, if necessary, after installation and painted red, unless another color is required by the Architect.

2.7 FREESTANDING FIRE HYDRANTS

A. Description: Cast-iron body, compression-type valve, opening against pressure and closing with pressure, 6-inch (DN150) mechanical-joint inlet, and 150-psig (1035-kPa) minimum working-pressure design.

B. Outlet Threads: NFPA 1963, with external hose thread used by the City of Los Angeles Fire Department. Include cast-iron caps with steel chains.

C. Operating and Cap Nuts: Pentagon 1-1/2 inch (40 mm) point to flat. Shall be pursuant to AWWA C503. Size and shape of operating nuts and threads on hose and pumper connections shall match those on existing hydrants in the vicinity.

D. Direction of Opening: Open hydrant valve by turning operating nut to left or counterclockwise.

E. Exterior Finish: Red or yellow (as directed by LOS ANGELES DEPARTMENT OF WATER AND POWER) alkyd-gloss enamel paint. Entire hydrant above and including connection to riser shall be sandblasted, if necessary, after installation and re-painted.

F. Wet-Barrel Fire Hydrants: AWWA C503, two 2-1/2-inch NPS (DN65) and one 4-1/2-inch NPS (DN115) outlets, 6-inch NPS (DN150) threaded or flanged inlet, and base section with 6-inch NPS (DN150) mechanical-joint inlet. Include interior coating according to AWWA C550.

2.8 FIRE DEPARTMENT CONNECTIONS

A. Exposed Fire Department Connections: UL 405, cast-brass body, with thread inlets according to NFPA 1963 and matching local fire department hose threads, and threaded bottom outlet. Include lugged caps, gaskets, and chains; lugged swivel connection and drop clapper for each hose-connection inlet; 18-inch- (460-mm-) high brass sleeve; and round escutcheon plate.

1. Connections: Two 2-1/2-inch NPS (DN65) inlets and 6-inch NPS (DN150) outlet.

2. Inlet Alignment: Inline, horizontal.

4. Escutcheon Plate Marking: "AUTO SPKR."

2.9 ANCHORAGES

A. Concrete Reaction Backing: Portland cement concrete mix, 3000 psig (20.7 MPa).
   1. Cement: ASTM C 150, Type I.

2.10 IDENTIFICATION

A. Refer to Division 2 Section 02200"Earthwork" for underground warning tape materials.

B. Arrange for warning tapes made of solid blue film with continuously printed black-letter caption "CAUTION--WATER LINE BURIED BELOW."
PART 3 - EXECUTION

3.1 EARTHWORK

A. Refer to Division 2 Section 02200 "Earthwork" for excavation, trenching, and backfilling.
B. Refer to Division 2 Section 02511 "Hot-Mix Asphalt Paving" for cutting and patching of existing paving.
C. Refer to Division 2 Section 02520 "Portland Cement Concrete Paving" for cutting and patching of paving.

3.2 PIPING APPLICATIONS

A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications:
B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used in applications below, unless otherwise indicated.
C. Do not use flanges or keyed couplings for underground piping.
D. Fire-Protection Water-Service Piping: Use the following:
   1. 4- to 8-Inch NPS (DN100 to DN200): Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed joints.

3.3 VALVE APPLICATIONS

A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Underground Valves, 3-Inch NPS (DN80) and Larger: AWWA, gate valves, non-rising stem, with valve box.
   2. Underground Valves, 4-Inch NPS (DN100) and Larger: UL/FM, gate valves, non-rising stem, with indicator post.

3.4 JOINT CONSTRUCTION

B. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, OD, and system working pressure. Refer to "Piping Systems - Common Requirements" Article below for joining piping of dissimilar metals.

3.5 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General Locations and Arrangements: Drawings indicate general location and arrangement of piping systems. Install piping as indicated, unless deviations to layout are approved in advance by the Architect or the Los Angeles Department of Public Works.
B. Install components with pressure rating equal to or greater than system operating pressure.
C. Install piping free of sags and bends.

D. Install fittings for changes in direction and branch connections.

G. Piping Connections: Unless otherwise indicated, make piping connections as specified below:
   1. Install dielectric fittings to connect piping of dissimilar metals.

3.6 SERVICE ENTRANCE PIPING

A. Extend water-service piping and connect to water-supply source and building water piping systems at outside face of building wall in locations and pipe sizes indicated.
   1. Terminate water-service piping at building wall until building water piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building water piping systems when those systems are installed.

B. Sleeves and mechanical sleeve seals are specified in Division 15 Section "Mechanical".

C. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.7 PIPING INSTALLATION

A. Water-Main Connection: Arrange for tap to me made by the Los Angeles Department of Water and Power or their water main, of size and in location indicated.

B. Comply with NFPA 24 for fire-protection water-service piping materials and installation.

C. Install ductile-iron piping according to AWWA C600.
   1. Encase piping with PE film according to ASTM A 674 or AWWA C105.
   2. Install encasement per manufacturer's written instructions. Close seams and overlaps in the polyethylene tubes with polyethylene compatible adhesive tape. The tape shall be approximately two inches wide and shall have the ability to bond securely to a metal surface and the polyethylene material. Repair all rips, tears and other damage with suitable adhesive tape.

D. Bury piping with depth of cover over top at least 30 inches (750 mm) and according to the following:
   1. Under Driveways: With at least 36 inches (900 mm) cover over top.
   2. If trenching before rough grading is completed would result in a lesser depth of cover than specified above, then trenching for water piping installation shall not be done until the specified minimum cover depth can be effected. If construction traffic will be allowed to pass over completed water piping installations prior to finish paving, then a protective pavement blanket at least equivalent to the final pavement and base thickness shall be constructed within the vehicle access area for a minimum distance of three feet on either side of the pipe. As an alternative to the temporary pavement blanket, the water pipe shall be installed at a minimum of two (2) feet deeper than specified within construction traffic areas.

3.8 ANCHORAGE INSTALLATION

A. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:

B. Apply full coat of asphalt or other acceptable corrosion-retarding material to surfaces of installed ferrous anchorage devices.

3.9 VALVE INSTALLATION

A. General Application: Use mechanical-joint-end valves for 3-inch NPS (DN80) and larger underground installation. Use non-rising-stem UL/FM gate valves for installation with indicator posts.

B. AWWA-Type Gate Valves: Comply with AWWA C600. Install underground valves with stem pointing up and with cast-iron valve box.

C. UL/FM-Type Gate Valves: Comply with NFPA 24. Install underground valves and valves in pits with stem pointing up and with vertical cast-iron indicator post.

3.10 FIRE HYDRANT INSTALLATION

A. General: Install each fire hydrant with separate gate valve in supply pipe, anchor with restrained joints or thrust blocks, and support in upright position.

B. Wet-Barrel Fire Hydrants: Provide for drainage.

C. AWWA-Type Fire Hydrants: Comply with AWWA M17.

D. UL/FM-Type Fire Hydrants: Comply with NFPA 24.

3.11 FIRE DEPARTMENT CONNECTION INSTALLATION

A. Install fire department connection of type and features indicated.

3.12 IDENTIFICATION INSTALLATION

A. Install continuous plastic underground warning tape during back-filling of trench for underground water-service piping. Locate 6 to 8 inches (150 to 200 mm) below finished grade, directly over piping.

3.13 FIELD QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.

B. Hydrostatic Tests: Test at not less than 1-1/2 times working pressure for 2 hours.

1. Increase pressure in 50-psig (350-kPa) increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to 0 psig (0 kPa). Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is 2 quarts (1.89 L) per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within above limits.

C. Prepare reports for testing activities.
3.14 CLEANING

A. Clean and disinfect water distribution piping as follows:

1. Purge new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.

2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities, use procedure described in AWWA C651 or as described below:
   
   a. Comply with NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
      
      1) Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine. Isolate system or part thereof and allow to stand for 24 hours.
      
      2) Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
      
      3) Following allowed standing time, flush system with clean, potable water until chlorine does not remain in water coming from system.
      
      4) Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

B. Prepare reports for purging and disinfecting activities.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install portland cement concrete paving as shown on the drawings, including curbs, gutters, walkways, and pavement, and other site concrete.

B. Material selection:
   1. Select materials that have the highest possible recycled content while still meeting performance criteria.
   2. Select materials from local manufacturers wherever possible.

1.2 SUBMITTALS

A. Provide samples, manufacturer's product data, test reports, and materials' certifications as required in referenced sections for concrete and joint fillers and sealers.

B. Mix design:
   1. Include the highest percentage of fly ash in concrete mix that will meet the specified performance criteria.

C. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:
   1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials:
      a. Concrete: Assembly
      b. Reinforcing (steel materials)
   2. LEED Credit MRc5.1: Provide manufacturer name and location data for the following materials:
      a. Concrete: Assembly
      b. Concrete: Mix Design Report
      1. Provide a copy of the plant batch mix report for each different mix design used and batch plant used.
   3. LEED Credit MRc5.2: Provide data from the manufacturer indicating the sources, including source name and locations, of raw materials used to fabricate the following materials. If different raw material sources are used the manufacturer shall provide a breakdown based on percentage of weight of materials used in the product for each different raw materials source used:
      a. Concrete: Portland Cement
b. Concrete: Aggregate

c. Concrete: Sand

d. Concrete: Fly Ash

b. Base Materials

1.3 QUALITY ASSURANCE

A. Unless otherwise specified, all materials and work shall be in accordance with "The Standard Specifications for Public Works Construction" (the Standard Specifications), latest edition.

B. Base material for concrete shall be CMB per 200-2.4 and shall be placed and compacted per the Standard Specifications.

C. Placed concrete shall be class 520-C-2500, maximum 4 inch slump. Pumped concrete shall be class 560-E-2500, maximum 6 inch slump. A complete delivery receipt shall be required for each truckload of concrete delivered. The receipt shall be given to the Contract Administration Inspector.

D. Portland Cement Concrete shall be Type II, (201-1.2).

E. The aggregates for all concrete shall be fractured face aggregates obtained from a quarry in the San Gabriel River drainage area only and shall be certified non-reactive by an approved testing laboratory as approved by the Bureau of Contract Administration, (201-1.2.2).

PART 2 PRODUCTS

2.1 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

1. Use flexible spring steel forms or laminated boards to form radius bends as required.

B. Coat forms with a nonstaining form release agent that will not discolor or deface surface of concrete.


D. Reinforcing Bars: Deformed steel bars, ASTM A 615, Grade 60.

E. Joint Dowel Bars: Plain steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

F. Concrete Materials: Comply with requirements of applicable Division 3 sections for concrete materials, admixtures, bonding materials, curing materials, and others as required.
G. Use high-range water-reducing admixture (HRWR) in pumped concrete, concrete for parking structure slabs, and concrete with water/cement ratios below 0.50. High-Range water-reducing admixture (Super Plasticizer) shall conform to ASTM C 494, Type F or Type G, and be one of the following products:


H. Expansion Joint Sealers: Comply with requirements of applicable Division 7 sections for joint sealers.


J. Provide a packaged, integral color, consisting of portland cement, coloring pigments, and plasticizing admixtures. Use coloring pigments that are nonfading mineral oxides, interground with cement. Color as selected by Architect from manufacturers’ standards. Subject to compliance with specified requirements, products that may be incorporated in the work include those of the following manufacturers:

1. Davis Color Inc.
2. A. C. Horn, Inc.
3. L & M Construction Chemicals, Inc.
4. Master Builders, Inc.
5. L. M. Scofield Co.
6. Or Equal.

K. Liquid-Membrane Forming and Sealing Curing Compound: Comply with ASTM C 309, Type I, Class A unless other type acceptable to Architect. Moisture loss no more than 0.055 gr./sq. cm. when applied at 200 sq. ft./gal, as follows:


2.2 CONCRETE MIX, DESIGN, AND TESTING

A. Comply with requirements of applicable Division 3 sections for concrete mix design, sampling and testing, and quality control and as herein specified.
B. Design mix to produce normal-weight concrete consisting of portland cement, aggregate, water-reducing or high-range water-reducing admixture (superplasticizer), air-entraining admixture, and water to produce the following properties:

1. Compressive Strength: As indicated on the drawings, or if not so indicated compressive strength shall be 3000 psi, minimum at 28 days.

2. Slump Limit: 8 inches minimum for concrete containing high-range water-reducing admixture (superplasticizer); 3 inches for other concrete.

3. Air Content: 5 to 8 percent.

PART 3 EXECUTION

3.1 FORM CONSTRUCTION

A. Set forms to required grades and lines, braced and secured. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after placement.

B. Check completed formwork for grade and alignment to following tolerances:

1. Top of forms not more than 1/8 inch in 10 feet.

2. Vertical face on longitudinal axis, not more than 1/4 inch in 10 feet.

C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

D. Slope step treads at 1/4 inch per foot to drain.

3.2 STEEL REINFORCEMENT

A. Locate, place, and support reinforcement as specified in Division 3 sections, unless otherwise indicated.

3.3 CONCRETE PLACEMENT

A. General: Comply with requirements of Division 3 sections for mixing and placing concrete, and as herein specified.

B. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Place concrete by methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand-spreading. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.

D. Use bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
E. Deposit and spread concrete in a continuous operation between transverse joints as far as possible. If interrupted for more than 1/2 hour, place a construction joint.

F. Curbs and Gutters: Automatic machine may be used for curb and gutter placement at Contractor's option. If machine placement is to be used, submit revised mix design and laboratory test results that meet or exceed minimums specified. Machine placement must produce curbs and gutters to required cross-section, lines, grades, finish, and jointing as specified for formed concrete. If results are not acceptable, remove and replace with formed concrete as specified.

3.4 JOINTS

A. General: Construct expansion, weakened-plane (contraction), and construction joints true to line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

B. When joining existing structures, place transverse joints to align with previously placed joints, unless otherwise indicated.

C. Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints, sectioning concrete into areas as shown on drawings. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness, as follows:

1. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.

D. Construction Joints: Use standard metal keyways. Place construction joints at end of placements and at locations where placement operations are stopped for more than 1/2 hour, except where such placements terminate at expansion joints.

E. Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, inlets, structures, walks, and other fixed objects.

F. Extend joint fillers full width and depth of joint, not less than 1/2 inch or more than 1 inch below finished surface where joint sealer is indicated. If no joint sealer, place top of joint filler flush with finished concrete surface.

G. Fillers and Sealants: Comply with requirements of applicable Division 7 sections for preparation of joints, materials, installation, and performance.

3.5 GENERAL CONCRETE FINISHING

A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Apply a float finish as a first phase preceding all other finishes. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with a 10-ft. straightedge. Distribute concrete as required to remove surface irregularities, and refloat repaired areas to provide a continuous smooth finish.

C. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2-inch radius.

D. After floating and when excess moisture or surface sheen has disappeared, complete troweling and finish surface as follows:
1. On level surfaces, broom finish by drawing a fine-hair broom across concrete surface perpendicular to line of traffic.

2. On inclined slab surfaces, provide a coarse, non-slip finish by scoring surface with a stiff-bristled broom, perpendicular to line of traffic.

E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Architect.

3.6 WOOD FLOAT FINISH

A. Also provide as second stage for other finishes, unless otherwise specified.

B. Using approved floating machines or hardwood trowels, float surfaces to required planes and shapes, working just sufficiently to bring surfaces to uniform condition.

C. Work no more than necessary to achieve uniform texture free from irregularities and screed marks; except where receiving fills or mortar beds, leave surfaces in roughened, granular condition for good mechanical bond.

D. Cut and fill surfaces as necessary to true up.

E. When followed by other finishes, floating shall leave small amount of mortar on surfaces without excess of water.

F. Do not proceed with subsequent finishes until surface water has absorbed or dried off and concrete has set sufficiently to prevent fines or water from being worked to the surface.

G. Finish texture shall be fine-grained and granular to provide good slip-resistance, and shall be reasonably free from directional trowel marks.

H. Provide for exterior and interior surfaces of buildings, unless otherwise indicated.

3.7 STEEL TROWEL FINISH

A. Using finishing machines or steel trowels, trowel surfaces to produce a dense, hard, smooth steel trowel finish. Commence troweling in 1 pass sufficiently to flatten floated surface.

B. Wait until concrete has set sufficiently; then resume steel troweling; continue and repeat as required to obtain a hard steel trowel finish, free of blemishes, ripples, and trowel marks.

C. Do not:
   1. Use cement or sand dusting to absorb or otherwise remove surface water.
   2. Commence troweling too soon on freshly placed concrete.
   3. Overwork surfaces by excessive troweling in an area in one pass.

D. Work out lips, uneven levels, and other irregularities prior to final troweling.

E. Neatly tool exposed edges, expansion joints, curbs, arises, and other details.
F. Surface across joints shall be level and free from offsets.

G. Provide for interior surface not otherwise indicated or specified.

3.8 BROOM FINISH

A. For exterior flatwork and where indicated.
B. Draw a soft-bristled push broom over an initially trowel-finished surface.
C. When coarser surfaces are desired, use a stiffer-bristled broom.
D. Broom finish shall provide a non-slip surface, even if exposed to rain.

3.9 CURING

A. Protect and cure finished concrete paving in compliance with applicable requirements of Division 3 membrane-forming curing and sealing compound.

3.10 REPAIRS AND PROTECTIONS

A. Repair or replace broken or defective concrete, as directed by Architect.
B. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.
C. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just before final inspection.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Centennial boulder.
   2. Supplementary parts and components, such as inserts, clips, fasteners, anchors, and other miscellaneous supports and accessories required for a complete installation.

B. Work furnished but installed in other Sections:
   1. Division 3 for embeds to be cast in cast-in-place concrete for attachments of cast stone units.

1.2 SUBMITTALS

A. Procedure: In accordance with Division One.

B. Samples: Submit 6 in. diameter sample of boulder to be used showing representative colors, veining and weathering.

C. Site boulder: Photographs representative of size and color, with person in photo for scale.

D. Shop drawings: Large scale shop and erection drawings, including dimensions and details of inserts and connections to adjoining work.

1.3 HANDLING

A. Procedure: In accordance with Division One.

B. Delivery: Protect boulder from chipping or scarring during delivery using reasonable and acceptable standards for shipment. Protect against staining or discoloration.

C. Handling: Use straps and not chains to move boulder. Do not chip or scar boulder during handling or placement.

1.4 SEQUENCING AND SCHEDULING

A. Acceptance: Do not install boulder work prior to acceptance by City Engineer.

B. Coordination: Coordinate with the work of other sections to insure the timely and proper installation of accessories imbedded in, built-in, attached to, supported by or covered over by the boulder work so that progress of the work is not delayed.
PART 2 - PRODUCTS

2.1 BOULDER

A. General:
   1. Standard grade, free of cracks, seams or starts which may impair structural integrity or function of boulder.
   2. Color, texture and finish shall be within the range of the mockup and photographs submitted.

B. Site boulder:
   1. Size: As indicated.
   2. Color and texture: To be selected by the City Engineer.

2.2 COMPONENTS

A. Connection materials: Size, number and types selected by the Contractor.


C. Water: Fresh, clean, and potable, non-alkaline water.

PART 3 - EXECUTION

3.1 PREPARATION

A. Boulder: Clean boulder before setting by thoroughly scrubbing them with fiber brushes. Follow with a thorough drenching with clean water. Use only mild cleaning compounds containing no caustic or harsh fillers or abrasives. Remove frost, dirt and other contaminants.
   1. Drill hole or holes into boulder depending on mounting technique used. Clean hole of dust and debris. Location, depth, and placement of hole or holes will depend on shape, weight and balance of boulder on anchorage materials.

B. Anchorage: Install connection materials to concrete base.

3.2 INSTALLATION

A. Do not install boulder that have chips, cracks, holes, spalls, patches, scratches, stains or other defects that would be visible in the finished work.

B. Install boulder on connection pin with cement grout.

3.3 CLEANING

A. After installation has been completed, carefully clean all boulder of dirt, excess mortar, stains and other defacements.
END OF SECTION
PART 1  GENERAL

1.1  SUMMARY

A. Extent of painted pavement surface striping is shown on the plans.
B. Prepare surface for painting.
C. Layout and obtain approval of the proposed striping before starting work.
D. Provide templates for stenciled lettering and legend painting.
E. Paint surface striping 4" wide, unless otherwise indicated.
F. Clean up.
G. Furnish and install all traffic control signs, posts and delineators.
H. LEED goals: Not used.

1.2  RELATED DOCUMENTS

A. The latest adopted edition of the Standard Specifications for Public Works Construction applies to the work of this section.
B. The latest revision to the Cal Trans Traffic Manual applies to the work of this section. Applicable plans are stipulated on drawings.
C. The latest adopted edition of the Caltrans Specifications, Manuals and Standard Plans apply to the work of this section.

1.3  QUALITY ASSURANCE

B. Submit material list and specifications to engineer and City representative for approval.

PART 2  PRODUCTS

2.1  MATERIALS

Accessibility symbol color shall be Federal Standard 595A "Blue #15090".

B. Paint shall comply with local environmental regulations.

C. Signs: Provide roadside signs complete with posts and braces and sign panel fastening hardware in accordance with City of Los Angeles Standard Plans and the APWA Standard Plans for Public Works Construction, and as shown on the drawings. Provide vandal proof connections. Posts shall be Qwik Punch or equal.

D. Custom Parking Lot Signs: Signs shall be constructed of reflective aluminum. Locate signs as indicated on the plans. Size and vandal proof mounting hardware shall be in accordance with Caltrans Standard Plans. Provide Western Highway signs or equal.

PART 3 EXECUTION

A. Painted traffic striping, pavement markings and curb markings shall comply with Section 301.5.6 of the Standard Specifications for Public Works Construction.

1. Preparation of Surfaces: All surfaces to be painted shall be dry and thoroughly free from oil, grease, and loose material.

2. At no cost to City, any painted traffic striping which is unacceptable (i.e., tire prints, etc.) shall be removed by wet-type sandblasting and repainted.

3. Application rate shall be in accordance with manufacturers' printed recommendations, but not over 400 sq. ft. per gallon.

4. Protection: Protect the painted surfaces from traffic until thoroughly dry, one day minimum.

B. Traffic sign installation procedures shall comply with Section 56 of the Caltrans Traffic Manual.

C. Cleanup: Remove all splash discoloration, over spray, and other blemishes from adjacent surfaces by wet type sandblasting. Remove excess material, debris, cartons, and containers from premises immediately upon completion of work.

END OF SECTION
SECTION 02536
PRECAST CONCRETE CLARIFIERS

PART 1   GENERAL

1.1  SUMMARY
A. Furnish and install precast concrete clarifiers as indicated on the drawings and specified.

1.2  SUBMITTALS
A. Shop Drawings: Submit dimensioned drawings that show materials, construction and appurtenances that comprise the clarifier. The drawings and calculations shall be stamped and signed by a professional engineer who is registered in the State of California. Bedding assembly, installation and backfilling instructions shall be submitted for approval.

B. Product Data: Manufacturer’s catalog data for materials. Include technical data for piping, grade rings, and covers.

C. Certificates: Certificates attesting that tests set forth in SSPWC have been performed and the results required by design have been met.

D. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:
   1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials:
      a. Precast Concrete Clarifier
   2. LEED Credit MRc5.1: Provide manufacturer name and location data for the following materials:
      a. Precast Concrete Clarifier

1.3  QUALITY ASSURANCE
A. Comply with the following as a minimum requirement:

PART 2   PRODUCTS

2.1  PRECAST CONCRETE CLARIFIERS
A. Subject to compliance with specified requirements the precast concrete clarifiers shall have the capacities indicated on the drawings and shall be the product of Jensen Precast Inc., or an “or equal” product of one of the following:
   1. Pyramid Precast Co.
   2. M.C. Nottingham Co.
   3. Wieser Precast Concrete Product.
B. Concrete, Mortar and Related Materials: Conform the requirements of the American Concrete Institute ACI 318 code, minimum compressive strength 4000 psi at 28 days, reinforced with ASTM A615 deformed bars.

C. Metal Covers, Frames and Accessories:
   2. Metal Covers and Frames: Vandal-resistant design and construction.

D. Bedding Materials: Conform to the requirements Section 02318, Excavating, Backfilling and Compacting for Utilities.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install the precast concrete clarifier in proper alignment and as indicated on the drawings. Before trench excavation, verify size, material, depth, and location of the point of connection.

B. Join pipes and fittings shall be as recommended by the manufacturer.

C. The clarifiers shall be tested for leakage by filling the vessels to the level of the outflow line for a period of 24 hours. All joints shall be left exposed (except the bottom of the tank) for inspection purposes. The drop in the water level shall not exceed 1 1/2" in 24 hours. The vessels shall remain watertight. Repairs, if necessary, shall be made at the Contractor's expense.

D. Adjust manholes to pavement level in accordance with Standard Specifications for Public Works Construction.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This section includes the requirements for the design, fabrication and installation of a Microwave Antenna Telecommunications Tower to be located as specified herein. The work included herein shall be as follows:

1. The telecommunications tower described in this document shall be used primarily for supporting telecommunications antennas and their associated hardware. These antennas shall include those that operate in the VHF, UHF, and microwave range of radio frequencies. Associated hardware includes but is not limited to wave-guide and coaxial cable support system(s), work platform(s), ladder(s) and antenna mounts.

2. This specification includes the technical, performance and equipment parameters required for the telecommunication tower.

3. The scope of work includes the furnishing of all materials, testing, labor, transportation, and engineering to completely design, fabricate and erect a self-supporting telecommunications tower, including appurtenances and foundations, including microwave and VHF/UHF antenna mounts (Outriggers).

4. Where the requirements of an industrial or government standard which is outlined below is in conflict with another industrial standard which is also outlined below, the more demanding requirement shall apply.

5. Where the requirements of an industrial standard or government standard that is outlined below are in conflict with this specification, this specification shall apply.

6. The telecommunications tower and all its appurtenances shall meet or exceed the requirements of this document, including but not limited to the telecommunications tower, tower foundation(s), microwave antenna(s), antenna mounts, ladder(s), work platform(s), electrical conduits(s), conduit support system, vertical waveguide, and tower lighting system.

7. The telecommunications tower shall be designed by or under the Direct supervision of a registered professional Engineer, specifically experienced in the design of microwave towers.

8. The telecommunications tower shall be fabricated or constructed by a California-licensed Contractor. The Contractor shall be licensed as a California General Engineering Contractor, specifically experienced in the construction of microwave tower.

9. Design and installation of vertical support for waveguide and coaxial cable horizontal bridge shall be compatible with the roof structure and roof system designed and specified by the building Architect.

B. Related Sections:

1. Documents affecting the Work of this section include, but are not necessarily limited to the GENERAL CONDITIONS, DIVISION 1 – GENERAL REQUIREMENTS and other sections of the Project Manual.

2. Division 3 – Section 03300 – Cast-In-Place Concrete

3. Division 5 – Section 05500 – Metal Fabrication

4. Division 16 – Section 16050 – Basic Electrical Requirements

5. Division 16 – Section 16135 – Electrical Boxes and Fittings
1.2 WORK NOT INCLUDED

A. All required local construction permits will be obtained by the City of Los Angeles before any construction begins. This includes FAA and FCC permits. All costs for the permits will be borne by the City.

B. The microwave antennas, microwave antenna second struts, and

C. VHF/UHF antennas and all antenna waveguides and antenna coaxial cables will be furnished and installed by others.

D. The general contractor shall provide access holes and feed-thru plates for Microwave Waveguide and Antenna Feed Cables as follows:
   1. Eight (8) each 4” diameter access holes shall be provided on the wall or roof of the Radio Frequency (RF) Communications Room to accommodate microwave waveguides and antenna feed cable. A 17.5” X 25.5” FEED-THRU PLATE shall be provided over the access holes. ANDREW TYPE 204673-8 FEED-THRU PLATE is suggested. Eight (8) each 4” diameter WAVEGUIDE BOOT shall be provided for the holes. The exact location of the feed-thru plate shall be determined in conjunction with the ITA Communications Engineer.

1.3 CERTIFICATIONS

A. The tower fabricator must obtain the services of a California licensed Structural Engineer to perform all design and engineering analysis, computations and installation drawings developed for and used in this project.

B. All design documents and structural engineering computations shall be certified, stamped and signed by a California licensed Structural Engineer, the Structural Engineer of Record for the self-supporting communications tower.

1.4 PRE-INSTALLATION CONFERENCE

A. The Contractor shall schedule a Pre-installation conference at the job-site

B. Those to attend shall be, but not limited to, the following:
   1. Project Engineer
   2. City Engineer
   3. Tower Engineer of Record
   4. Inspector
   5. Any sub-contractor who will be engaged in the work and any related work associated with the installation of the communications tower.
   6. ITA Staff

1.5 CODES AND STANDARDS

A. Electronic Industry Association (EIA)
   1. The telecommunications tower and all tower mounted appurtenances installed by this specification shall meet or exceed the specifications in ANSI/TIA/EIA standard ANSI/TIA/EIA 222-F entitled “Structural Standards for Steel Antenna Towers and Antenna Supporting Structures”, 2003 edition including all TIA/EIA-222F Annexes.


C. The telecommunications tower and all its appurtenances shall be classified as an Essential Facility, per CCR Title 24, Part 2, California Building Code 2001.

D. The telecommunications tower and all its appurtenances shall be classified as being in Seismic Zone 4, per CCR Title 24, Part 2, California Building Code 2001.
E. The telecommunications tower and all its appurtenances shall be classified to be in Exposure C, per CCR Title 24, Part 2, California Building Code 2001.

F. The California Code of Regulations (CCR) Title 24, Part 3 Electrical Code
   1. The telecommunications tower and all its appurtenances shall meet or exceed the requirements of CCR Title 24, Part 3 – California Electrical Code.

G. National Electric Code – National Fire Protection Association (NFPA 70)
   1. The telecommunications tower and all its appurtenances shall meet or exceed the National Electrical Code, NFPA – 70, 2002.

H. Lighting and Painting – Code of Federal Regulations (CFR)
   1. The telecommunications tower painting and lighting shall meet CFR Title 47, Telecommunications Part 17; and CFR Title 14, Aeronautics and Space, Part 77.
   2. The tower shall be equipped with a FAA approved obstruction red light system, supplied with the tower.
   3. The obstruction lighting controller shall be mounted at the base of the tower.
   4. Lighting shall be activated and deactivated by photoelectric control.
   5. The obstruction lighting controller shall include an automatic telephone dialer, to activate upon failure of the lighting system. The controller shall also include a form “C” contact closure to change state upon failure of the tower lighting system.
   6. The obstruction lighting controller shall include a complete set of drawings and operational instructions.
   7. The obstruction lighting controller shall come with a complete set of operating spare parts.

   2. The lightning protection and grounding system shall be installed per NFPA 780 and Motorola R56 Standard for a Type B facility.

J. California Code of Regulations (CCR) Title 8, Industrial Relations
   1. The telecommunications tower and all its appurtenances shall meet or exceed the requirements of CCR Title 8, Division 1, Department of Industrial Relations, Chapter 4, Division of Industrial Safety, Subchapter 7. General Industry Safety Orders.

1.6 APPLICABLE DOCUMENTS

A. The following documents form a part of this specification and operational Requirements document to the extent specified elsewhere in this document. In the event of conflict between the referenced documents below and the contents of this specification, the most stringent requirement shall govern.
   1. American Concrete Institute ACI 318:
      a. Building Code Requirements for Reinforced Concrete
      b. American Institute of Steel Construction (AISC)
      a. ASTM A325 High Strength Steel
b. ASTM A490  Bolts  
c. ASTM A-36  Structural Steel  
d. ASTM A-50  Structural Steel  
e. ASTM A-441  Structural Steel  
f. ASTM A-572  Structural Steel  
g. ASTM A-53  Welded and Seamless Steel Pipe  
h. ASTM A-123  Zinc  
i. ASTM A-615  Reinforcing Bars  
j. ASTM A-706  Reinforcing Bars  
k. ASTM C-9  Ready-mix Concrete  

3. California Code of Regulations (CCR)  
   a. Title 24 – Building Standards  
      1) Part 2 – California Building Code  
      2) Part 3 – California Electrical Code  
   b. Title 8 – Industrial Relations  
      1) Chapter 4 Division of Industrial Safety  
         a) Subchapter 7 General Safety Orders  

4. Concrete Reinforcing Steel Institute (CFR)  
   a. CFR Title 47, Telecommunications, Part 17  
   b. CFR Title 14, Aeronautics and Space, Part 77  

5. Telecommunications Industries Association (TIA)  
   a. TIA-222-F “Structural Standards for Steel Antenna  

6. National Fire Protection Association Inc. (NFPA)  

7. International Conference of Building Officials  

1.7 QUALITY CONTROL  
A. General  
   1. To ensure the quality of the furnished items and the installation of those items in an  
      acceptable manner, the following shall be part of a quality control and assurance program  
      used for implementation of the specifications and requirements contained in this  
      document.  

B. Right to Inspections  
   1. The City of Los Angeles Information Technology Agency, Communications Services  
      Division reserves the right to inspect all jobsite work without notice to the prime contractor  
      or any subcontractor.  

C. Contractor Certifications
1. The Contractor shall certify that he has had successful experience for a minimum of 10 years in the immediate past in Telecommunications Tower work.

2. The Contractor shall submit a successful projects list for a minimum of 10 years, in the immediate past, demonstrating Telecommunications Work within the State of California. The list shall, as a minimum, include names, titles, addresses, telephone numbers of project references and contacts, project address, dates, significant contribution, and other relevant project experience; and other items of information the City may elect to require.

3. Tower Manufacturer Certification: The Contractor shall obtain product from a Tower Manufacturer with a minimum of 10 continuous years in the immediate past of successful experience specializing in the manufacturer of communication towers similar to the tower specified herein. The Contractor shall cause the Tower Manufacturer to produce a certificate, which shall be co-signed by the Contractor, authenticating the Tower Manufacturer’s minimum experience required herein.

D. Tower Structural Analysis Submittals

1. Design Plans and Drawings shall clearly and completely show all tower components, dimensions, welds, antenna types, sizes, weights, and projected areas for wind design; and shall properly be cross-referenced with other drawings.
   a. Symbols: use logical and consistent symbols, industry conventions and notations.
   b. Titles: identify each and every sheet and drawing.
   c. Identification: shall include the signatory engineer name, title, firm name, address, telephone number, facsimile number, and e-mail on each sheet.
   d. Drawings shall show all the design loading parameters.

2. Material specifications: Shall clearly and completely show requirements for the various types of materials that will enter the work. The grades and materials shall be shown on the drawings for each item.

3. A finite element analysis computer program, using a three-dimensional (space) first order elastic approach, shall be used to structurally analyze the tower.
   a. A graphical interface in the computer program shall print a line drawings of the tower, identifying and numbering the joints.
   b. Displacements and stresses shall be listed for each joint in addition to the per section or total tower analysis summary.
   c. When excessive shear forces and moments occur on tower locations other than joints, an additional second order analysis may be required.

4. Submittal drawings and specifications shall be complete, including but not be limited to the design of the Tower, electrical, foundation; Calculations for individual structural members shall be organized, tabulated and properly represented so as to show clearly, readily and properly each individual design member.

5. Structural calculations, including all loads, forces, moments and foundation calculations shall be provided such that they are easily read and understood and can be documented for future reference.

6. Calculations: Computations, stress diagrams and other pertinent data shall be included in the submittal.
   a. Computations shall include a statement of Calculation Criteria, clearly and concisely outlining the basis for the structural design; computations shall clearly and properly indicate the way by which the structure will resist vertical loads, horizontal forces, etc.
b. Loads and Forces:
   1) The computations shall clearly and properly establish that the structure will
      resist the loads and forces in accordance with CBSC assumed safe bearing
      pressures on soils.
   2) Specified strengths of concrete shall be included in computations and noted
      on plans and drawings.
   3) Where unusual conditions occur, such data as are pertinent to the work
      shall be submitted.

c. Calculations shall clearly show how all vertical and horizontal loads are transferred
   from the steel tower to the concrete foundations.

7. Foundation Design: Provide foundation design and installation methods and procedures;
   include drawings, specifications, and calculations prepared, stamped and signed by a
   current California licensed Civil Engineer. The foundation shall meet or exceed EIA-222-
   F. The impact of the tower foundations on the adjacent police station structure must be
   coordinated with the design Architect. Any additional loads generated by the close
   proximity of the tower foundations must be quantified and provided to the building
   Architect.

8. Electrical Design: Provide electrical design for Tower lighting as required by FAA and by
   CCR Part 3, California Electrical Code. Include drawings, specifications and electrical
   calculations prepared, stamped and signed by a California-licensed Electrical Engineer.

9. The Contractor’s engineer shall make corrections necessary to meet requirements of the
   Codes, regulations and other regulatory requirements, and resubmit to the City Engineer,
   as directed by the City of Los Angeles.
1.8 SUBMITTAL OF PLANS

A. All design and analysis computations and installation drawings developed or used in this project shall be certified and stamped by a California-licensed Civil or Structural Engineer.

B. Drawings and Plans to be submitted by the Contractor.

C. The Contractor shall prepare three complete sets of plans approved and signed by a licensed California Civil or Structural Engineer, and submit the seven sets of plans and specifications to the City Engineer/Architect.

1. Plans shall include the following:
   a. Foundation Plans
   b. Tower Plans with all appurtenances
   c. Wind loading calculations
   d. Seismic calculations with all appurtenances added and identified
   e. Copy of geo-technical soil report
   f. Foundation concrete mix design

1.9 LOCATION

A. The telecommunications tower shall be located at the Hollenbeck Police Station and as shown on the Drawings.

1.10 TOWER ORIENTATION

A. The tower shall be oriented as shown on drawings.

B. At the site, the exact location of the communications tower shall be centered as indicated on the project construction drawings.

1.11 TOWER TYPE

A. The telecommunications tower shall be a free standing, open lattice, three legged tower.

B. Dimensions of Telecommunications Tower

1. The Telecommunications Tower shall have an overall design height of 180’. One hundred and twenty feet (180’ for some sites) of the telecommunications tower shall be provided under this contract.

2. The Telecommunications Tower face width at ground level shall not exceed 40’.

C. Tower Loading

1. The allowable unit stresses and the actual member stresses resulting from the specified design loads shall not exceed those given in the American Institute of Steel Construction, AISC allowable Stress Design specifications, and EIA-222-F.

2. All members of the structure shall be considered primary members for the purpose of establishing allowable compressive stress per AISC, except those members whose sole function is to reduce the effective slenderness ratio (kl/r) of primary members.

3. The telecommunications tower shall have a safety factor for uplift as described in EIA-222-F.
4. Foundations shall be designed with sufficient reserve capacity to match the least tower leg reserve capacity.

5. Combined telecommunications tower wind loads and antenna loads shall be applied in combination such that the maximum axial forces are produced in girders, diagonals, and legs. Multiple analyses shall be necessary to ensure that worst-case design conditions have been investigated per EIA-222-F.

D. Tower Protective Coatings

1. The Telecommunications Tower and all above ground appurtenances installed by this specifications shall contain a protective coating, as referenced in EIA-222-F, which shall consist of the following:
   a. Under no circumstance shall any coating on any metal member or fastener be cathodic relative to the base material.
   b. “Devcon” or equivalent zinc paint, or approved equal, shall be used to touch up damaged galvanizing. Touch up may be done by either a spray or brush application.
   c. When required, telecommunication tower structures shall be painted per Federal “Aviation Administration Specification AC7017460.
   d. All painting shall be performed in the shop using an acrylic latex paint specifically formulated for application to galvanized material.
   e. Field painting shall be limited to touch-up of paint damaged during transportation and erection. Paint shall be the same as was used in the shop to touch-up damaged paint and provide the same protection as original shop painting.

1.12 GROUNDING

A. The telecommunication tower ground shall conform to the requirements of EIA-222-F and Motorola R56 Standard for a Type B facility.

B. Each tower leg shall be connected directly to a 5/8” ground rod with a #2 tinned, solid, bare copper conductor. The impedance to ground shall be 5 ohms or less as specified in the Motorola R56 Standard for a Type B facility.

C. A 5/8” diameter, copper plated steel, 8 foot minimum length ground rod shall be installed within 5 feet of each tower leg. Each ground rod shall be exothermically welded to its respective copper main conductor, which shall be connected to its respective tower leg.

D. The connection of the main conductor cable(s) shall be exothermically welded to each respective leg.

E. The ground rods shall be interconnected with (appropriately-sized) solid Copper conductor to form a loop ground system. The tower loop grounding system shall be tied to the grounding system (also 5 ohms or less) provided for the Main Communications Room, Radio Frequency (RF) Room and Telephone Closets.

1.13 OPERATIONAL REQUIREMENTS

A. General

1. The telecommunications tower shall meet or exceed the following listed operational requirements. This operational requirements document provides some of the technical, performance and equipment parameters required for the telecommunications tower.

   Note: Specific antenna requirements are not yet determined for each project. The listed antennas merely represent the anticipated requirements.

B. Microwave Antennas

MASTER BUILDING SPECIFICATION

MICROWAVE ANTENNA

TELECOMMUNICATIONS TOWER

02580-8
1. The telecommunications tower shall be required to support the following: microwave antenna(s), ice shield(s), and microwave antenna mounting(s), at the locations, heights, frequencies, and azimuths indicated.

2. These shall be connected to their respective microwave waveguide (circuit runs).

3. Provide design loading of antenna type, manufacturer, and model number as follows, or equal:

**ANTENNA 1**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna size</td>
<td>10’</td>
</tr>
<tr>
<td>Center Line height of antenna</td>
<td>180’</td>
</tr>
<tr>
<td>Azimuth from true North, clockwise</td>
<td>0</td>
</tr>
<tr>
<td>Operating frequency</td>
<td>13GHz</td>
</tr>
<tr>
<td>Antenna type</td>
<td>Parabolic</td>
</tr>
<tr>
<td>Antenna manufacturer</td>
<td>Andrew Corp.</td>
</tr>
<tr>
<td>Antenna manufacturer model</td>
<td>UHX 10-127</td>
</tr>
<tr>
<td>Radome requirements</td>
<td>Included</td>
</tr>
<tr>
<td>Radome manufacturer</td>
<td>Andrew Corp.</td>
</tr>
<tr>
<td>Ice shield required</td>
<td>No</td>
</tr>
<tr>
<td>Ice shield size</td>
<td>N/A</td>
</tr>
<tr>
<td>Second antenna strut required</td>
<td>Yes</td>
</tr>
<tr>
<td>Antenna mount type</td>
<td>Pipe 4-1/2” O.D.</td>
</tr>
<tr>
<td>Antenna mount style</td>
<td>6’ minimum X 4-1/2” dia.</td>
</tr>
<tr>
<td>Antenna mount location</td>
<td>Leg</td>
</tr>
</tbody>
</table>

**ANTENNA 2**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna size</td>
<td>10’</td>
</tr>
<tr>
<td>Center line height of antenna</td>
<td>180’</td>
</tr>
<tr>
<td>Azimuth from true North, clockwise</td>
<td>120</td>
</tr>
<tr>
<td>Operating frequency</td>
<td>3 GHz</td>
</tr>
<tr>
<td>Antenna type</td>
<td>Parabolic</td>
</tr>
<tr>
<td>Antenna manufacturer</td>
<td>Andrew Corp.</td>
</tr>
<tr>
<td>Antenna manufacturer model</td>
<td>UHX 10-127</td>
</tr>
<tr>
<td>Radome requirements</td>
<td>Included</td>
</tr>
<tr>
<td>Radome manufacturer</td>
<td>Andrew Corp.</td>
</tr>
<tr>
<td>Ice shield required</td>
<td>NO</td>
</tr>
<tr>
<td>Ice shield size</td>
<td>N/A</td>
</tr>
<tr>
<td>Second antenna strut required</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Antenna mount type   Pipe 4-1/2” O.D.
Antenna mount style   6’ minimum X 41/2” dia
Antenna mount location   Leg

ANTENNA 3

Antenna size   10’
Center line height of antenna   180’
Azimuth from true North, clockwise   240 degrees
Operating frequency   13GHz
Antenna type   Parabolic
Antenna Manufacturer   Andrew Corp.
Antenna manufacturer model   UHX 10-127
Radome requirements   Included
Ice shield required | NO
Second antenna strut required | Yes
Antenna mount type | Pipe 4-1/2" O.D.
Antenna mount style | 6’ minimum X 41/2" dia.
Antenna mount location | Leg

ANTENNA 4

Antenna size | 10’
Center line height of antenna | 165’
Azimuth from true North, clockwise | 0 degrees
Operating frequency | 13 GHz
Antenna type | Parabolic
Antenna manufacturer | Andrew Corp.
Antenna manufacturer model | UHX 10-127
Radome requirements | Included
Ice shield required | NO
Second antenna strut required | Yes
Antenna mount type | Pipe 4-1/2" O.D.
Antenna mount style | 6’ minimum X 41/2” dia.
Antenna mount location | Leg

ANTENNA 5

Antenna size | 10’
Center line height of antenna | 165’
Azimuth from true North, clockwise | 120 degrees
Operating frequency | 13 GHz
Antenna type | Parabolic
Antenna manufacturer | Andrew Corp.
Antenna manufacturer model | UHX 10-127
Radome requirements | Included
Ice shield required | NO
Second antenna strut required | Yes
Antenna mount type | Pipe 4-1/2" O.D.
Antenna mount style | 6’ minimum X 4-1/2” dia.
<table>
<thead>
<tr>
<th>Description</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna mount location</td>
<td>Leg</td>
</tr>
<tr>
<td>Antenna size</td>
<td>10’</td>
</tr>
<tr>
<td>Center line height of antenna</td>
<td>165’</td>
</tr>
<tr>
<td>Azimuth from true North, clockwise</td>
<td>240 degrees</td>
</tr>
<tr>
<td>Operating frequency</td>
<td>13 GHz</td>
</tr>
<tr>
<td>Antenna type</td>
<td>Parabolic</td>
</tr>
<tr>
<td>Antenna manufacturer</td>
<td>Andrew Corp.</td>
</tr>
<tr>
<td>Antenna manufacturer model</td>
<td>UHX 10-127</td>
</tr>
<tr>
<td>Radome requirements</td>
<td>Included</td>
</tr>
<tr>
<td>Ice shield required</td>
<td>NO</td>
</tr>
<tr>
<td>Second antenna strut required</td>
<td>Yes</td>
</tr>
<tr>
<td>Antenna mount type</td>
<td>Pipe 4-1/2” O.D.</td>
</tr>
<tr>
<td>Antenna mount style</td>
<td>6’ minimum X 4-1/2” dia.</td>
</tr>
<tr>
<td>Antenna mount location</td>
<td>Leg</td>
</tr>
</tbody>
</table>
C. **UHF AND VHF ANTENNA**

1. The telecommunications tower shall be required to support the following: UHF and VHF antenna(s); UHF and VHF antenna mounting(s) at the heights and locations(s) indicated.

2. These shall be connected to their respective UHF and VHF Coaxial circuit run(s).

### ANTENNA 7

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna mounting height</td>
<td>180’</td>
</tr>
<tr>
<td>Antenna length above mounting position</td>
<td>20’</td>
</tr>
<tr>
<td>Antenna length below mounting position</td>
<td>2’</td>
</tr>
<tr>
<td>Antenna mount location</td>
<td>Northeast leg</td>
</tr>
<tr>
<td>Antenna mount type</td>
<td>3’ Outrigger</td>
</tr>
<tr>
<td>Antenna type</td>
<td>Omni</td>
</tr>
<tr>
<td>Antenna manufacturer</td>
<td>Celwave</td>
</tr>
<tr>
<td>Antenna manufacturer model</td>
<td>PD220</td>
</tr>
</tbody>
</table>

### ANTENNA 8

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna mounting height</td>
<td>180’</td>
</tr>
<tr>
<td>Antenna length above mounting position</td>
<td>20’</td>
</tr>
<tr>
<td>Antenna length below mounting position</td>
<td>2’</td>
</tr>
<tr>
<td>Antenna mount location</td>
<td>Southwest leg-270 Degrees</td>
</tr>
<tr>
<td>Antenna mount type</td>
<td>3’ Outrigger</td>
</tr>
<tr>
<td>Antenna type</td>
<td>Omni</td>
</tr>
<tr>
<td>Antenna manufacturer</td>
<td>Celwave</td>
</tr>
<tr>
<td>Antenna manufacturer model</td>
<td>PD220</td>
</tr>
</tbody>
</table>

### ANTENNA 9

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna mounting height</td>
<td>180’</td>
</tr>
<tr>
<td>Antenna length above mounting position</td>
<td>20’</td>
</tr>
<tr>
<td>Antenna length below mounting position</td>
<td>2’</td>
</tr>
<tr>
<td>Antenna mount location</td>
<td>Northwest-270 Degrees</td>
</tr>
<tr>
<td>Antenna mount type</td>
<td>3’ Outrigger</td>
</tr>
<tr>
<td>Antenna type</td>
<td>Omni</td>
</tr>
<tr>
<td>Antenna manufacturer</td>
<td>Celwave</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Antenna manufacturer model</td>
<td>PD220</td>
</tr>
</tbody>
</table>

**ANTENNA 10**

<table>
<thead>
<tr>
<th>Antenna mounting height</th>
<th>120’</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenna length above mounting position</td>
<td>12’</td>
</tr>
<tr>
<td>Antenna length below mounting position</td>
<td>2’</td>
</tr>
<tr>
<td>Antenna mount location</td>
<td>Northeast leg-0 degr.</td>
</tr>
<tr>
<td>Antenna mount type</td>
<td>3’ Outrigger</td>
</tr>
<tr>
<td>Antenna type</td>
<td>Omni</td>
</tr>
<tr>
<td>Antenna manufacturer</td>
<td>Kreco</td>
</tr>
<tr>
<td>Antenna manufacturer model</td>
<td>C041A</td>
</tr>
</tbody>
</table>
ANTENNA 11

Antenna mounting height   120'
Antenna length above mounting position  12'
Antenna length below mounting position  2'
Antenna mount location    Southwest leg-270 Degrees
Antenna mount type    3' Outriggers
Antenna type     Omni
Antenna manufacturer    Kreco
Antenna manufacturer model   C041A

D. Basic Design Wind Speed
1. The telecommunications tower specified basic wind speed for the structure locations shall be a minimum of 100 mph.
2. All antenna and appurtenance wind loading calculations shall be developed using 2001 California Building Code and include appropriate factors to comply with Essential Facilities criteria. A "Factored" EIA design will not be acceptable.
3. Under wind pressures up to 35 mph (5psi) all horizontal members shall be capable of supporting a 300 lb vertical load mid-span, in addition to all other design loads.
4. The square foot area, for winding loading, and ice loading calculations, of each VHF/UHF antenna and its associated outriggers shall be calculated when developing the tower basic wind speed loading and when developing the tower ice loading.

E. Tower Twist
1. The maximum limit of telecommunications tower twist at the antenna attachment point shall not exceed 0.5 at an elevation of 180’, and shall not exceed 0.5 at elevations below 120’ per EIA-222-F. All microwave antenna to be installed on the tower shall be considered as part of a Cross-Polarization Limited System.
2. The twist requirement shall be maintained through wind speeds to 70 mph. The telecommunications tower twist at all antenna mounting elevations shall be determined by analytical methods and shall be noted on the formal type-written detailed stress analysis.

F. Tower Sway
1. The maximum limit of telecommunications tower sway at the antenna attachment point shall not exceed 0.60 at an elevation of 180’ and shall not exceed 0.60 at elevations below 120’ per EIA-222-F. All the microwave antenna to be installed on the tower shall be considered as part of a Cross-Polarization Limited System.
2. The sway requirement shall be maintained through wind speeds to 70 mph. The telecommunications tower at all antenna mounting elevations shall be determined by analytical methods and shall be noted on the formal type-written detailed stress analysis.

G. Tower Deflection
1. The telecommunications tower deflection limits are to be held both vertically and horizontally. Deflection must be determined at each specific point on the tower where an antenna is attached.
H. Ice Loading
1. Ice shield shall be installed for those microwave antenna listed in Paragraph 1.13.B Microwave Antennas as requiring ice shields.
2. The ice shield shall be effective in preventing damage to their associated microwave antenna from falling large pieces of ice. The falling ice may be from as high as the top of the tower.
3. The ice shield shall, as a minimum, be as wide as their associated microwave antenna is wide.

I. Combination of Ice and Snow
1. The combined ice and snow loading criteria for the communications tower shall be as stated in the section on Ice loading above.

J. Microwave Antenna Mounting Structure
1. A microwave antenna mounting structure shall be furnished and installed at each microwave center line height for each antenna at its respective azimuth, as identified in Microwave Antenna section above.
2. The microwave antenna mounting structure shall consist of a vertically positioned galvanized steel pipe of 4” inside diameter per ASTM A53. The angle, of this steel pipe shall be true vertical in all planes.
3. The microwave antenna mounting structure shall be secured to its respective tower leg with a minimum of two u-bolts, or a minimum four bolt assembles, at both its upper end and at its lower end.
4. The microwave antenna mounting structure shall consist of vertical pipe, measuring a minimum of 6’, and a maximum of 10’ in length (or longer if ice shield mounting is included)
5. The microwave antenna mounting structure shall be mounted at the tower corner or tower face as the antenna azimuth and locations information indicates above.
6. Pipe mounts shall be positioned to prevent the antenna feed horn assembly from being directly opposite a tower member. Pipe mount positioning shall not prevent direct waveguide installation to any antenna.
7. Each microwave antenna mounting structure shall include two associated microwave antenna stiff-arm supports locations within 12 feet of the respective microwave antenna. The stiff-arm locations shall be within 25 degrees of the antenna’s horizontal centerline. The stiff-arm support locations shall meet the support requirements as listed by the microwave antenna manufacture, in their latest microwave antenna installation bulletin. The stiff-arm support location shall be adequate to maintain the respective microwave antenna within 3 DB of the antenna beam width through winds up to 70 mph and survive winds up to 125 mph without damage.
8. Mounts and stiff-arm support locations shall meet or exceed the standards specified by the antenna manufacturer in their latest installation bulletin.
9. Antenna mounts shall be positioned to allow the indicated antenna to be adjusted in horizontal azimuth continuously from +18 degrees through –18 degrees of the indicated antenna azimuth.
10. Antenna mounts shall be positioned to allow the indicated antenna to be adjusted in vertical altitude angle continuously from +3 degrees through –9 degrees of zero horizontal angle.

K. Microwave Antenna Waveguide and VHF Antenna Coaxial Cable Circuit Run(s)
1. The telecommunications tower shall be required to support the following listed individual microwave antenna waveguide and VHF/UHF coaxial cable circuit run(s) and their respective support system(s):

2. Microwave waveguides and VHF coaxial cables listed below are manufactured by Andrew Corp.

<table>
<thead>
<tr>
<th>Antenna Number Ground</th>
<th>Height Above Line Outside</th>
<th>Transmission Line Mode Diameter</th>
<th>Transmission Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. 180'</td>
<td>2.01&quot; x 1.16&quot;</td>
<td>EW63</td>
<td></td>
</tr>
<tr>
<td>b. 180'</td>
<td>2.01&quot; x 1.16&quot;</td>
<td>EW63</td>
<td></td>
</tr>
<tr>
<td>c. 180'</td>
<td>2.01&quot; X 1.16&quot;</td>
<td>EW63</td>
<td></td>
</tr>
<tr>
<td>d. 170'</td>
<td>2.01&quot; X 1.16&quot;</td>
<td>EW63</td>
<td></td>
</tr>
<tr>
<td>e. 170'</td>
<td>2.01&quot; x 1.16&quot;</td>
<td>EW63</td>
<td></td>
</tr>
<tr>
<td>f. 170'</td>
<td>2.01&quot; X 1.16&quot;</td>
<td>EW63</td>
<td></td>
</tr>
<tr>
<td>g. 180'</td>
<td>1.98&quot;</td>
<td>LDF 7-50A</td>
<td></td>
</tr>
<tr>
<td>h. 180'</td>
<td>1.98&quot;</td>
<td>LDF 7-50A</td>
<td></td>
</tr>
<tr>
<td>i. 180'</td>
<td>1.98&quot;</td>
<td>LDF 7-50A</td>
<td></td>
</tr>
<tr>
<td>j. 120'</td>
<td>1.98&quot;</td>
<td>LDF 7-50A</td>
<td></td>
</tr>
<tr>
<td>k. 120'</td>
<td>1.98&quot;</td>
<td>LDF 7-50A</td>
<td></td>
</tr>
</tbody>
</table>

L. Vertical Waveguide and Coaxial Cable Rigid Support System

1. The telecommunications tower shall contain a vertical waveguide and coaxial cable ridge support system. At a minimum, the vertical waveguide and coaxial cable bridge system shall consist of 15 inches wide crosspieces.

2. The vertical waveguide and coaxial cable rigid support system shall be fabricated from and supported by rigid steel members. Cables are not acceptable.

3. The vertical waveguide and coaxial cable rigid support system shall be easily accessed.

4. The vertical waveguide and coaxial cable rigid support system horizontal run support bars shall be positioned a maximum of each 30 inches apart.

5. The vertical waveguide and coaxial cable rigid support system vertical run supports to the tower shall be positioned a maximum of each 20 feet of vertical run.

6. The vertical waveguide and coaxial cable rigid support system horizontal run supports to the tower shall be positioned a maximum of each 20 feet of horizontal run.

7. The vertical waveguide and coaxial cable rigid support system shall be made to attach waveguide clamp head equal to or better than the Andrew Company, Inc., waveguide support system.

8. The vertical waveguide and coaxial cable rigid support system supports shall be equal to or better than Tower Structures, Inc. waveguide support system.

9. The vertical waveguide and coaxial cable rigid support system shall terminate at ground level at the tower position closest to the equipment building.
M. Horizontal Waveguide and Coaxial Cable Bridge Support System

A horizontal waveguide and coaxial cable bridge system shall be provided as part of the overall tower design/build. The horizontal waveguide and coaxial cable bridge system shall extend from the tower waveguide and coaxial rigid vertical support system to the equipment building (RF Room) Waveguide Entry Port(s) approximately 20’ from the tower location.

1. The horizontal waveguide and coaxial cable bridge system shall be at a minimum 15 inches wide and contain an ice shield.

2. For applications using wall entry into the equipment building (RF Room) the top of the horizontal waveguide and coaxial cable system shall be installed next to the Waveguide Entry Port at 7'-0” above the finished floor of the RF Room.

3. For applications using roof entry into the equipment building (RF Room) the horizontal waveguide and coaxial cable bridge system shall extend from the tower to the location of the Waveguide Entry Port(s) on the roof, near the wall closest to the tower.

4. The horizontal waveguide and coaxial cable bridge system, at a minimum, shall be capable of supporting the waveguides and coaxial cables listed under section 1.13.K.2. The connection of the vertical support system, to the roof, must be designed to be compatible with the roof system and roof materials. Coordinate the design with the Architectural plans and specifications.

N. Fixed Ladder

1. The telecommunications tower shall contain a fixed ladder.

2. The fixed ladder shall conform to CCR Title 8, Chapter 4, Subchapter 7, Group 1, Article 4, Section 3277 – Fixed ladders, inclusive.

3. The fixed ladder shall be fabricated of steel. Step bolts shall not be used. The maximum allowable spacing of the horizontal step rungs shall be 12”. The minimum diameter of the step rungs will be ¾” and will support a concentrated load of 300 lbs. The minimum allowable spacing of the side rails shall be 16”.

4. A clear climbing space shall be maintained on the climbing side of the ladder and extending a minimum of 30 inches from the center of the ladder climbing rungs (at a right angle to the climbing rungs).

5. A clear climbing space shall be maintained on the climbing side of the ladder and extending a minimum of 15 inches from the center line of the ladder climbing rungs (parallel to the climbing rungs).

6. The fixed ladder shall be centrally located on one tower face.

7. The fixed ladder system shall be fabricated from and supported by rigid steel members. Cables are not acceptable.

O. Work Platform(s)

1. The telecommunications tower shall contain a work platform located at an elevation appropriate to the job site, as determined in conjunction with the ITA Communications Engineer. The work platform shall consist of a level platform of steel grating. A full coverage platform shall be provided which allows reasonable access to work areas. The minimum coverage of the platform shall be as determined for the project or equal to the area enclosed by the tower (at that elevation), whichever is greater.

2. Safety handrails shall be provided around the perimeter of the platform with the upper railing at 42” above the deck and the intermediate rail at 18” above the deck.

3. Telecommunications tower diagonals may be used to support the platform handrails.
4. When platform access is via an inside climbing ladder, a hatch shall be provided to eliminate the hazard of an access opening in the work area.

5. Work platforms shall be designed to support two concentrated live loads of 300 lbs. each. Live loads imposed by persons on the platform shall be considered to concentrate at such points that will cause maximum stress in the structural members being considered.

P. Electrical Requirements

1. The telecommunications tower shall contain electrical duplex convenience outlet(s).
   a. The duplex convenience outlet(s) shall be installed on each of the tower work platform.
   b. The duplex convenience outlet(s) shall be a weatherproof, OFI protected, 120 volt, 20 ampere, NEMA 5-20R receptacle(s).
   c. The duplex convenience outlet(s) shall be installed as a home-run individually to circuit breaker protected circuit with ground fault protection.
   d. The duplex convenience outlet(s) circuit shall be installed in rigid metallic electrical conduit (for all tower, underground, and exterior overhead runs). Radio vault interior circuit conduit(s) shall be in electrical metallic conduit (EMT). The bottom of the tower vertical conduit run shall contain a conduit breather.
   e. The duplex convenience outlet(s) circuit shall be installed using a minimum of 10 gauge copper wire.
   f. The duplex convenience outlet circuit shall include a 10 gauge copper insulated green ground wire installed from a ground point on the duplex convenience outlet metallic frame to the radio vault ground bus bar in the electrical distribution panel.
   g. The duplex convenience outlet circuit voltage drop shall be limited to 4% maximum at the outlet under 16 amperes load.
   h. The duplex convenience outlet(s) shall be installed on the tower work platform, one foot above the platform deck.

Q. FAA Beacon

1. To meet FAA requirements, the communications tower top shall be provided with a beacon mount and a flashing red beacon consisting of two simultaneously flashing incandescent lamps, each rated at 620 or 700 watts, (PS-40 Code Beacon type) equipped with aviation red color filters. The flashing mechanism should produce not more than forty flashes per minute, nor less than twelve flashes per minute.
2. The beacon light shall conform to FAA Specification CAA 446, and be approved by the Underwriters Laboratories or the City of Los Angeles, Department of Building and Safety, Electrical Testing Laboratory.

3. Two obstruction lights shall be mounted at the tower mid point with each lamp rated at least 116 watts and enclosed in an aviation red obstruction light globe. At least one light shall be visible from any angle of approach.

R. Beacon and Obstruction Lighting Controls

4. The flashing beacon and steady burning obstruction lights shall be provided with a controlling device which will turn the lights on when the north sky illumination falls to less than 35 footcandles and turn off the lights when the north sky illumination rises to a level of not less than 58 footcandles, as specified in CAA-446 and AC 150/5345-2.

5. The controlling device shall be a modular design that allows future addition of beacons and obstruction lights, and be mounted inside a NEMA Type 4 outdoor housing cabinet. The controlling device shall be equipped with an override switch to bypass the light sensing circuitry, and a comprehensive set of status indicators and alarm contacts for remote alarm monitoring. At a minimum, individual status indicators and a corresponding alarm contacts shall be provided for each of the following conditions:
   a. Control power failure
   b. Flasher By-Pass alarm/status for each beacon
   c. Each flashing red beacon
   d. Each level of steady burning obstruction lights
   e. Day/night node status

6. The controlling device shall withstand temperature ranges of –55C to +55C and 95% relative humidity.

1.14 LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN (LEED REQUIREMENTS)

A. LEED requirements for this section apply to all the construction materials of this project.

B. The contractor shall comply with the LEED credit and/or prescriptive requirements of this section and submittal requirements of Section 01351.

C. Construction Waste Management – The contractor shall recycle, salvage, reuse, and/or donate a minimum of 75% by weight (not volume), of the total construction and demolition waste, less hazardous waste materials, generated during the construction of the project. Construction waste such as trimmings, that will be produced shall be disposed of consistent with the requirements of Construction Waste Management credit of LEED Rating System version 2.1 and Section 01351.

1. The contractor shall provide the following Submittals on the Submittal Dates identified:
   b. Construction Waste Monthly Reports.
   c. Construction Waste Final Report at the end of construction. The report shall include:
      1) The Contractor’s cost of disposing of all construction, waste materials.
      2) A detailed breakdown by weight of each material type disposed of as follows:
         a) Recycling (broken down by material type)
b) Salvage, including reuse on site.
c) Hazardous waste disposal.
d) Landfill
e) Provide electronic versions of the Construction/Maintenance/Alteration and Demolition Projects Sample Construction Waste Management Project dorms in Exhibit I and II of Section 01351.
f) Submittal Date: At the end of construction.

PART 2 - PRODUCTS

2.1 TOWER
A. Custom built structure by Tower Structures, Valmont/Microflect, Rohn Industries, or approved equal.

2.2 OBSTRUCTION LIGHTS
A. Hughey & Phillips (Honeywell) OGS21A000100 or approved equal.

PART 3 - EXECUTION

3.1 DESIGN
A. The telecommunications tower shall be designed by or under the direct supervision of a registered professional engineer specifically experienced in the design of microwave towers.

3.2 FABRICATION
A. Field Fabrication
2. Under no circumstances shall “dissimilar metals” be used in contact with one another.
3. Inside and outside surfaces of all hot-dipped galvanized steel shall be as specified in standards and methods listed elsewhere in this specification.
4. All welding processes and welding operators shall be qualified in accordance with AWS Standard Qualification Procedure.
5. All materials shall be properly marked and match-marked for field assembly.
6. All materials shall be fabricated for a delivery sequence which will expedite erection and minimize field handling of materials.

B. Connections and Locking Devices
1. No field welding shall be permitted unless specifically approved in writing.
2. All members shall be connected with galvanized structural bolts unless otherwise approved.
3. Provide bolts, nuts and lock washers in a quantity in excess of the actual bolt count and per the table below, for each size required for each telecommunications tower site.

<table>
<thead>
<tr>
<th>Bolt Count</th>
<th>Excess</th>
<th>Minimum Excess</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-200</td>
<td>5%</td>
<td>1</td>
</tr>
<tr>
<td>200-500</td>
<td>4%</td>
<td>10</td>
</tr>
</tbody>
</table>

MASTER BUILDING SPECIFICATION
MICROWAVE ANTENNA
TELECOMMUNICATIONS TOWER
02580-21
4. The telecommunications tower shall be provided with the correct size and length of anchor bolts necessary to carry the anticipated telecommunications tower loads.

5. If the telecommunications tower loads require more than one bolt per leg, they shall be shop held into a cluster with a template during field installation.

6. All threaded fasteners shall extend not less than 1-1/2 threads beyond nuts and locking devices.

3.3 FOUNDATION DESIGN

A. The vendor will be required to develop foundation designs conforming to EIA-222-F and based on soil conditions reported as part of the Geotechnical and Seismological Investigation for the site.

B. Foundation recommendations contained within Geotechnical and soils reports referred to in other sections are general in nature and are made without benefit of tower reactions.

C. Foundation designs shall utilize 3000 psi concrete and grade 60 reinforcing steel. When specified, a concrete mix design shall be submitted to the telecommunications tower engineer to ensure that materials are proportioned by weight to produce concrete with a minimum compressive strength at 28 days of 3000 psi.

D. Where a soil investigation indicates that adequate rock conditions exist, grouted anchors may be designed. Field tension testing shall be done when specified.

E. When abnormal soil conditions are encountered to the extent that additional charges may be incurred, the City of Los Angeles must verify said conditions.

3.4 INSTALLATION

A. Foundation Installation

1. All concrete construction methods shall conform to the applicable sections of the American Concrete Institute, ACI 318-95.

2. All materials shall be stored in such a manner as to prevent deterioration or intrusion of foreign matter. Deteriorated materials shall not be used in the work.

3. Concrete shall be conveyed from the mixer to the place of in final deposit by methods that will prevent the separation or loss of material.

4. When concreting is once started, it shall be carried out as a continuous operation until the section being poured is completed.

5. Where the free fall of concrete is greater than 10’, a placing truck shall be used to direct the concrete and to avoid hitting the forms, form ties, or reinforcing steel, thus preventing segregation.

6. To ensure uniform production of concrete, representative samples will be taken at the request of and under the supervision of the City Inspector for the purpose of making cylinders for strength tests.

7. All tests shall conform to ACI methods and the appropriate ASTM Specifications.

8. Forms shall be constructed in accordance with the following guidelines:

   a. Forms shall conform to the shapes, lines, and dimensions shown on the drawings, and shall be of adequate strength and tightness to support the fresh concrete without undue deformation and without loss of mortar.
9. Forms shall be properly braced and tied together to maintain their position and shape when concrete is tamped or vibrated.

10. Any mis-shaped concrete resulting from sagging or bulging forms may be rejected.

11. Forms for permanently exposed surfaces shall produce a smooth even, level finish.

12. No splashing of oil on forms will be allowed.

13. Removal of forms shall be done in a manner which will assure complete safety of the structure and concrete.

14. Forms may be removed after 24 hours, provided the concrete has sufficiently cured to prevent its being damaged during subsequent construction.
   a. A chamfer of 1” shall be provided on edges of exposed Footings, equipment pads, beams and columns.
   b. All piers shall project a minimum of 6” above the finished grade.
15. Reinforcing shall be in accordance with the following:
   a. No splashing or oil coating of any kind will be permitted on any part of the reinforcing steel.
   b. Reinforcing steel shall be manufactured from new billet steel, intermediate grade, deformed bars, in accordance with the standard specifications of ASTM A615/A615M-96a, latest edition, or better.
   d. Metal reinforcement shall be accurately positioned and secured against displacement and shall be supported in a manner that will keep all metal away from the exposed surface.
   e. The minimum clear distance between any bar and the exposed surface shall be not less than 3" when placed against earth or ½" when concrete is placed against form work.
   f. Concrete shall not be placed when ambient temperatures are below 34 degrees F.

16. Accelerators such as calcium chloride shall not be used except by permission of the City Engineer and the structural engineer of record and then shall be limited to a maximum of 2% by weight of cement.

17. Concrete shall not be placed on frozen subgrade or in frozen forms or handled in equipment containing ice or snow. The subgrade and forms shall be thawed out by the use of vented heating methods. Open flame heating methods will not be permitted.

18. Before depositing new concrete on or against concrete that has hardened, the forms shall be retightened, the surface of the hardened concrete shall be roughened as required, thoroughly cleaned of foreign matter, and painted with a bonding agent composed of epoxy resin, in strict accordance with the manufacturers instructions.

19. No free-standing water will be allowed within the foundation excavation before and during the placement of concrete.

20. All reinforcement bars shall be new, clean and free of loose scale.

B. Tower Erection
   1. The contractor shall furnish all necessary personnel, supervision, tools, equipment, and transportation required to complete the installation and erection of all items specified herein.
   2. After materials have been unloaded, the contractor shall inventory all parts per the bill of material and report immediately any shortages, or damaged materials, and that materials received agree with the bill of materials, to the City Inspector or City Engineer.
   3. Any members that sustain damage after delivery shall be reported to the City Inspector.
   4. Correction of damage shall not be done by the Contractor without approval of the City Inspector.
   5. Field modifications including welding or burning of holes in members is not acceptable.
   6. The actual location of the tower, building and other structures will be determined by the City. The structures will be shown on plot plan that accompanies this specification. Telecommunications Tower orientation will also be shown.
   7. All necessary local construction permits will be obtained by the City before any construction begins. This includes FAA and FCC Permits. All costs for the permits will be borne by the City.
8. Set structural members accurately to lines and elevations indicated on the erection drawings. Align and adjust the various members forming each telecommunications tower bay before permanently fastening.

9. The Contractor shall maintain a check of the tower’s plumbness during all phases of the erection work.
   a. Plumbness shall be measured by means of a transit placed so that the sight elevation angles are less than 45 degrees.
   b. At least two sights shall be made for each check, oriented at right angles to each other and taken within the shortest practical time interval.
   c. At all times the telecommunications tower shall be plumb within the tolerance specified in drawings.
   d. After completion of tower construction, with all joints tight, all appurtenances installed, the Contractor shall make a final check of the telecommunications tower plumbness in the manner prescribed above.
   e. A full time qualified field supervisor, representing the tower manufacturer, shall be assigned throughout all phases of construction of the telecommunications tower. Responsibilities will include, but not be limited to:
      1) Verification of telecommunications tower and anchor locations.
      2) Verification of quality of finished grade and construction of foundations.
      3) Delivery and erection of telecommunications tower and joint inspection of construction.
      4) Provide reports that include but not be limited to, date, time, weather conditions, attendees, conditions observed, solutions to problems, and the like.

C. Record of Construction

1. A copy of the construction inspections logs, manufacturer’s steel pipe certifications, manufacturer’s galvanization certification(s) and concrete samples are to be submitted to the City Engineer.

END OF SECTION
PART 1   GENERAL

1.1 SUMMARY
A. Furnish and install storm drainage systems as indicated on the drawings.
B. Material selection:
   1. Select materials that have the highest possible recycled content while still meeting performance criteria.
   2. Select materials from local manufacturers wherever possible.

1.2 REFERENCES
B. "Standard Plans and Specifications, Department of Public Works", City of Los Angeles.

1.3 SUBMITTALS
A. Product Data: Submit data describing storm drainage systems.

1.4 SUBMITTALS AT PROJECT CLOSEOUT
A. Accurately record actual locations components and invert elevations.
B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5 REGULATORY REQUIREMENTS
A. Perform all work of this Section in strict accordance with applicable Government Codes and Regulations especially meeting all safety standards and requirements of CAL/OSHA, Department of Public Works, and the City of Los Angeles as indicated.

PART 2   PRODUCTS

2.1 STORMWATER INTERCEPTORS
A. The Jensen JPHV-2500 and JPHV-3000 interceptors or equals shall be installed and tested per the manufacturer’s specifications.

2.2 STORMWATER RECHARGER CHAMBER
A. The Cultec 125 (or approved equal) recharger chambers shall be Standard Duty H10 for non-traffic applications. Installation shall be per the manufacturers specifications unless otherwise shown on the plans and shall include 1 1/2 "to 2" diameter washed stone and filter fabric as recommended by he manufacturer and laid on 6" rounded stone base 12" deep.
PART 3 EXECUTION

3.1 INSTALLATION

A. Hand trim excavations to required elevations. Correct over excavation with lean concrete.

B. Remove large stones or other hard matter which could damage piping or impede consistent backfilling or compaction.

C. Place bedding material at trench bottom, level materials in continuous layer not exceeding 6 inches compacted depth.

D. Maintain optimum moisture content of bedding material to attain required compaction density.

E. Request inspection prior to and immediately after placing cover over storm drainage systems.

F. Compaction testing will be performed in accordance with ASTM D1557.

END OF SECTION
PART 1  GENERAL

1.1  SUMMARY

A. Section includes pipe and fittings for site water distribution, as indicated and specified.
B. Material selection:
   1. Select materials that have the highest possible recycled content while still meeting performance criteria.
   2. Select materials from local manufacturers wherever possible.

1.2  SUBMITTALS FOR REVIEW

A. Submit under provisions of Section 01330 - Submittals.
B. Product Data: Submit data on pipe materials, pipe fittings, valves and accessories.

1.3  SUBMITTALS FOR CLOSEOUT

A. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.4  SUBMITTALS AT PROJECT CLOSEOUT

A. Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
B. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.5  QUALITY ASSURANCE

A. Unless otherwise specified, all materials and work shall be in accordance with "The Standard Specifications for Public Works Construction" (the Standard Specifications), latest edition.
B. Ductile iron pipe shall be in accordance with Section 207-9 of the Standard Specifications. Pipe shall be lined and coated per AWWA C 151 or AWWA C 110. Valves and fittings shall be encased per Section 207-9.2.6.
C. Valves: The manufacturer's name and pressure rating shall be marked on valve body.
D. Pipe Laying and trenching shall be per Section 306 of the Standard Specifications and pipe joints shall be per Section 306-1.2.3 of the Standard Specification unless otherwise shown on the plans or specified in these specifications.
E. Trench excavations may be backfilled with onsite soils under the observation of a representative of the City Geotechnical Division (GED). After pipes have been laid and properly bedded, the space around the pipe shall be backfilled with clean sand (having sand equivalent of 30 or greater) or gravel to a depth of 1 foot over the top of the pipe, before the controlled backfill is placed. The controlled backfill shall be moisture conditioned, placed and compacted in accordance with the recommendations presented in Section 9.2.8 of the "Geotechnical Engineering Report for the New Valley Police Station" dated August 14, 2003, GED File #03-066. Compaction shall be 5% relative compaction.

F. Water meters and fire service connection shall be per City of Los Angeles requirements. Contractor shall obtain a Private Fire Hydrant Permit from the City Fire department, Hydrant and Access Unit, located at 121 Figueroa Street, suite 1500. Contractor shall contact Inspector Johnson at (213) 482-6506. This is a "fee exempt" permit.

G. On-site 2", 3" and 4" potable water mains shall be constructed of Type "K" hard copper per AWWA specifications. Lines shall be coated with 20-mill plastic tape and be electrically insulated (isolated) from above grade metals by means of dielectric fittings in ferrous utilities and/or exposed metal structures breaking grade

PART 2 PRODUCTS

2.1 WATER PIPE

A. Manufacturers:
   1. Beetle Plastics, Inc.
   2. Easyway Plastics, Inc.
   3. Hefco Plastics, Inc.

B. PVC Pipe: ASTM D1785, Schedule 40:
   1. Fittings: ASTM D2466, PVC.
   3. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Water Service" in large letters.

2.2 GATE VALVES - UP TO 3 INCHES

A. Manufacturers:
   1. Hammond Valve.
   2. Stockham Valves and Fittings.
   3. American Valve.
   4. Crane Valve
   5. Walworth.
   6. Milwaukee Valve Co.
B. Brass or Bronze body, non-rising stem, inside screw, single wedge or disc, compression ends, with control rod, extension box and valve key.

2.3 GATE VALVES - 3 INCHES AND OVER

A. Manufacturers:
   1. Hammond Valve.
   2. Stockham Valves and Fittings.
   3. American Valve.
   4. Crane Valve
   5. Walworth.
   6. Milwaukee Valve Co.

B. AWWA C500, Iron body, bronze trim, non-rising stem with square nut, single wedge, flanged ends, control rod, extension box and valve key.

2.4 BALL VALVES - UP TO 2 INCHES

A. Manufacturers:
   1. Hammond Valve.
   2. Stockham Valves and Fitting
   3. Jenkins Valves Inc.

B. Brass body, teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA inlet end, compression outlet, with control rod, extension box and valve key.

2.5 SWING CHECK VALVES - FROM 2 INCHES TO 24 INCHES

A. Manufacturers:
   1. General Controls or equal.

B. AWWA C508, iron body, bronze trim, 45 degree swing disc, renewable disc and seat, flanged ends.

2.6 BUTTERFLY VALVES - FROM 2 INCHES TO 24 INCHES

A. Manufacturers:
   1. Hammond Valve.
   2. Stockham Valves and Fittings.
   3. Jenkins Valves Inc.

B. AWWA C504, iron body, bronze disc, resilient replaceable seat, water or lug ends, ten position lever handle.
2.7 ACCESSORIES

A. Concrete for Thrust Restraints: Concrete type specified in Section 03300 – Cast-In-Place Concrete.

B. Backflow Preventer: Type as required by the City of Los Angeles.

C. Meter: Type as required by the City of Los Angeles.

D. Extension Stems for Valve Operators:
   1. Where depth of valve is such that center-line is more than 3 feet below grade, provide operating extension stem to bring operating nut 6 inches below surface of ground and flash or box cover.
   2. Construct extension stems of steel, complete with 2 inch square operating nut.

PART 3 EXECUTION

3.1 INSTALLATION - PIPE

A. Maintain separation of water main from sewer piping in accordance with code.

B. Install pipe to indicated elevation to within tolerance of 5/8 inches.

C. Install grooved and shouldered pipe joints to AWWA C606.

D. Route pipe in straight line.

E. Install pipe to allow for expansion and contraction without stressing pipe or joints.

F. Slope water pipe and position drains at low points.

G. Form and place concrete for thrust restraints at each elbow or change of direction of pipe main.

H. Establish elevations of buried piping to ensure not less than 2 ft of cover.

I. Install trace wire continuous over top of pipe.

3.2 INSTALLATION - VALVES AND HYDRANTS

A. Set valves on solid bearing.

B. Center and plumb valve box over valve. Set box cover flush with finished grade.

3.3 SERVICE CONNECTIONS

A. Provide water service to utility company requirements with reduced pressure backflow preventer and water meter with by-pass valves and sand strainer.


C. Anchor service main to interior surface of foundation wall.
D. Provide 18 gage galvanized sheet metal sleeve surrounding service main to 6 inches above floor and 6 feet minimum below grade. Size for 2 inches minimum of glass fiber insulation stuffing.

3.4 FIELD QUALITY CONTROL

A. Compaction testing will be performed in accordance with ASTM D1557.

B. If tests indicate Work does not meet specified requirements, refer to Section 01405 – Testing and Inspecting.

C. Provide hydrostatic leak test as indicated in the California Code of Regulations, Title 24 - Building Standards, Part 5, 1998 Basic Plumbing Regulations with State Amendments.

END OF SECTION
SECTION 02687  
NATURAL GAS DISTRIBUTION

PART 1   GENERAL

1.1 SUMMARY
A. Section includes pipe and fittings for site utility natural gas distribution as indicated on the drawings and specified.
B. Material selection:
   1. Select materials that have the highest possible recycled content while still meeting performance criteria.
   2. Select materials from local manufacturers wherever possible.

1.2 SUBMITTALS FOR REVIEW
A. Section 01330 - Submittals: Procedures for submittals.
B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories.

1.3 QUALITY ASSURANCE
A. Perform Work in accordance with the City of Los Angeles, and the Southern California Gas Company standards.
B. Conform to ANSI B31.2.
C. Welding Materials and Procedures: Conform to ASME Boiler and Pressure Vessel Code and applicable state regulations.
D. Welders Certification: In accordance with ASME SEC IX.
E. Conform to NFPA 54.

PART 2   PRODUCTS

2.1 PIPING
A. Polyethylene Pipe: ASTM D2513, SDR 11.5:
   2. Joints: Mechanical or Compression fit.
   3. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Natural Gas Service" in large letters.

2.2 GAS COCKS
A. Up to 2 Inches: 150 psig WOG, bronze body, bronze tapered plug, non-lubricated, Teflon packing, threaded ends.
B. Over 2 Inches: 125 psig WOG, Cast iron body and tapered plug, non-lubricated, Teflon
packing, threaded ends.

C. Gas Cock and Pressure Regulating Valves: Manufacturer's name and pressure rating marked on valve body.

2.3 PRESSURE REGULATING VALVES

A. Valves: Single stage, malleable iron body, corrosion-resistant, pressure regulator with atmospheric vent, elevation compensator; with threaded ends for 2 inch and smaller, flanged ends larger than 2 inch.

B. Capacity: For inlet and outlet gas pressures, specific gravity, and flow rate indicated.

PART 3 EXECUTION

3.1 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs. Bevel plain end ferrous pipe over 2 inches diameter.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections with threading and unions.

3.2 BEDDING

A. Hand trim excavation for accurate placement of pipe to elevations indicated.

B. Place bedding material at trench bottom, level fill materials in one continuous layer not exceeding 6 inches compacted depth, compact to 95 percent.

C. Backfill around sides and to top of pipe with cover fill, tamped in place and compacted to 95 percent.

D. Maintain optimum moisture content of bedding material to attain required compaction density.

3.3 INSTALLATION - PIPING

A. Maintain separation of gas line from water piping in accordance with the State of California Building Code.

B. Route piping in straight line.

C. Install piping to conserve space and not interfere with use of site space.

D. Install piping to allow for expansion and contraction without stressing pipe or joints.

E. Install cocks and other fittings.

F. Establish elevations of buried piping to ensure not less than 24 inches of cover in non-traveled areas and 48 inches of cover in driveways and parking areas.

G. Lay pipe on bedding.

H. Install trace wire continuous over top of pipe.

J. Center and plumb valve box over valve. Set box cover flush with finished ground.
surface. Prevent shock or stress from being transmitted through valve box to valve.

3.4 FIELD QUALITY CONTROL

A. Test all piping for leakage. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to the City.

END OF SECTION
SECTION 02720
BASE COURSE

PART 1   GENERAL

1.1   SECTION INCLUDES

A. Furnishing and placing of base material.

1.2   REFERENCE STANDARDS


1.3   SUBMITTALS

A. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:

1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following:
   a. Base Materials

2. LEED Credit MRc5.1: Provide manufacturer name and location data for the following materials:
   a. Base Materials

3. LEED Credit MRc5.2: Provide data from the manufacturer indicating the sources, including source name and location, of raw materials used to fabricate the following materials. If different raw material sources are used, the manufacturer shall provide a breakdown based on percentage of weight of materials used in the product for each different raw materials source used:
   a. Base Materials

PART 2   PRODUCTS

2.1   UNTREATED BASE MATERIALS

A. The following base materials are classified, in order of preference, in conformance with the requirements of Standard Specifications for Public Works Construction: Section 200 - Rock Materials.

1. Crushed aggregate base or crushed slag base.

2. Crushed miscellaneous base.

3. Processed and miscellaneous base.

4. Select sub-base.
5. Disintegrated Granite Base: Conforming to requirements of the Standard Specifications for Public Works Construction: Section 400 - Alternate Rock Products, Asphalt Concrete, Portland Cement Concrete and Untreated Base Material.

B. Substitution of a higher classification of grade base materials than specified will not entitle Contractor to an adjustment in Contract sum.

2.2 MATERIAL APPROVAL

A. Material supplied shall be approved by the City Engineer Inspector, prior to placing.

PART 3 EXECUTION

3.1 INSTALLATION

A. Spread, level, moisten, and roll or tamp base material in layers not exceeding 4" in thickness. Use 2 tandem power roller weighing not less than 8 tons. Continue cutting or filling, watering and rolling until the surface is hard and true to grade and cross section; until it is firm and ceases to "creep" in front of roller, and the relative compaction is at least 95%.

B. Grade base course to elevations indicated on Drawings, ready to receive surfacing, in accordance with Section 02310: Grading.

END OF SECTION
SECTION 02730
SANITARY SEWERAGE SYSTEMS

PART 1 GENERAL

1.1 SUMMARY
A. Section includes sanitary sewerage drainage piping, fittings, accessories and bedding; connection of building sanitary drainage system to and cleanout access all as indicated on the drawings and specified.

B. Material selection:
   1. Select materials that have the highest possible recycled content while still meeting performance criteria.
   2. Select materials from local manufacturers wherever possible.

1.2 SUBMITTALS FOR REVIEW
A. Submit under provisions of Section 01330 - Submittals.

B. Product Data: Submit data indicating pipe and pipe accessories.

C. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:
   1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials:
      a. Cast Iron Soil Pipe

1.3 REGULATORY REQUIREMENTS
A. Perform all work of this Section in strict accordance with applicable Government Codes and Regulations especially meeting all safety standards and requirements of CAL/OSHA. Provide additional measures, added materials and devices as may be needed as directed by the City Representative.

B. Conform to the California Code of Regulations, Title 24 - Building Standards, Part 5, 1998 Basic Plumbing Regulations with State Amendments.

1.4 QUALITY ASSURANCE
A. Unless otherwise specified, all materials and work shall be in accordance with "The Standard Specifications for Public Works Construction" (the Standard Specifications), latest edition.

B. The Contractor shall tie into the existing sewer on Schoenborn Street per the plans and the Standard Specifications. The Contractor shall provide existing sewer by-passing per Section 500-1.2.4 if required by the process.

C. 6" and 8" Vitrified Clay Pipe (VCP) and testing shall be in accordance with Section 207-8 of the Standard Specifications. 6" sewer laterals shall be VCP per Standard Plan 222-0. Manholes shall be per Standard Plan 200-0 and shall be constructed per the Standard Specifications.
D. Pipe laying and trenching shall be per Section 306 if the Standard Specifications and pipe joints shall be per Section 306-1.2.3 if the Standard Specifications unless otherwise shown on the plans or specified in these specifications.

E. Trench excavations may be backfilled with onsite soils under the observation of a representative of the City Geotechnical Division (GED). After pipes have been laid and properly bedded, the space around the pipe shall be backfilled with clean sand (having sand equivalent of 30 or greater) or gravel to a depth of 1 foot over the top of the pipe, before the controlled backfill is placed. The controlled backfill shall be moisture conditioned, placed and compacted in accordance with the recommendations presented in Section 9.2.8 of the "Geotechnical Engineering Report for the New Valley Police Station" dated August 14, 2003, GED File #03-066. Compaction shall be 5% relative compaction.

F. Contractor shall comply with City requirements for offsite work in he public right-of-way including public convenience and traffic control per Section 7-10 of the Standard Specifications.

PART 2 PRODUCTS

2.1 PIPE MATERIALS

A. Cast Iron Soil Pipe and Joint Devices:
   1. Pipe: ASTM A74, Extra Heavy Service type, inside nominal diameter as indicated on Drawings, hubless.

B. PVC outside of buildings shall conform to ASTM modulus indicator wall thickness T-1 of ASTM-F789 or SDR-35 of ASTMD-3034.

2.2 PIPE ACCESSORIES

A. Pipe Joints: Mechanical clamp ring type, stainless steel expanding and contracting sleeve, neoprene ribbed gasket for positive seal.

B. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, clean-outs, reducers, traps and other configurations required.

C. Trace Wire: Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Sewer Service" in large letters.

D. Polyethylene: Encase metal pipe below grade with 6 mil thick clear polyethylene film, type recommended for below grade application.

2.3 CLEAN-OUTS

A. As indicated.

B. Pad: Cast-in-place concrete of type specified in Section 03300- Cast-in-Place Concrete.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on drawings.

3.2 PREPARATION

A. Hand trim excavations to required elevations. Correct over excavation with lean concrete.

B. Maintain moisture content of bedding material at optimum or above to plus or minus 2 percent to attain required compaction density.

3.3 INSTALLATION - PIPE

A. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal joints watertight.

B. Lay pipe to slope gradients noted on drawings; with maximum variation from true slope of 1:1000.

C. Install bedding at sides and over top of pipe to minimum compacted thickness indicated on soils report; compacted to 90% unless otherwise indicated.

D. Do not displace or damage pipe when compacting.

E. Connect to building sanitary sewer outlet and municipal sewer system, through installed sleeves.

F. Install trace wire and colored marker tape continuous over top of pipe, buried 6 inches below finish grade, above pipe line.

G. Coordinate the Work with termination of sanitary sewer connection outside building, connection to municipal sewer utility service and trenching.

3.4 INSTALLATION - CLEAN-OUTS

A. Form and place cast-in-place concrete pad with provision for sanitary sewer pipe ends.

B. Establish elevations and inverts for inlets and outlets as indicated.

C. Mount clean-out surface hub level in grout, to elevation indicated.

3.5 FIELD QUALITY CONTROL

A. Request inspection prior to and immediately after placing bedding.

B. Compaction testing will be performed in accordance with ASTM D1557.

C. Moisture content testing will be performed in accordance with ASTM D1557.

D. Pressure, Infiltration and Deflection Test: Coordinate the Work with the California Code of Regulations, Title 24 - Building Standards, Part 5, 1998 Basic Plumbing Regulations with State Amendments.

E. Protect pipe and aggregate cover from damage or displacement until backfilling operation is in progress.
PART 1 - GENERAL

1.1 RELATED WORK

A. Requirements: Provide asphaltic concrete paving in accordance with Contract Documents.

B. Related Work Specified Elsewhere.
   1. Section 02312 Earthwork for Grading and Paving: Excavation and backfill.
   2. Section 02630 Storm Drainage System: Asphalting over pipe trenches.

1.2 STANDARD SPECIFICATIONS

A. All work to be performed and materials to be used shall be in accordance with the Standard Specifications for Public Works Construction, latest edition and supplements.

B. The Contractor shall have one copy of the Standard Specifications at the job site.

C. The Standard Specifications apply only to performance and materials and how they are to be incorporated into the Work. The legal/contractual relationship sections and the measurement and payment sections do not apply to this document.

1.3 QUALITY ASSURANCE

A. Testing Agency: The Contractor will engage, at his own expense, Testing Agency to inspect asphaltic concrete paving, to perform tests specified, and to submit reports to City Engineer.

   1. Testing Agency will be responsible for conducting and interpreting tests, will state in each report whether or not test results comply with Contract Documents, will specifically note deviation there from, and will indicate corrective measures required and taken.

   2. Provide Testing Agency with the following:
      a. Test reports of materials incorporated in Work.
      b. Proposed asphalt concrete pavement mix.
      c. Time and place of plant mixing and Project Site paving operations.
      d. Representative samples of material requested for testing.

1.4 REFERENCES

A. Except as modified by governing codes and by Contract Documents, comply with applicable provisions and recommendations of the following:

   1. Standard Specifications for Public Works Construction (indicated "SSPWC").
a. Terms "Board" or "Agency" refer to City Engineer.

b. Terms "Engineer" or "Inspector" refer to City Engineer or Testing Laboratory.

c. Provisions relating to methods of payment do not apply.

2. State Department of Highways, Division of Highways, State of California "Standard Specifications" (indicated "Caltrans").

1.5 PROJECT CONDITIONS

A. Environmental Requirements: Do not install asphaltic concrete pavement mixture on wet surfaces or when temperature is below 40 degrees Fahrenheit.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials in accordance with SSPWC requirements unless otherwise noted.

B. Aggregate Base Course: SSPWC Section 200-2.2, Crushed Aggregate Base.

C. Asphalt Tack Coat: SSPWC Section 302-5.3 and 302-5.4.

D. Asphaltic Concrete: D1-AR-4000 SSPWC Section 203-6.

E. All other materials to be manufacturer's standard for the items required or type best suited for the intended use.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine substrates, adjoining construction, and conditions under which Work is to be installed. Do not proceed with Work until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation

1. Do not commence preparing of sub-grade until underlying drains and other subsurface structures have been constructed and their trenches have been properly backfilled and compacted.

2. Do not commence asphaltic concrete paving work until concrete curbs are constructed and cured.

3. Maintain sub-grade in satisfactory condition and properly drained, until pavement is placed thereon.

3.3 INSTALLATION
A. Aggregate Base Course: Provide in accordance with SSPWC Section 301-2.

B. Asphaltic Concrete: Provide in accordance with SSPWC Section 203-6.
   1. Establish job Mix formula proposed for this Work.
   2. Compact by hand methods to produce required density in areas not accessible to rolling.
   3. Apply uniform tack coat, in accordance with SSPWC at rate of 0.05 to 0.10 gallons per square yard as directed where previously primed base course does not contain sufficient viscous qualities to secure proper surface course adhesion.

C. Asphalt Tack Coat: Provide in accordance with SSPWC Section 302-5.3.

3.4 PATCHING
   A. Cut out and fill with fresh, hot asphaltic concrete. Remove deficient areas for full depth of surface and base course. The extent of the failure shall be cut perpendicular and parallel to the direction of traffic. Apply tack coat to exposed surfaces before placing new pavement. Compact and finish to specification.

3.5 TOLERANCES
   A. Smoothness: Surface of asphaltic concrete after rolling, shall be even, smooth and uniform in texture with no voids or rock pockets, free of roller marks or other irregularities, and not varying by more than 0.03-ft, except at local depressions or raised areas as indicated, when a 10-ft straight edge is placed on the surface.
   B. Grade: Finished grade shall not vary more than 0.02-ft above or below designed grade. Variations within prescribed tolerances shall be compensating so that average grade and cross-section are met.

3.6 CLEANING
   A. After completion of paving operations, thoroughly clean paved areas by sweeping or washing and remove defacements or stains. Exercise care to avoid soiling of adjacent construction. Remove such soiling prior to final acceptance of Work.

3.7 PROTECTION
   A. Protect finished surfaces against blemishes and disfigurement.
   B. Do not permit vehicular traffic on finished pavement until it has hardened sufficiently, and in no case less than 36 hours after completion.

END OF SECTION
PART 1 – GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.


1.2 Summary

A. This Section includes the following:
   1. Expansion and contraction joints within portland cement concrete pavement.
   2. Joints between portland cement concrete and asphalt pavement.

B. Related Sections include the following:
   1. Division 2 Section “Hot-Mix Asphalt Paving” for constructing joints between concrete and asphalt pavement.

1.3 Submittals

A. Product Data: For each joint-sealant product indicated.

B. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Product Certificates: Signed by manufacturers of joint sealants certifying that products furnished comply with requirements and are suitable for the use indicated.

D. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Compatibility and Adhesion Test Reports: From joint sealant manufacturer indicating the following:
   1. Materials forming joint substrates and joint-sealant backer materials have been tested for compatibility and adhesion with joint sealants.
   2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.
F. Product Test Reports: From a qualified testing agency indicating joint sealants comply with requirements, based on comprehensive testing of current product formulations.

1.4 Quality Assurance

A. Installer Qualifications: An experienced installer who has specialized in installing joint sealants similar in material, design, and extent to those indicated for this Project and whose work has resulted in joint-sealant installations with a record of successful in-service performance.

B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.

C. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency, based on testing current sealant formulations within a 36-month period.

1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 to conduct the testing indicated, as documented according to ASTM E 548.

2. Test joint sealants for compliance with requirements indicated by referencing standard specifications and test methods.

D. Preconstruction Compatibility and Adhesion Testing: Submit to joint sealant manufacturer, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

   a. Perform tests under environmental conditions replicating those that will exist during installation.

2. Submit not fewer than nine pieces of each type of material, including joint substrates, joint-sealant backer materials, secondary seals, and miscellaneous material.

3. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

4. For materials failing tests, obtain joint sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.

5. Testing will not be required if joint sealant manufacturer submits joint preparation data that are based on previous testing of current sealant products for adhesion to, and compatibility with, joint substrates and other materials matching those submitted.

1.5 Delivery, Storage, And Handling
A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multicomponent materials.

B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 Project Conditions

A. Environmental Limitations: Do not proceed with installation of joint sealants under the following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer.
   2. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 deg F (4.4 deg C).
   3. When joint substrates are wet.

B. Joint-Width Conditions: Do not proceed with installation of joint sealants where joint widths are less than that allowed by joint sealant manufacturer for application indicated.

C. Joint-Substrate Conditions: Do not proceed with installation of joint sealants until contaminants capable of interfering with their adhesion are removed from joint substrates.

PART 2 – PRODUCTS

2.1 Materials, General

A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint sealant manufacturer based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range for this characteristic.

2.2 Cold-Applied Joint Sealants

A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.

B. Available Products: Subject to compliance with requirements, cold-applied joint sealants that may be incorporated into the Work include, but are not limited to, the following:
   1. Type NS Silicone Sealant for Concrete:
      a. Roadsaver Silicone-SL; Crafco Inc.
2.3 Hot-Applied Joint Sealants

A. Elastomeric Sealant for Concrete: Single-component formulation complying with ASTM D 3406.

B. Sealant for Concrete and Asphalt: Single-component formulation complying with ASTM D 3405.

C. Available Products: Subject to compliance with requirements, hot-applied joint sealants that may be incorporated into the Work include, but are not limited to, the following:

1. Elastomeric Sealant for Concrete:
   a. Superseal 444/777; Crafco, Inc.
   b. POLY-JET 3406; W.R. Meadows, Inc.

2. Sealant for Concrete and Asphalt:
   a. ROADSAVER 221; Crafco Inc.
   b. Product #9005; Koch Materials Company.
   c. Product #9030; Koch Materials Company.
   d. SEALIGHT HI-SPEC; W.R. Meadows, Inc.

2.4 Joint-Sealant Backer Materials

A. General: Provide joint-sealant backer materials that are nonstaining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint sealant manufacturer based on field experience and laboratory testing.

B. Round Backer Rod for Cold- and Hot-Applied Sealants: ASTM D 5249, Type 1, of diameter and density required to control sealant depths and prevent bottom-side adhesion of sealant.

2.5 Primers

A. Primers: Product recommended by joint sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 – EXECUTION

3.1 Examination

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Preparation
A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint sealant manufacturer's written instructions.

B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 Installation Of Joint Sealants

A. General: Comply with joint sealant manufacturer's written installation instructions applicable to products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations of ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of backer materials.

2. Do not stretch, twist, puncture, or tear backer materials.

3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.

D. Install sealants by proven techniques to comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.

2. Completely fill recesses provided for each joint configuration.

3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

E. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealants from surfaces adjacent to joint.

2. Use tooling agents that are approved in writing by joint sealant manufacturer and that do not discolor sealants or adjacent surfaces.

F. Provide joint configuration to comply with joint sealant manufacturer's written instructions, unless otherwise indicated.
G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 Cleaning

A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 Protection

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from the original work.

END OF SECTION
PART 1 - GENERAL

1.1 Description

A. Work shall consist of furnishing and construction of interlocking concrete pavers in accordance with these specifications and in reasonably close conformity with the lines, grades, design, and dimensions shown on the plans.

B. Work includes preparing subgrade, furnishing and installing leveling bed, edge and unit pavers to the lines and grades shown on the construction drawings.

1.2 Related Sections

C. Section 02100 - Site Preparation

D. Section 02200 – Aggregate Base

1.2 Reference Documents

A. American Society for Testing and Materials (ASTM)

1. ASTM C-33, Specification for Concrete Aggregates

2. ASTM C-136, Method for Sieve Analysis for Fine and Coarse Aggregate

3. ASTM C-140, Sampling and Testing Concrete Masonry Units

4. ASTM C 144, Standard Specification for Aggregate for Masonry Mortar

5. ASTM C 936, Specification for Solid Interlocking Concrete Paving Units

6. ASTM C 979, Specification for Pigments for Integrally Colored Concrete

7. ASTM D 698, Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 5.5-lb (2.49 kg) Rammer and 12 in. (305 mm) drop

8. ASTM D-1557, Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 10-lb (4.54 kg) Rammer and 18 in. (457 mm) drop

9. ASTM D-2940, Graded Aggregate Material for Bases or Subbases for Highways or Airports.

B. Interlocking Concrete Pavement Institute (ICPI)

1.3 Submittals/Certification

A. Shop or product drawings, and product data.

B. Full size samples of concrete paving units to indicate color and shape selections. Final color will be approved by Landscape Architect from Manufacturer’s available colors.

C. Sieve analysis for grading of bedding and joint sand.

D. Test results from an independent testing laboratory for compliance of paving unit requirements to ASTM C 936 or other applicable requirements.

E. Manufacturer’s certification of concrete pavers by ICPI as having passed applicable ASTM standards.

F. Indicate layout, pattern, and relationship of paving joints to fixtures and project formed details.

1.4 Mock-Ups

A. Install a 7 ft x 7 ft (2 m x 2 m) paver area as described in Article 3.02.

B. This area will be used to determine surcharge of the bedding sand layer, joint sizes, lines, laying pattern(s), color(s), and texture of the job.

C. This area shall be the standard from which the work will be judged and shall be incorporated into the work.

1.5 Quality Assurance

A. Installation shall be by a contractor and crew with at least one year of experience in placing interlocking concrete pavers on projects of similar nature or dollar cost.

B. Contractor shall hold current Basic Level Certificate from the Interlocking Concrete Pavement Institute contractor certification program.

1.6 Delivery, Storage and Handling

A. Deliver concrete pavers to the site in steel banded, plastic banded, or plastic wrapped cubes capable of transfer by fork lift or clamp lift.Unload pavers at job site in such a manner that no damage occurs to the product.

B. Cover sand with waterproof covering to prevent exposure to rainfall or removal by wind. Secure the covering in place.

C. Coordinate delivery and paving schedule to minimize interference with normal use of buildings adjacent to paving.

1.7 Environmental Conditions

A. Do not install sand or pavers during heavy rainfall.
PART 2 - PRODUCTS

2.1 Concrete Pavers

A. Sierra Building Products or equal, 10714 Poplar Ave, Fontana, CA 92335
   909-355-6422, fax 909-355-6444

B. Product name(s)/shape(s), color(s), overall dimensions, and thickness:
   1. Dublin Cobble
      a. 6“ x 7 3/8” x 2 3/8”
      b. 6“ x 6 3/4” x 2 3/8”
      c. 6“ x 6” x 2 3/8”
      d. 6“ x 5 1/8” x 2 3/8”
   2. Dublin Cobble
      a. 9“ x 9 “ x 3 1/8”
   3. Color: Toscana Blend

Meet the following requirements set forth in ASTM C 936, Standard Specification for Interlocking Concrete Paving Units:

Note: If 3 1/8 in. (80 mm) thick pavers are specified, their compressive strength test results should be adjusted by multiplying them by 1.18 to equate the results to that from 2 3/8 in. (60 mm) thick pavers.

4. Average compressive strength of 8,000 psi (55 MPa) with no individual unit under 7,200 psi (50 MPa).

5. Average absorption of 5% with no unit greater than 7% when tested in accordance with ASTM C 140.

6. Resistance to 50 freeze-thaw cycles when tested according to ASTM C 67.

C. Pigment shall conform to ASTM C 979.

2.2 Bedding and Joint Sand

A. Clean, non-plastic, free from deleterious or foreign matter, natural or manufactured from crushed rock. Do not use limestone screenings or stone dust that do not conform to the grading requirements in Table 1.

B. Sieve according to ASTM C 136.

C. Conform to the grading requirements of as shown in Table 1 below:

Table 1
Grading Requirements for Joint Sand
ASTM C 144 ASTM
Natural Sand Manufactured Sand

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>100</td>
<td>5 mm</td>
<td>100</td>
</tr>
<tr>
<td>No. 8 (2.36 mm)</td>
<td>95 to 100</td>
<td>2.5 mm</td>
<td>95 to 100</td>
</tr>
<tr>
<td>No. 16 (1.18 mm)</td>
<td>70 to 100</td>
<td>1.25 mm</td>
<td>90 to 100</td>
</tr>
<tr>
<td>No. 30 (0.600 mm)</td>
<td>40 to 100</td>
<td>0.600 mm</td>
<td>35 to 80</td>
</tr>
<tr>
<td>No. 50 (0.300 mm)</td>
<td>20 to 40</td>
<td>0.300 mm</td>
<td>15 to 80</td>
</tr>
<tr>
<td>No. 100 (0.150 mm)</td>
<td>10 to 25</td>
<td>0.150 mm</td>
<td>2 to 15</td>
</tr>
<tr>
<td>No. 200 (0.075 mm)</td>
<td>0-10</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

D. The joint sand shall conform to the grading requirements as shown in Table 2 below:

Table 2
Grading Requirements for Bedding Sand
ASTM C 33

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>3/8 in.(9.5 mm)</td>
<td>100</td>
<td>10 mm</td>
<td>100</td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>95 to 100</td>
<td>5 mm</td>
<td>95 to 100</td>
</tr>
<tr>
<td>No. 8 (2.36 mm)</td>
<td>85 to 100</td>
<td>2.5 mm</td>
<td>80 to 100</td>
</tr>
<tr>
<td>No. 16 (1.18 mm)</td>
<td>50 to 85</td>
<td>1.25 mm</td>
<td>50 to 90</td>
</tr>
<tr>
<td>No. 30 (0.600 mm)</td>
<td>25 to 60</td>
<td>0.630 mm</td>
<td>25 to 65</td>
</tr>
<tr>
<td>No. 50 (0.300 mm)</td>
<td>10 to 30</td>
<td>0.315 mm</td>
<td>10 to 35</td>
</tr>
<tr>
<td>No. 100 (0.150 mm)</td>
<td>2 to 10</td>
<td>0.160 mm</td>
<td>2 to 10</td>
</tr>
</tbody>
</table>

2.3 Edge Restraints

A. Edge restraints shall be concrete pre-cast concrete

PART 3 - EXECUTION

3.1 Examination

A. Verify that subgrade preparation, compacted density and elevations conform to the specifications.

B. Verify that aggregate base materials, thickness, compaction, surface tolerances, and elevations conform to the specifications.

C. Verify that base is dry, uniform, even, and ready to support sand, pavers, and imposed loads.

D. Beginning of bedding sand and paver installation means acceptance of base and edge restraints.

3.2 Installation

A. Spread the bedding sand evenly over the base course and screed to a nominal 1 in. (25 mm) thickness, not exceeding 1 1/2 in. (40 mm) thickness. The screeded sand should not be disturbed. Place sufficient sand to stay
ahead of the laid pavers. Do not use the bedding sand to fill depressions in
the base surface.

B. Ensure that pavers are free of foreign material before installation.

C. Lay the pavers in the pattern(s) as shown on the drawings. Maintain straight
pattern lines.

D. Points between the pavers on average shall be between 1 /16 in. and 3 /16 in.
(2 mm to 5 mm) wide.

E. Fill gaps at the edges of the paved area with cut pavers or edge units.

F. Cut pavers to be placed along the edge with a [double blade paver splitter or]
masonry saw.

G. Use a low amplitude plate compactor capable of at least 5,000 lbf (22 kN)
compaction at a frequency of 75 hz –100 hz.

H. Compact the pavers, sweeping dry joint sand into the joints and vibrating until
they are full. This will require at least two or three passes with the compactor.
Do not compact within 3 ft (1 m) of the unrestrained edges of the paving units.

I. All work to within 3 ft (1 m) of the laying face must be left fully compacted with
sand-filled joints at the end of each day. Cover the laying face with plastic
sheets overnight if not closed with cut and compacted pavers.

J. Sweep off excess sand when the job is complete.

K. The final surface elevations shall not deviate more than 3 /8 in. (10 mm)
under a 10 ft (3 m) long straightedge.

L. The surface elevation of pavers shall be 1 /8 to 1 /4 in. (3 to 6 mm) above
adjacent drainage inlets, concrete collars or channels.

3.3 Field Quality Control

A. After removal of excess sand, check final elevations for conformance to the
drawings.

B. Quality Assurance - The CITY ENGINEER shall/may engage inspection and
testing services, including independent laboratories, to provide quality
assurance and testing services during construction. This does not relieve the
Contractor from securing the necessary construction quality control testing.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. This Section includes the following:
      1. Supply material, pipe, pipe fittings, automatic valves, wiring, and labor to install a fully automatic sprinkler system. Restore any existing landscaping disturbed during the installation.
   B. Related Sections include the following:
      1. Section 02900 - Landscaping

1.3 QUALITY ASSURANCE & REQUIREMENTS
   A. Obtain and pay for any and all permits and inspections as required.
   B. Follow manufacturer's directions and detailed drawings in all cases when the manufacturers of products used in this contract furnish directions covering points not included in the drawings and specifications.
   C. All local, municipal and state laws, and rules and regulations governing or relating to any portion of this work are hereby incorporated into and made a part of these specifications, and their provisions shall be carried out by the Contractor. Anything contained in these specifications shall not be construed as conflicting with any such rules and regulations, or the requirements of the same. However, when these specifications and drawings call for or describe materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by such rules and regulations, the provisions of these specifications and drawings shall take precedence.
   D. Superintendent:
      1. A superintendent satisfactory to the City Engineer's Representative shall be present on the site at all times during progress of the work.
      2. Do not change the Superintendent except with the consent of the City Engineer.
      3. The Superintendent shall be authorized to represent the Contractor.
   E. Explanation of Drawings:
      1. Due to the scale of drawings, it is not possible to indicate all offsets, fittings, sleeves, etc., which may be required. Carefully investigate the structural and finish conditions affecting this work and plan work accordingly, furnishing such offsets, fittings, sleeves, etc., as may be required to meet site conditions. Drawings are generally diagrammatic and indicative of the work to be installed. Install the work in such a manner as to avoid conflicts between irrigation systems, planting and Architectural features.
      2. The word City Engineer as used herein refers to the Authorized representative.
      3. Furnish and install all work called for on the drawings by notes or details whether or not specifically mentioned in the specifications.
      4. Do not install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences or discrepancies in area dimensions exist that might not have been considered in engineering. Bring such obstructions or differences to the attention of the City Engineer. Failure to do so will mean the Contractor is responsible for any revisions necessary.
5. Do not purchase or install materials as noted in legend on drawing when it is obvious there is an oversight or discrepancy. Failure to obtain prior material approval may result in rejection by the City Engineer. The Contractor will be responsible for any revisions necessary due to his failure to bring material discrepancies to the attention of City Engineer, or failure to comply with material submittals.

6. Coordinate as necessary the work of this Section which is allied with the work of other trades.

7. It is the intent of the drawings and specifications to describe a complete irrigation system providing uniform water coverage. If the plans or specifications appear in any way to be incomplete, misleading, conflicting, or subject to misinterpretation, it is the Contractor's responsibility to bring these concerns to the City Engineer's attention before bidding. If the Contractor fails to do so, the Contractor must accept the City Engineer's interpretation and any potential related financial impact that may occur.

F. Electrical wiring, controls, motors, and devices shall be Underwriters Laboratories listed, and labeled U.L.

1.4 SUBMITTALS

A. Material List:
1. Furnish the articles, equipment, materials, or processes specified by name in the drawings and specifications. Substitution is allowed only with prior written approval of the City Engineer.
2. Submit complete material list prior to performing any work. Material list shall include the manufacturer name, model number and description of all proposed materials and equipment.
3. Equipment or materials installed or furnished without prior approval of the City Engineer may be rejected and the Contractor required to remove such materials from the site at the Contractor's own expense.
4. If equipment proposed for use is as specified, a material list ONLY is required, and it is UNNECESSARY to submit manufacturer descriptive catalogs with submittal.

B. Record Drawings:
1. Provide and maintain up to date and complete project record documents (set of blueline prints). Update daily and show all changes from the original drawings and specifications, as well as exact "as-built" locations, and sizes and types of equipment. Prints for this purpose may be acquired from the City Engineer. Keep this set of drawings on site and use only for such recording.
2. These drawings shall also serve as work progress prints and shall be the basis for measurement and payment for work completed. Drawings must be available at all times for site reviews, in a location designated by the City Engineer. Should the record blueline progress prints be unavailable for review or fail to be up to date at the time of any site reviews (refer to Section 3.2-B-3 - Observation Schedule), it will be assumed no work has been completed and the Contractor will be assessed the cost of that site visit at the current billing rate of the City Engineer. No other inspections will take place until payment of that assessment.
3. Make neat and legible notations daily on the record progress prints as the work proceeds, showing the work as actually installed. Should equipment location differ from plan, indicate the new location in a graphic manner, matching the original symbols in the irrigation legend.
4. Before the final site review, transfer all information from the record prints to computer-generated reproducible drawings (or other approved method), and submit these reproducible drawings along with related CAD disk to the City Engineer for approval prior to preparing controller chart.
5. Dimension the following locations from two permanent points of reference (building corners, sidewalks, road intersections, etc.):
   a. connection to existing water lines
   b. connection to existing electrical power supply
   c. gate valves
   d. sprinkler pressure line routing and directional turns (dimension maximum 100 feet along routing).
e. automatic controller
f. remote control valves
g. control wire routing
h. quick coupling valves
i. master valve
j. flow sensor
k. lightning protection (rod, plate, etc.)
l. backflow prevention units
m. tracer wires (main line routing)
n. irrigation water meters

6. On or before the date of the final site review, deliver the updated and completed reproducible drawings to the City Engineer. Delivery of these drawings does not relieve the Contractor of responsibility for furnishing any required information that may have been omitted from the prints.

C. Controller Charts:
   1. Record drawings must be approved by the City Engineer before controller charts are prepared.
   2. Provide two controller charts for each controller installed.
   3. The chart shall show the area controlled by the automatic controller and shall be the maximum size controller door will allow.
   4. The chart shall be based on a record drawing, reduced to the maximum size that will fit inside controller housing (printed on two sides if required for graphic clarity).
   5. The chart shall be a photocopy or black line print with colors to differentiate areas of coverage for each hydrozone, using pastel or transparent colors.
   6. When completed and approved, hermetically seal the chart between two pieces of plastic (thickness of each piece being minimum 10 mils).
   7. These charts must be completed and approved prior to final acceptance of the irrigation system. Installation will not be accepted without charts.

D. Operation and Maintenance Manuals:
   1. Prepare and deliver to the City Engineer within 10 calendar days prior to completion of construction two hardcover three ring binders containing the following information:
      a. Index sheet stating Contractor's address and telephone number
      b. List of equipment with names, addresses, and telephone numbers of local manufacturer representative
      c. Catalog and parts sheets regarding material and equipment installed under this contract
      d. Warranty statement
      e. Complete operating and maintenance instruction on all major equipment
   2. In addition to these maintenance manuals, instruct City Engineer's maintenance personnel regarding operation of major equipment and show written evidence to the City Engineer at the conclusion of the project that this service has been rendered.

E. Equipment to be Furnished:
   1. Supply as part of this contract the following tools:
      a. Two keys for each automatic controller
      b. Two keys for opening valve boxes
      c. One quick coupler key and matching hose swivel (per five quick coupling valves)
d. One 5 foot valve key for operation of gate valve

e. One remote hand-held radio control unit (transmitter and receiver) compatible with controller specified

f. Two Rain Bird pressure gauges, RBG-L160-D

2. Turn over this equipment to the City Engineer at the conclusion of the project. Before final acceptance can occur, written evidence that the City Engineer has received materials must be shown to the City Engineer.

F. Backflow Prevention Device Certification:
   1. Ensure that backflow prevention unit is certified as required by prevailing authority and submit two copies of certification at final review.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Exercise care in handling, loading, unloading, and storing p.v.c. pipe and fittings. Transport p.v.c. pipe in a vehicle which allows the length of pipe to lie flat, to avoid undue bending or concentrated external load at any point. Any section of pipe dented or damaged must be discarded or, if installed, must be replaced with new piping.

B. Cover any pipe stored outdoors to protect it from sunlight.

1.6 SUBSTITUTIONS

A. To request substitution of any equipment or material in lieu of equipment or material listed on the irrigation drawings and in the specifications, provide the following information to the City Engineer for approval:
   1. Statement indicating the reason for making the substitution, using a separate sheet of paper for each requested substitution
   2. Descriptive catalog literature and performance charts (if available) for each requested substitution
   3. Hydraulic calculations for proposed substitution, as applicable
   4. Itemized list of proposed substitution(s), noting difference in material and labor costs between substitution and item originally specified
   5. Written confirmation that City Engineer has received any credit resulting from approved substitution (with a copy sent to City Engineer)

B. Approval of any substitution or alternate will be based on information and/or samples provided by the Contractor.

C. Responsibility for the total performance of any substitution to equal or surpass the item originally specified in every respect rests with the Contractor.

D. If the City Engineer determines the substitution has proven to be unsatisfactory, it shall be removed and replaced with the originally specified item as part of the work of this contract (both materials and labor).

E. The City Engineer shall be solely responsible for accepting or rejecting any substitution as equal to equipment and materials listed on the irrigation drawings and in the specifications.

1.7 WARRANTY

A. Sprinkler irrigation system warranty shall be according to the following form. The general and supplementary conditions of these specifications shall be filed with the City Engineer or his representative prior to acceptance of the irrigation system.

B. Manufacturer warranties do not relieve the Contractor of his liability under the warranty. Such warranties only supplement the warranty.

C. Include a copy of the warranty form in the Operations and Maintenance Manual.

D. The following warranty form shall be typed on Contractor's letterhead:

WARRANTY FOR SPRINKLER IRRIGATION SYSTEM
We hereby warranty that the sprinkler irrigation system we have furnished and installed is free from defects in materials and workmanship, and the work has been completed in accordance with the drawings and specifications, ordinary wear and tear, unusual abuse or neglect excepted. We agree to repair or replace any defects in material or workmanship which may develop during a period of one year from the date of acceptance, and also to repair or replace any damage resulting from the repairing or replacing of such defects, at no additional cost to the City Engineer. We will perform such repairs or replacements within three days after receipt of written notice. In the event of our failure to perform such repairs or replacements within a reasonable time after receipt of written notice from City Engineer, we authorize the City Engineer to proceed to complete said repairs or replacements at our expense and we will pay the costs and charges therefor upon demand.

PROJECT:  
CONTRACTOR:  
ADDRESS:  
PHONE NO.:  
BY:  
DATE OF ACCEPTANCE:  
BY: 

1.8 TEMPORARY REPAIRS

A. The City Engineer reserves the right to make temporary repairs as necessary to keep the sprinkler system equipment in operating condition. The exercise of this right by the City Engineer will not relieve the Contractor of responsibilities under the terms of the guarantee as herein specified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use only new materials of manufacturer and type noted on drawings and as specified herein, or approved equal.

2.2 PIPE & FITTINGS

A. Pressure main line piping and fittings sizes to be sch. 40 pvc solvent weld.
B. Non-pressure lines (buried) shall be p.v.c Schedule 40. (1/2 inch pipe is not permitted.)
C. Non-pressure lines (drip) shall be p.v.c. Schedule 40.
D. Sleeves or conduit lines shall be p.v.c. Schedule 80.

E. All p.v.c. pipe and fittings shall conform to following specific requirements:

1. P.v.c. (Solvent Weld)
   a. Pipe shall be manufactured from virgin polyvinyl chloride compound in accordance with ASTM D 1784 or ASTM D 2241, cell classification 12454 B, hydrostatic design stress rating not less than 2,000 p.s.i.
   b. Fittings (solvent weld or thread) shall be standard weight, Schedule 40, side gated, injection molded p.v.c., complying with ASTM D 1784, cell classification 13454 B, including threads when required.

2. P.v.c. nipples shall be Schedule 80, with molded threads.

3. All p.v.c. pipe must bear the following markings:
   a. Manufacturer name
   b. Nominal pipe size
   c. Schedule or class
   d. Date of extrusion
4. Solvent cement and primer for p.v.c. solvent-weld pipe and fittings shall be of type and installation method prescribed by the manufacturer.

F. Brass Pipe and Fittings:
   1. Brass pipe shall be 85 percent red brass, American National Standard Institute (ANSI), Schedule 40 screwed pipe.
   2. Fittings shall be medium brass, screwed 125 pound class.

G. Copper Pipe and Fittings:
   1. Pipe shall be Type K, hard tempered.
   2. Fittings shall be wrought copper, solder joint type.
   3. Joints shall be soldered with silver solder, 45 percent silver, 15 percent copper, 16 percent zinc, 24 percent cadmium, solidus at 1125 F. and liquidus at 1145 F.

2.3 TRACER WIRES

A. Install No. 14 polyethylene coated copper tracer wire with all non-metallic irrigation main lines, Paige P7079D or equal.

2.4 ELECTRICAL (HIGH VOLTAGE)

A. All high voltage electrical services required for automatic controller and other irrigation system equipment noted on drawing shall be provided under electrical section.

B. Electrical equipment installed outside building shall be NEMA 4 type.

C. All connections between electrical services and equipment shall be in rigid galvanized electrical conduit, with conduit and wiring sizes as required.

2.5 ELECTRICAL (LOW VOLTAGE)

A. Make connections between controller and remote control valves using direct burial AWG-UF 600 volt wire, insulation thickness 3/64 inch, utilizing low density, high molecular weight polyethylene insulation.

B. Waterproof splices (where permitted) use gel type, DBR or DBY and house in a box. Boxes for other irrigation uses may be utilized for this purpose when approved by City Engineer.

C. Wire shall be minimum #14 UF 600 volt underground wiring. Common wire shall be white, and all other wires any color except white.

2.6 GATE VALVES

A. Valves shall be ASTM B 62 brass body, 150 pound saturated steam rated with screwed joints, non-rising stem, screwed bonnet, and solid disc, unless otherwise noted on drawings. Provide with hand wheel.

2.7 QUICK COUPLING VALVES
A. Valves shall have brass body, 150 pound class, with 3/4 inch female threads opening at base permitting operation with a special connecting device (coupler) designed for this purpose.
   1. Coupler threads shall be lug type (acme type).
   2. Provide with rubber-like vinyl hinge cover.

2.8 BACKFLOW PREVENTION UNITS

A. Backflow preventer shall be designed to operate on a “reduced pressure” principle and be equipped with gate valves and two field test cocks (supply and discharge sides).

B. Pressure regulator at backflow unit shall be a brass/cast iron unit, type and size as noted on drawing.

C. Wye strainers at backflow prevention units shall be 125 pound class cast brass with 40 mesh monel screen, unless otherwise noted on drawing.

2.9 CENTRAL COMPUTER CONTROL

A. See Central Computer Control specifications for specific information. When applicable.

2.10 AUTOMATIC CONTROLLER

A. Controller shall be fully automatic and capable of operating the required number of stations, flow sensors, master valves, and moisture sensors. Controller shall be wall mount type, in a housing with locking hinged cover. Fuse and chassis ground all controller components. Automatic controller shall include the following:
   1. 117 volt pump starter relay for each controller being served.
   2. Surge protection.
   3. Copper clad lightning protection device (specific type to be coordinated with General Contractor).
   4. Permanent connection outside controller housing for quick connection of remote hand-held radio controls.
   5. Remote pole mounted drain switch assembly mounted on the right hand side of enclosure, with interconnect wire harness pre-wired through a bypass switch into the controller and to the terminal strip.
   6. Master valve relay assembly pre-wired to the terminal strip. If more than one controller is served off master valve, provide additional relays for each such controller.

B. Mount the controller on wall in accordance with the manufacturer’s instructions and plan installation details. Metal conduit shall run from the 120 volt supply to the controller housing. All power within the housing shall be properly phased.

2.11 REMOTE CONTROL VALVES

A. Valve shall be spring-loaded, packless diaphragm activated, normally closed type with brass body, equipped with flow control and pressure regulation capabilities when noted on drawing.

B. Valve solenoid shall be 24 volt a.c. 4.5 watt maximum, 500 mili-amp maximum surge, corrosion-proof, stainless steel construction, epoxy encapsulated to form a single integral unit.

C. When valves called for are not equipped with a flow control, provide a ball valve on discharge side of valve.

D. Valve shall be equipped with an external bleeder to permit operation in the field without power at the controller.

2.12 SMALL TURF SPRINKLER HEADS

A. Sprinklers shall be similar in all respects to type noted in legend on drawing.

B. Heads shall have screw adjustments.
C. Nozzle shall rise a minimum of 4 inches.
D. Body shall be equipped with a built-in check valve.
E. Provide pressure compensating screens (pcs) as noted on drawing.
F. Provide variable arc nozzles as necessary in irregular corners and due to planting area configuration.
G. Use pressure regulating type heads where noted.

2.13 SMALL SHRUB/GROUND COVER SPRINKLER HEADS
A. Sprinklers shall be similar in all respects to type shown on drawing.
B. Where noted, use pop-up type body with height per legend on drawing.
C. When noted, body shall be equipped with a built-in check valve.
D. Provide pressure compensating screens (pcs) as noted on drawing.
E. Provide variable arc nozzle as necessary
F. Use pressure regulating type heads where noted.

2.14 ROTARY SPRINKLER HEADS
A. Heads shall be gear driven pop-up sprinkler heads, built-in check valve.
B. Part circle heads shall have variable arc setting.
C. Nozzles shall be matched precipitation type as noted on plan.

2.15 VALVE BOXES
A. All valve boxes shall be concrete with cast iron lids.
B. Remote control valves, flow sensors, and master control valves shall be installed in rectangular concrete valve boxes, with locking cast iron covers.
C. All valve boxes shall be concrete, with locking cast iron covers.
D. Gate valves and quick coupling valves shall be installed in concrete valve boxes with cast locking cast iron cover.

2.16 MASTER VALVE
A. Master valve shall be spring-loaded, packless diaphragm activated, normally open type with a brass body, equipped with flow control and pressure regulation capabilities when noted on drawing.

2.17 FLOW SENSOR
A. Flow sensor size shall be based on the lowest flow demand through the sensor, with the piping size per dimensions noted in construction detail. Verify size of sensor with Manufacturer’s Representative.
B. Install sensor per manufacturer’s recommendations. Retain a factory-trained representative to check installation and perform start-up services, including adjustment of all equipment. Provide City Engineer with proof of compliance.

2.18 TREE IRRIGATORS/BUBBLER HEADS
A. Bubbler heads shall be similar in all respects to type shown in detail and sprinkler legend.
B. Provide assemblies as indicated on drawings for tree well applications.
C. See drawing for construction detail regarding height and typical assembly of bubbler on fixed head riser.
D. Use Teflon tape on all threaded fittings.
E. Install bubbler head away from walkway to minimize pedestrian hazard and unsightly conditions whenever possible.
F. In slope areas, install bubbler head on uphill side of plant material.
G. Nozzles shall be as specified in legend.
H. Install check valve on riser as required for low head drainage.
I. Provide pressure compensating screens (pcs) as noted on drawing.
J. Refer to typical spacing of heads per drawing and adjust as required for actual field conditions.

PART 3 - EXECUTION
3.1 SITE CONDITIONS
A. All scaled dimensions are approximate. Check and verify all dimensions per City Engineer's approval prior to proceeding with work under this section.
B. Exercise extreme care in excavating and working near existing utilities. Coordinate excavations with underground service alert and utility companies. Damage to utilities caused by operations or neglect shall be repaired at Contractor's expense. Check existing utility drawings for locations.
C. Coordinate installation of sprinkler irrigation materials, including pipe, so there will be NO interference with utilities or other construction, or difficulty in planting trees, shrubs, and ground covers.
D. Carefully check all grades to ensure work on the sprinkler irrigation system may safely commence.

3.2 PREPARATION
A. Water Supply:
   1. The General Contractor will provide new meter and service line and pay all costs incurred. Coordinate with Civil Engineer for exact location.
   2. Connect sprinkler irrigation system to water supply points of connection as indicated on the drawings. Verify exact location on site.
   3. Connections as shown on drawings are approximate. Minor deviations (plus or minus 20 feet) required by actual site conditions shall be a part of this contract.
   4. Coordinate connection to meters, water outlets, etc. with General Contractor and other trades on site to ensure proper connection.
   5. Coordinate pipe crossing hardscapes, walks, etc., with appropriate trades to minimize disturbance to finish product. If a preferable route is noted on site, contact City Engineer to discuss alternative and obtain approval of same.
B. Observation Schedule:
   1. Notify the City Engineer in advance for the following observation meetings, according to the time indicated:
      a. Pre-job conference - 5 days
      b. Backflow assembly and automatic controller location - 48 hours
      c. Pressure supply line and control wire installation and testing - 48 hours
      d. Lateral line and sprinkler installation - 48 hours
      e. Coverage test - 48 hours
      f. Final site review - 5 days
   2. When observations are conducted by other than the City Engineer, show evidence in writing when and by whom these observations were made.
   3. Maintain a set of current and up to date plans on the job site at all times. No site observations will commence without record drawings and current plans. In the event the Contractor calls for a site visit without record drawings, without current plans, without completing previously noted corrections, or without preparing the system for said visit, he shall be responsible for reimbursing the City Engineer based on his current billing rates per hour (portal to portal, plus transportation costs) for the inconvenience. No subsequent site visits will be scheduled until this charge has been paid.
C. Physical Layout:
1. All piping or equipment shown diagrammatically on drawings outside planting areas shall be installed inside planting area whenever possible, to exact dimensions noted in construction details unless otherwise approved.

2. Prior to installation, stake out all pressure supply line routing and sprinkler head locations.

3. Entire layout shall be approved by City Engineer prior to installation.

3.3 INSTALLATION

A. Piping:

1. Install all plastic pipe and fittings according to manufacturer instructions.

2. All lines shall have a minimum clearance of 6 inches from each other and from lines of other trades. Parallel lines shall not be installed directly over one another.

3. Adhere to all other related regulations of governing agencies.

4. Install concrete thrust blocks in accordance with pipe manufacturer recommendations for pressure supply piping 3 inches and larger.

5. Coordinate installation of piping shown through walls as required with General Contractor to avoid penetrating walls if possible. If penetration is necessary, coordinate and waterproof.

6. Scale of drawing may not permit indicating all sleeving required. Provide sleeves for all piping under paved areas. Refer to sections that pertain to sleeving material, size, etc.

7. All major plumbing work using copper pipe shall be performed by a licensed and bonded Plumbing Contractor. Irrigation Contractor shall obtain all permits required.

B. Trenching:

1. Excavate trenches to required depths. Follow approved layout for each system.

2. Trench bottom shall be flat to ensure piping is supported continuously at prepared grade.

3. Where lines occur under paved areas, consider dimension to be below the subgrade.

4. Provide minimum coverage as follows:
   
a. Pressure supply lines (3 inches and smaller): 24 inches, unless otherwise noted on drawing.

   b. Pressure supply lines (3-1/2 inches and larger): 30 inches, unless otherwise noted on drawing.

   c. Pressure supply lines under paving: 36 inches, unless otherwise noted on drawing.

   d. Non-pressure lines: 12 inches, unless otherwise noted on drawing.

   e. Non-pressure lines under paving: 24 inches, unless otherwise noted on drawing.

   f. Control wire: 18 inches, unless otherwise noted on drawing.

C. Tracer Wires:

1. Carefully place tracer wire on bottom of trench under vertical projection of pipe, avoiding stress from backfilling and running wire continuously throughout the length of pipe.

2. Tracer wire shall follow main line pipe and branch lines, terminating in a yard box with a gate valve that controls these main irrigation lines. Provide sufficient wire to reach surface grade, bending back end of wire to form a loop, and attach a Dymo-Tape type plastic label noting “TRACER WIRE.”

3. All splices shall be made using Scotchlok or equal, encased in epoxy resin to provide a permanent U.L. approved watertight connection.

4. Record locations of tracer wires and their termination points on record drawings.

D. Backfilling:
1. Buried pipe in trenches shall be center loaded only until all required tests are performed. Carefully backfill trenches with approved excavated materials such as earth, loam, sandy clay, sand, or other approved materials free from large clods of earth or stones. Mechanically compact backfill in landscaped areas to a dry density equal to adjacent undisturbed soil in planting areas. Backfill must conform to adjacent grades without dips, depressions, humps or other surface irregularities.

2. Place fine granular material backfill on all lines initially. No foreign matter larger than 1/2 inch in size will be permitted in the initial backfill.

3. Flooding of trenches will be permitted only with approval of the City Engineer.

4. If settlement occurs and subsequent adjustments in pipe, valves, sprinkler heads, lawn, planting, etc. are necessary, make all such adjustments without cost to the City Engineer.

E. Trenching and Backfill Under Paving:

1. Backfill trenches located in heavy clay soil under areas where paving, asphaltic concrete or concrete will be installed shall have sand 6 inches below and 3 inches above the pipe. Compact in layers to 95 percent compaction using manual or mechanical tamping devices. Compact trenches for piping to equal the compaction of the existing adjacent undisturbed soil and leave in a firm, unyielding condition. All trenches shall be flush with the adjoining grade. Pressure test all piping under paving prior to the paving work.

2. Install piping under existing walks by jacking, boring or hydraulic driving. Cut or break sidewalks and/or concrete as necessary and replace paving as a part of the contract cost. Obtain permission from the City Engineer to cut or break sidewalks and/or concrete. No hydraulic driving will be permitted under asphaltic concrete paving.

3. Coordinate installation of piping and sleeves under paved areas with General Contractor.

4. Install all p.v.c. piping crossing hardscape in a sleeve two pipe sizes larger than the piping, or as noted on drawing. Install wires under paving in separate sleeve of size required, or as authorized.

F. Assemblies:

1. Routing of sprinkler irrigation lines as indicated on the drawings is diagrammatic. Install lines and various assemblies to conform with details on plans.

2. Install NO multiple assemblies in plastic lines. Provide each assembly with its own outlet.

3. Perform all directional changes on pressure supply line using 45 degree elbows. No 90 degree elbows will be permitted without approval of City Engineer.

4. No more than one size may be used when reducing or increasing a fitting outlet, unless approved by City Engineer.

5. Install all assemblies specified herein in accordance with respective detail. In absence of detail drawings or specifications pertaining to specific items required to complete work, perform such work in accordance with best standard practice, with prior approval of the City Engineer.

6. Thoroughly clean p.v.c. pipe and fittings of dirt, dust and moisture before installation. Installation and solvent welding methods shall be as recommended by the pipe and fitting manufacturer.

7. On p.v.c. to metal connections, work the metal connections first. Use Teflon tape or approved equal on all threaded p.v.c. to p.v.c. and on all threaded p.v.c. to metal joints, with only light wrench pressure. Where threaded p.v.c. connections are required, use threaded p.v.c. adapters into which the pipe may be welded.

8. Install backflow assemblies in shrub areas at minimum height permitted by local code, unless otherwise approved. Flush pressure supply line before installing backflow prevention unit as required to ensure piping is free of debris.

9. Verify exact location of all major equipment with the City Engineer before installation.

10. Install remote control valves in shrub areas and perpendicular to hardscape unless otherwise approved.
11. Unless otherwise approved, locate quick coupling valves within 12 inches of hardscape or at separation between shrub and lawn areas.

12. Assemble pressure supply steel pipe and fittings using red lead and boiled linseed oil paste or an approved equivalent, applied to male threads only.

13. Locate tree irrigators at each tree. Install as indicated on drawings, including vents, strainers, etc.

G. Automatic Controller:
1. Install per manufacturer instructions and per details. Connect remote control valves to controller in numerical sequence shown on the drawings.

H. Flushing of System:
1. After all new sprinkler pipe lines and risers are in place and connected, all necessary diversion work has been completed, and prior to installation of sprinkler heads, open the control valves and flush out the system using adequate pressure.
2. Install sprinkler heads only after the system has been flushed to the complete satisfaction of the City Engineer.

I. Sprinkler Heads:
1. Install the sprinkler heads per the drawings and according to their respective detail.
2. Spacing of heads shall not exceed 5 percent of width of planting area. Refer to plan, and bring any discrepancies to the attention of City Engineer.

J. Valve Boxes:
1. Install all buried valves and equipment in the specified box.
2. Fill area under box with a minimum of 1-1/2 cubic feet of 3/4 inch gravel 12 inches deep for remote control valves, gate valves and quick coupling valves, before box is installed.
3. Attach identification tags to each remote control valve, showing number that corresponds with controller sequence. Tags shall be manufactured of polyurethane Behr Desopaid, yellow in color with black letters, 2-3/4 inches by 2-1/4 inches.
4. Brand sequence number of each valve in minimum 2 inch high numerals into box top.
5. Install valve boxes in shrub areas unless otherwise approved.
6. Install valve boxes square to one another and to edges of adjacent hardscape, unless otherwise approved by City Engineer.

K. Electrical Supply:
1. Place low voltage wiring in the same trench and along side of main lines unless otherwise approved.
2. When more than one wire is placed in a trench, tape wires together at maximum 12 feet on center.
3. Provide a 12 inch expansion loop at each connection and directional change for low voltage wires and two feet for stub outs.
4. Use a continuous wire between controller and remote control valves. Except as otherwise approved, do not splice wire at any point. Enclose all approved splices in an U.L. approved junction box.
5. Provide each controller with separate ground wire.
6. Provide pull box for low voltage wires approximately every 200 feet along continuous lineal runs.
7. Provide electrical service for pumps as noted on drawing.

L. Protective Pipe Covering:
1. Clean buried pipe & fittings of all foreign substances and film.
2. Coat all surfaces with adhesive primer.
3. Wrap pipe & fittings with three layers of polyvinyl chloride tape. Overlap each layer approximately two thirds the width of tape without stretching.

4. Total wrap thickness shall be no less than 10 mils over all surfaces, with no voids.

5. Wrap all piping, fittings, and equipment noted to be frost protected with three layers of burlap, secured with one wrap of p.v.c. tape.

3.4 FIELD QUALITY CONTROL

A. Adjustment of the System:

1. Adjust all sprinkler heads and valves for optimum performance and to minimize overspray onto walks and roadways. Spray on buildings and/or windows is not permitted.

2. If it is determined that adjustments in the irrigation equipment will provide proper or more adequate coverage, make such adjustments prior to planting. Adjustments may include changes in nozzle sizes or trajectory of spray or degrees of arc, as may be required. Use variable arc nozzles where required.

3. Set all sprinkler heads perpendicular to finish grades unless otherwise designated on the plans, and at height and distance from walks, buildings, etc, as noted or as directed by City Engineer.

4. When using master flow monitors and sensors, determine exact flow rates and proper operating time to avoid water runoff for each control valve. Program this information into the controller, along with minimum flow of each valve and maximum flow for the largest valve. Provide a written copy of this data to City Engineer. Fault detection shall be 5 percent greater than actual flow. Show evidence in writing to the City Engineer at the conclusion of the project that this service has been rendered.

B. Testing of Irrigation System:

1. Test all pressure lines under hydrostatic pressure of 125 pounds per square inch and prove watertight.

2. Testing of pressure main lines must occur prior to installation of electric control valves, quick couplers or any other equipment that might prevent a proper test from being performed.

3. Test all piping under paved areas under hydrostatic pressure of 125 pounds per square inch, and prove watertight prior to paving.

4. Sustain pressure in lines for minimum 24 hours, unless otherwise authorized. If leaks develop (more than 5 percent), replace joints and repeat test until entire system is proven watertight.

5. All hydrostatic tests shall be conducted only in the presence of the City Engineer or other duly authorized representative of the City Engineer. Do not completely backfill pipe until it has been inspected, tested and approved in writing.

6. Furnish necessary force pump and all other test equipment, if permanent connection is unavailable.

7. When the sprinkler irrigation system is completed, perform a coverage test in the presence of the City Engineer to confirm that water coverage for planting areas is complete and adequate. Furnish all materials and perform all work required to correct any inadequacies of coverage due to deviations from plans, or where the system has been willfully installed as indicated on the drawings when it is obviously inadequate without notifying the City Engineer. This test shall be accomplished before any planting occurs.

8. Provide handheld walkie-talkie or personnel as necessary to accomplish this task expeditiously.

9. Upon completion of each phase of work, test and adjust entire system to meet site requirements.

10. Test any low voltage wiring more than 50 feet long installed under paving for continuity prior to paving.

C. Final Observation Prior to Acceptance:
1. Operate each system in its entirety for the City Engineer at time of final observation. Any items deemed unacceptable by the City Engineer due to noncompliance with the specifications and drawings shall be corrected to the complete satisfaction of the City Engineer.

2. Operate the following at conclusion of maintenance period to confirm proper performance:
   a. automatic controller
   b. rain sensor
   c. flow sensor/master valve
   d. flow monitor
   e. pumps

3. Evidence must be shown to the City Engineer that the City Engineer has received all required equipment, charts, record drawings, etc. before final observation can occur.

D. Conclusion of Maintenance Period:

1. At end of maintenance period, submit written confirmation to City Engineer that the system is operating properly, as per final acceptance, and note any changes/adjustments made during maintenance period. Based on this, City Engineer may request additional site review.

3.5 FLOW SENSOR AND MASTER VALVE

A. Flow sensor and master valve shall be installed per construction detail on drawing and according to manufacturer recommendation.

3.6 MAINTENANCE

A. The entire sprinkler irrigation system shall be operated automatically for a period of seven days prior to any planting.

B. The City Engineer reserves the right to waive or shorten the operation period.

C. After maintenance period, demonstrate in presence of the City Engineer that the system is in proper operating order.

3.7 CLEANUP

A. Perform cleanup as each portion of the work progresses. Remove refuse and excess dirt from the site, and sweep or wash down all walks and paving. Repair any damage to the work of others and return to original condition.

3.8 OPERATING INSTRUCTIONS

A. Train City Engineer's maintenance personnel in proper operation of all major equipment, including recommended winterization procedures. Provide written confirmation of the person(s) so trained to the City Engineer.

B. During maintenance period, establish infiltration rate of soil in all areas (particularly slopes). Schedule automatic controller to not exceed saturation point, and program repeat cycles as required to meet landscape needs while avoiding runoff. At conclusion of maintenance period, provide a typed record of the watering schedules for each valve during maintenance, including various schedules due to seasonal changes.

3.9 EXISTING LANDSCAPING

A. Protect all existing landscaping. Any existing landscaping removed or damaged shall be properly replaced, including sod, as directed by the City Engineer.

B. Verify that fencing has been provided around trees, located at the dripline (line of furthest branch of tree plus 3 feet). Notify City Engineer to review and approve final location of the proposed irrigation system layout and trenching in the vicinity of existing trees to be retained.
C. Do not excavate or install irrigation materials or equipment within the dripline of existing trees. Do not permit sprinkler heads to spray onto or within 5 feet of the trunks of existing trees. Use all possible care to avoid injury to trees and tree roots. Excavate by hand in areas where 2 inch and larger roots occur. Tunnel under all roots 2 inches and larger in diameter and heavily wrap with burlap, to prevent scarring or excessive drying.

D. Do not use ditching machine within the dripline of existing trees. In no case shall more than two sides of an existing tree be trenched for irrigation lines. Confirm trenching locations at existing trees with City Engineer to obtain approval prior to trenching. Where roots are encountered outside the dripline, hand trim the wall of the trench adjacent to the tree, making clean cuts through. Paint roots 1 inch and larger in diameter with two coats of Tree Seal, or equivalent. Close trenches adjacent to tree within 24 hours. Where this is not possible, shade the side of the trench adjacent to the tree with burlap or canvas.

3.11 SERVICES/DATA TO BE PROVIDED BY THE CONTRACTOR

A. Flow sensor cable test
B. Written flow monitor and flow sensor test records
C. Water schedules
D. Training of City Engineer’s personnel in proper operation of all major equipment
E. Equipment to be supplied per Section 1.05, E.
### Seasonal Establishment Irrigation Schedule

**Winter (Nov.-Dec.-Jan.-Feb.)**

<table>
<thead>
<tr>
<th>Project Name: Hollenbeck Replacement Station</th>
<th>Water Meter Number: 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm Name: EDIC</td>
<td>Reclaimed/Potable: P</td>
</tr>
<tr>
<td>Date: 12/22/04</td>
<td></td>
</tr>
</tbody>
</table>

#### Evapotranspiration Rates:

<table>
<thead>
<tr>
<th>Historical</th>
<th>Seasonal: 50.20 In./Yr.</th>
<th>Turf: 0.8</th>
<th>Irr. Efficiency%: Spray Heads: 0.70</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seasonal: 9.50 Inches</td>
<td>Low Water Use Shrubs: 0.3</td>
<td>Rotors: 0.75</td>
<td></td>
</tr>
<tr>
<td>Seasonal: 0.59 In./Week</td>
<td>Medium Water Use Shrubs: 0.4</td>
<td>Bubbler Heads: 0.85</td>
<td></td>
</tr>
<tr>
<td></td>
<td>High Water Use Shrubs: 0.5</td>
<td>Drip Systems: 0.90</td>
<td></td>
</tr>
</tbody>
</table>

#### Valve Information:

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>17</td>
<td>1</td>
<td>101</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>17</td>
<td>1</td>
<td>302</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>17</td>
<td>1</td>
<td>402</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>17</td>
<td>1</td>
<td>67</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>17</td>
<td>1</td>
<td>319</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>17</td>
<td>1</td>
<td>201</td>
</tr>
<tr>
<td>7</td>
<td>28</td>
<td>0.4</td>
<td>1.83</td>
<td>1.83</td>
<td>3</td>
<td>0.1</td>
<td>4</td>
<td>0</td>
<td>119</td>
</tr>
<tr>
<td>8</td>
<td>13</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>17</td>
<td>1</td>
<td>218</td>
</tr>
<tr>
<td>9</td>
<td>23</td>
<td>0.4</td>
<td>1.83</td>
<td>1.83</td>
<td>3</td>
<td>0.1</td>
<td>4</td>
<td>0</td>
<td>98</td>
</tr>
<tr>
<td>10</td>
<td>16</td>
<td>0.4</td>
<td>1.83</td>
<td>1.83</td>
<td>3</td>
<td>0.1</td>
<td>4</td>
<td>0</td>
<td>68</td>
</tr>
<tr>
<td>11</td>
<td>18</td>
<td>0.4</td>
<td>1.83</td>
<td>1.83</td>
<td>3</td>
<td>0.1</td>
<td>4</td>
<td>0</td>
<td>77</td>
</tr>
<tr>
<td>12</td>
<td>11</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>17</td>
<td>1</td>
<td>184</td>
</tr>
<tr>
<td>13</td>
<td>16</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>17</td>
<td>1</td>
<td>268</td>
</tr>
<tr>
<td>14</td>
<td>25</td>
<td>0.8</td>
<td>1.00</td>
<td>0.75</td>
<td>6</td>
<td>0.6</td>
<td>38</td>
<td>2</td>
<td>950</td>
</tr>
<tr>
<td>15</td>
<td>25</td>
<td>0.8</td>
<td>1.00</td>
<td>0.75</td>
<td>6</td>
<td>0.6</td>
<td>38</td>
<td>2</td>
<td>950</td>
</tr>
<tr>
<td>16</td>
<td>19</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>17</td>
<td>1</td>
<td>319</td>
</tr>
<tr>
<td>17</td>
<td>5</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>17</td>
<td>1</td>
<td>84</td>
</tr>
<tr>
<td>18</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>19</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>21</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>22</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>23</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>24</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>25</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>26</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>27</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>28</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>29</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>31</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>32</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>33</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>34</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>35</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>36</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>37</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>38</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>39</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>40</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Run Time Totals:

<table>
<thead>
<tr>
<th>Run Time Totals:</th>
<th>Run Time Totals:</th>
<th>Water Cost Totals:</th>
</tr>
</thead>
<tbody>
<tr>
<td>277.4322789 Min./Wk.</td>
<td>4726.1 Gal/Wk. 0.0145 Acft./Wk.</td>
<td>$ 630.00 Cost/Acft.</td>
</tr>
<tr>
<td>4.623871315 Hrs./Wk.</td>
<td>20464 Gal/Mo. 0.0628 Acft./Mo.</td>
<td>39.56775454 Cost/Mo.</td>
</tr>
<tr>
<td>3 Days/Wk.</td>
<td>61439.3 Gal/Ssn. 0.1886 Acft./Ssn.</td>
<td>118.7946441 Cost/Ssn.</td>
</tr>
<tr>
<td>1.541290438 Hrs./Day</td>
<td>1575.37 Gal/Day 0.0048 Acft./Day</td>
<td>627.735088 Cost/Yr.</td>
</tr>
</tbody>
</table>
### Seasonal Establishment Irrigation Schedule

**Project Name:** Hollenbeck Replacement Station  
**Water Meter Number:** 1  
**Date:** 12/22/04  
**Firm Name:** EDIC  
**Reclaimed/Potable:** P

#### Evapotranspiration Rates:

<table>
<thead>
<tr>
<th>Historical</th>
<th>Seasonal</th>
<th>Seasonal</th>
<th>Plant Factors (% of Eto)</th>
<th>Irr.Efficiency%</th>
</tr>
</thead>
<tbody>
<tr>
<td>50.20 In./Yr</td>
<td>8.00 Inches</td>
<td>1.00 In./Week</td>
<td>Turf: 0.8</td>
<td>Spray Heads: 0.70</td>
</tr>
<tr>
<td>Low Water Use Shrubs: 0.3</td>
<td>Rotors: 0.75</td>
<td>Medium Water Use Shrubs: 0.4</td>
<td>Bubbler Heads: 0.85</td>
<td>High Water Use Shrubs: 0.5</td>
</tr>
</tbody>
</table>

#### Controller: A

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>0.60</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.7</td>
<td>42</td>
<td>2</td>
<td>254</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>0.60</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.7</td>
<td>42</td>
<td>2</td>
<td>762</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>0.60</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.7</td>
<td>42</td>
<td>2</td>
<td>1016</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>0.60</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.7</td>
<td>42</td>
<td>2</td>
<td>169</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
<td>0.60</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.7</td>
<td>42</td>
<td>2</td>
<td>805</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
<td>0.60</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.7</td>
<td>42</td>
<td>2</td>
<td>508</td>
</tr>
<tr>
<td>7</td>
<td>28</td>
<td>0.80</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>1.1</td>
<td>37</td>
<td>3</td>
<td>1049</td>
</tr>
<tr>
<td>8</td>
<td>13</td>
<td>0.60</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.7</td>
<td>42</td>
<td>2</td>
<td>551</td>
</tr>
<tr>
<td>9</td>
<td>23</td>
<td>0.80</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>1.1</td>
<td>37</td>
<td>3</td>
<td>862</td>
</tr>
<tr>
<td>10</td>
<td>16</td>
<td>0.80</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>1.1</td>
<td>37</td>
<td>3</td>
<td>600</td>
</tr>
<tr>
<td>11</td>
<td>18</td>
<td>0.80</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>1.1</td>
<td>37</td>
<td>3</td>
<td>674</td>
</tr>
<tr>
<td>12</td>
<td>11</td>
<td>0.60</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.7</td>
<td>42</td>
<td>2</td>
<td>466</td>
</tr>
<tr>
<td>13</td>
<td>16</td>
<td>0.60</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.7</td>
<td>42</td>
<td>2</td>
<td>678</td>
</tr>
<tr>
<td>14</td>
<td>25</td>
<td>0.80</td>
<td>1.00</td>
<td>0.75</td>
<td>6</td>
<td>1.1</td>
<td>64</td>
<td>3</td>
<td>1600</td>
</tr>
<tr>
<td>15</td>
<td>25</td>
<td>0.80</td>
<td>1.00</td>
<td>0.75</td>
<td>6</td>
<td>1.1</td>
<td>64</td>
<td>3</td>
<td>1600</td>
</tr>
<tr>
<td>16</td>
<td>19</td>
<td>0.60</td>
<td>1.83</td>
<td>0.85</td>
<td>3</td>
<td>0.7</td>
<td>23</td>
<td>2</td>
<td>440</td>
</tr>
<tr>
<td>17</td>
<td>5</td>
<td>0.60</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.7</td>
<td>42</td>
<td>2</td>
<td>212</td>
</tr>
<tr>
<td>18</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>19</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>21</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>22</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>23</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>24</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>25</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>26</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>27</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>28</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>29</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>31</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>32</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>33</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>34</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>35</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>36</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>37</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>38</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>39</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>40</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Run Time Totals:

<table>
<thead>
<tr>
<th>Run Time Totals</th>
<th>Run Time Totals</th>
<th>Water Cost Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min./Wk. 724.559994</td>
<td>Gal/Wk. 12245.9</td>
<td>Cost/Wk. 0.0376</td>
</tr>
<tr>
<td>Hrs./Wk. 12.0759332</td>
<td>Gal/Mo. 53024.8</td>
<td>Cost/Mo. 0.1627</td>
</tr>
<tr>
<td>Days/Wk. 4</td>
<td>Gal/Ssn. 159197</td>
<td>Cost/Ssn. 0.4886</td>
</tr>
<tr>
<td>Hrs./Day 3.01898331</td>
<td>Acre/Day 3061.48</td>
<td>Cost/Yr. 3.01898331</td>
</tr>
</tbody>
</table>

#### Water Cost Totals:

- Cost/Acre: $630.00
- Cost/Month: $102.5250674
- Cost/Site: $307.8119806
- Cost/Year: $1931.520178
### Seasonal Establishment Irrigation Schedule

**Summer (May-June-July-Aug.-Sept.)**

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Hollenbeck Replacement Station</th>
<th>Water Meter Number:</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm Name:</td>
<td>EDIC</td>
<td>Reclaimed/Potable:</td>
<td>P</td>
</tr>
<tr>
<td>Date:</td>
<td>12/22/04</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Evapotranspiration Rates:

<table>
<thead>
<tr>
<th>Historical:</th>
<th>50.20 In./Yr.</th>
<th>Turf:</th>
<th>0.8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seasonal:</td>
<td>28.40 Inches</td>
<td>Low Water Use Shrubs:</td>
<td>0.3</td>
</tr>
<tr>
<td>Seasonal:</td>
<td>1.42 In./Week</td>
<td>Medium Water Use Shrubs:</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>High Water Use Shrubs:</td>
<td>0.5</td>
</tr>
</tbody>
</table>

#### Controller:

- A


<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>0.8</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>1.3</td>
<td>80</td>
<td>2</td>
<td>481</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>0.8</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>1.3</td>
<td>80</td>
<td>2</td>
<td>1443</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>0.8</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>1.3</td>
<td>80</td>
<td>2</td>
<td>1925</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>0.8</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>1.3</td>
<td>80</td>
<td>2</td>
<td>321</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
<td>0.8</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>1.3</td>
<td>80</td>
<td>2</td>
<td>1524</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
<td>0.8</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>1.3</td>
<td>80</td>
<td>2</td>
<td>962</td>
</tr>
<tr>
<td>7</td>
<td>28</td>
<td>0.8</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>1.6</td>
<td>53</td>
<td>2</td>
<td>1490</td>
</tr>
<tr>
<td>8</td>
<td>13</td>
<td>0.8</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>1.3</td>
<td>80</td>
<td>2</td>
<td>1042</td>
</tr>
<tr>
<td>9</td>
<td>23</td>
<td>0.8</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>1.6</td>
<td>53</td>
<td>2</td>
<td>1224</td>
</tr>
<tr>
<td>10</td>
<td>16</td>
<td>0.8</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>1.6</td>
<td>53</td>
<td>2</td>
<td>851</td>
</tr>
<tr>
<td>11</td>
<td>18</td>
<td>0.8</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>1.6</td>
<td>53</td>
<td>2</td>
<td>958</td>
</tr>
<tr>
<td>12</td>
<td>11</td>
<td>0.8</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>1.3</td>
<td>80</td>
<td>2</td>
<td>882</td>
</tr>
<tr>
<td>13</td>
<td>16</td>
<td>0.8</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>1.3</td>
<td>80</td>
<td>2</td>
<td>1283</td>
</tr>
<tr>
<td>14</td>
<td>25</td>
<td>0.8</td>
<td>1.00</td>
<td>0.75</td>
<td>6</td>
<td>1.5</td>
<td>91</td>
<td>2</td>
<td>2272</td>
</tr>
<tr>
<td>15</td>
<td>25</td>
<td>0.8</td>
<td>1.00</td>
<td>0.75</td>
<td>6</td>
<td>1.5</td>
<td>91</td>
<td>2</td>
<td>2272</td>
</tr>
<tr>
<td>16</td>
<td>19</td>
<td>0.8</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>1.3</td>
<td>80</td>
<td>2</td>
<td>1524</td>
</tr>
<tr>
<td>17</td>
<td>5</td>
<td>0.8</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>1.3</td>
<td>80</td>
<td>2</td>
<td>401</td>
</tr>
<tr>
<td>18</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>19</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>21</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>22</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>23</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>24</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>25</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>26</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>27</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>28</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>29</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>31</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>32</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>33</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>34</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>35</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>36</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>37</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>38</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>39</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>40</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

#### Run Time Totals:

- Min./Wk.: 1276.664312
- Hrs./Wk.: 21.27773853
- Days/Wk.: 7
- Hrs./Day: 3.039676933

#### Run Time Totals:

- Gal/Wk.: 20854.4
- Acft./Wk.: 0.064
- Gal/Mo.: 90299.5
- Acft./Mo.: 0.2771
- Gal/Ssn.: 271107
- Acft./Ssn.: 0.8321
- Gal/Day: 2979.2
- Acft./Day: 0.0091

#### Water Cost Totals:

- Cost/Acft.: 630.00
- Cost/Mo.: 174.5967452
- Cost/Ssn.: 524.1934613
- Cost/Yr.: 926.5673154
## Seasonal Establishment Irrigation Schedule

**Fall (Oct.)**

**Project Name:** Hollenbeck Replacement Station  
**Water Meter Number:** 1  
**Firm Name:** EDIC  
**Reclaimed/Potable:** P  
**Date:** 12/22/04

### Evapotranspiration Rates:

- **Historical:** 50.20 In./Yr.
- **Seasonal:** 3.90 Inches
- **Seasonal:** 0.98 In./Week

### Plant Factors (% of Eto):

- Turf: 0.8
- Low Water Use Shrubs: 0.3
- Medium Water Use Shrubs: 0.4
- High Water Use Shrubs: 0.5
- Spray Heads: 0.70
- Rotors: 0.75
- Bubbler Heads: 0.85
- Drip Systems: 0.90

### Controller:

- A

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>0.7</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>16</td>
<td>1</td>
<td>96</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>0.7</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>16</td>
<td>1</td>
<td>289</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>0.7</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>16</td>
<td>1</td>
<td>385</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>0.7</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>16</td>
<td>1</td>
<td>64</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
<td>0.7</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>16</td>
<td>1</td>
<td>305</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
<td>0.7</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>16</td>
<td>1</td>
<td>193</td>
</tr>
<tr>
<td>7</td>
<td>28</td>
<td>0.8</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.4</td>
<td>12</td>
<td>1</td>
<td>341</td>
</tr>
<tr>
<td>8</td>
<td>13</td>
<td>0.7</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>16</td>
<td>1</td>
<td>209</td>
</tr>
<tr>
<td>9</td>
<td>23</td>
<td>0.8</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.4</td>
<td>12</td>
<td>1</td>
<td>280</td>
</tr>
<tr>
<td>10</td>
<td>16</td>
<td>0.8</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.4</td>
<td>12</td>
<td>1</td>
<td>219</td>
</tr>
<tr>
<td>11</td>
<td>18</td>
<td>0.8</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.4</td>
<td>12</td>
<td>1</td>
<td>177</td>
</tr>
<tr>
<td>12</td>
<td>11</td>
<td>0.7</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>16</td>
<td>1</td>
<td>257</td>
</tr>
<tr>
<td>13</td>
<td>16</td>
<td>0.7</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>16</td>
<td>1</td>
<td>250</td>
</tr>
<tr>
<td>14</td>
<td>25</td>
<td>0.8</td>
<td>1.00</td>
<td>0.75</td>
<td>6</td>
<td>0.3</td>
<td>21</td>
<td>1</td>
<td>520</td>
</tr>
<tr>
<td>15</td>
<td>25</td>
<td>0.8</td>
<td>1.00</td>
<td>0.75</td>
<td>6</td>
<td>0.3</td>
<td>21</td>
<td>1</td>
<td>520</td>
</tr>
<tr>
<td>16</td>
<td>19</td>
<td>0.8</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>18</td>
<td>1</td>
<td>349</td>
</tr>
<tr>
<td>17</td>
<td>5</td>
<td>0.8</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>18</td>
<td>1</td>
<td>92</td>
</tr>
<tr>
<td>18</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>19</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>21</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>22</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>23</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>24</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>25</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>26</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>27</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>28</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>29</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>31</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>32</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>33</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>34</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>35</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>36</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>37</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>38</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>39</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>40</td>
<td>0</td>
<td>0.0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Run Time Totals:

- **Run Time Totals:**  
  - Min./Wk.: 271.5472379  
  - Hrs./Wk.: 4490.83  
  - Days/Wk.: 19445.3  
  - Hours/Day: 58380.9  
  - Gal/Ssn.: 1496.94  
  - Gal/Day: 0.0046  
  - costs: 4.52810 - 2028

### Water Cost Totals:

- **Costs:**  
  - Acft./Wk.: 37.59808963  
  - Acft./Mo.: 112.8811005  
  - Acft./Ssn.: 1452.982371  
  - Acft./Day: 0.0138  
  - cost per acft.: 0.0597  
  - Cost/Ssn.: 0.1792  
  - Cost/Yr.: 0.2810 - 02810

---

**MASTER BUILDING SPECIFICATION**

IRRIGATION

02810 - 19
## Seasonal Irrigation Schedule

**Winter (Nov.-Dec.-Jan.-Feb.)**

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Hollenbeck Replacement Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firm Name:</td>
<td>EDIC</td>
</tr>
<tr>
<td>Date:</td>
<td>12/22/04</td>
</tr>
</tbody>
</table>

### Evapotranspiration Rates:

- **Historical:** 50.20 In./Yr.
- **Seasonal:** 9.50 Inches
- **Seasonal:** 0.59 In./Week

### Plant Factors (% of Eto):

<table>
<thead>
<tr>
<th></th>
<th>Turf: 0.8</th>
<th>Low Water Use Shrubs: 0.3</th>
<th>Medium Water Use Shrubs: 0.4</th>
<th>High Water Use Shrubs: 0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Historical</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seasonal</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Irrigation Efficiency (%):

- **Spray Heads:** 0.70
- **Rotors:** 0.75
- **Bubbler Heads:** 0.85
- **Drip Systems:** 0.90

### Controller: A

### Valve Number | Flow in GPM | Precip. Rate | Irr. Effic. | Irr. Cycles | Irr/Wk. Minutes | Cycles | Gallons | Run Time Totals: |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Min./Wk.</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0</td>
<td>17</td>
<td>1</td>
<td>101</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0</td>
<td>17</td>
<td>1</td>
<td>302</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0</td>
<td>17</td>
<td>1</td>
<td>402</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0</td>
<td>17</td>
<td>1</td>
<td>67</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0</td>
<td>17</td>
<td>1</td>
<td>319</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0</td>
<td>17</td>
<td>1</td>
<td>201</td>
</tr>
<tr>
<td>7</td>
<td>28</td>
<td>1.83</td>
<td>1.83</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>119</td>
</tr>
<tr>
<td>8</td>
<td>13</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0</td>
<td>17</td>
<td>1</td>
<td>218</td>
</tr>
<tr>
<td>9</td>
<td>23</td>
<td>1.83</td>
<td>1.83</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>98</td>
</tr>
<tr>
<td>10</td>
<td>16</td>
<td>1.83</td>
<td>1.83</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>68</td>
</tr>
<tr>
<td>11</td>
<td>18</td>
<td>1.83</td>
<td>1.83</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>77</td>
</tr>
<tr>
<td>12</td>
<td>11</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0</td>
<td>17</td>
<td>1</td>
<td>184</td>
</tr>
<tr>
<td>13</td>
<td>16</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0</td>
<td>17</td>
<td>1</td>
<td>268</td>
</tr>
<tr>
<td>14</td>
<td>25</td>
<td>0.8</td>
<td>1.00</td>
<td>0.75</td>
<td>6</td>
<td>38</td>
<td>2</td>
<td>950</td>
</tr>
<tr>
<td>15</td>
<td>25</td>
<td>0.8</td>
<td>1.00</td>
<td>0.75</td>
<td>6</td>
<td>38</td>
<td>2</td>
<td>950</td>
</tr>
<tr>
<td>16</td>
<td>19</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>17</td>
<td>319</td>
</tr>
<tr>
<td>17</td>
<td>5</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.3</td>
<td>17</td>
<td>184</td>
</tr>
<tr>
<td>18</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>19</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>21</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>22</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>23</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>24</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>26</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>27</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>28</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>29</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>31</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>32</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>33</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>34</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>35</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>36</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>37</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>38</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>39</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>40</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Run Time Totals:

<table>
<thead>
<tr>
<th></th>
<th>Min./Wk.</th>
<th>Hrs./Wk.</th>
<th>Days/Wk.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>277.4322789</td>
<td>4.623871315</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>1.541290438</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Run Time Totals:

<table>
<thead>
<tr>
<th></th>
<th>Gal/Wk.</th>
<th>Acft/Wk.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4726.1</td>
<td>0.0145</td>
</tr>
<tr>
<td></td>
<td>20464</td>
<td>0.0628</td>
</tr>
<tr>
<td></td>
<td>61439.3</td>
<td>0.1886</td>
</tr>
</tbody>
</table>

### Water Cost Totals:

<table>
<thead>
<tr>
<th></th>
<th>$</th>
<th>Cost/Acft.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>630.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>39.56775454</td>
<td></td>
</tr>
<tr>
<td></td>
<td>118.7946441</td>
<td></td>
</tr>
<tr>
<td></td>
<td>627.7359088</td>
<td></td>
</tr>
</tbody>
</table>

---

**MASTER BUILDING SPECIFICATION**

**IRRIGATION**

02810 - 20
Seasonal Irrigation Schedule

<table>
<thead>
<tr>
<th>Water Meter Number: 1</th>
<th>Reclaimed/Potable: P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Name:</strong> Hollenbeck Replacement Station</td>
<td></td>
</tr>
<tr>
<td><strong>Firm Name:</strong> EDIC</td>
<td></td>
</tr>
<tr>
<td><strong>Date:</strong> 12/22/04</td>
<td></td>
</tr>
</tbody>
</table>

**Evapotranspiration Rates:**

- **Historical:** 50.20 In./Yr.
- **Seasonal:** 8.00 Inches
- **Seasonal:** 1.00 In./Week

**Plant Factors (% of Eto):**

- Turf: 0.8
- Low Water Use Shrubs: 0.3
- Medium Water Use Shrubs: 0.4
- High Water Use Shrubs: 0.5

**Irr. Efficiency%:**

- Spray Heads: 0.70
- Rotors: 0.75
- Bubbler Heads: 0.85
- Drip Systems: 0.90

**Controller:** A

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>0.40</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.5</td>
<td>28</td>
<td>1</td>
<td>169</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>0.40</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.5</td>
<td>28</td>
<td>1</td>
<td>508</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>0.40</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.5</td>
<td>28</td>
<td>1</td>
<td>678</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>0.40</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.5</td>
<td>28</td>
<td>1</td>
<td>113</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
<td>0.40</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.5</td>
<td>28</td>
<td>1</td>
<td>536</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
<td>0.40</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.5</td>
<td>28</td>
<td>1</td>
<td>339</td>
</tr>
<tr>
<td>7</td>
<td>28</td>
<td>0.40</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.6</td>
<td>19</td>
<td>1</td>
<td>525</td>
</tr>
<tr>
<td>8</td>
<td>13</td>
<td>0.40</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.5</td>
<td>28</td>
<td>1</td>
<td>367</td>
</tr>
<tr>
<td>9</td>
<td>23</td>
<td>0.40</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.6</td>
<td>19</td>
<td>1</td>
<td>431</td>
</tr>
<tr>
<td>10</td>
<td>16</td>
<td>0.40</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.6</td>
<td>19</td>
<td>1</td>
<td>300</td>
</tr>
<tr>
<td>11</td>
<td>18</td>
<td>0.40</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.6</td>
<td>19</td>
<td>1</td>
<td>337</td>
</tr>
<tr>
<td>12</td>
<td>11</td>
<td>0.40</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.5</td>
<td>28</td>
<td>1</td>
<td>311</td>
</tr>
<tr>
<td>13</td>
<td>16</td>
<td>0.40</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.5</td>
<td>28</td>
<td>1</td>
<td>452</td>
</tr>
<tr>
<td>14</td>
<td>25</td>
<td>0.80</td>
<td>1.00</td>
<td>0.75</td>
<td>6</td>
<td>1.1</td>
<td>64</td>
<td>3</td>
<td>1600</td>
</tr>
<tr>
<td>15</td>
<td>25</td>
<td>0.80</td>
<td>1.00</td>
<td>0.75</td>
<td>6</td>
<td>1.1</td>
<td>64</td>
<td>3</td>
<td>1600</td>
</tr>
<tr>
<td>16</td>
<td>19</td>
<td>0.40</td>
<td>1.83</td>
<td>0.85</td>
<td>3</td>
<td>0.5</td>
<td>15</td>
<td>1</td>
<td>293</td>
</tr>
<tr>
<td>17</td>
<td>5</td>
<td>0.40</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.5</td>
<td>28</td>
<td>1</td>
<td>141</td>
</tr>
<tr>
<td>18</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>19</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>21</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>22</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>23</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>24</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>25</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>26</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>27</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>28</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>29</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>31</td>
<td>0</td>
<td>0.80</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>32</td>
<td>0</td>
<td>0.80</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>33</td>
<td>0</td>
<td>0.80</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>34</td>
<td>0</td>
<td>0.80</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>35</td>
<td>0</td>
<td>0.80</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>36</td>
<td>0</td>
<td>0.80</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>37</td>
<td>0</td>
<td>0.80</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>38</td>
<td>0</td>
<td>0.80</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>39</td>
<td>0</td>
<td>0.80</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>40</td>
<td>0</td>
<td>0.80</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Run Time Totals:**

- **Run Time Totals:**
  - Min/Wk. 500.7235156
  - Hrs/Wk. 8.345391927
  - Days/Wk. 4
  - Hrs/Day 2.086347982

**Water Cost Totals:**

- **Water Cost Totals:**
  - Cost/Acft. $630.00
  - Cost/Mo. 72,836,123.28
  - Cost/Ssn. 218,675,682.8
  - Cost/Yr. 137,195,556.2

**Run Time Totals:**

- **Run Time Totals:**
  - Gal/Wk. 8699.78
  - Gal/Mo. 37,670
  - Gal/Ssn. 113,097
  - Gal/Day 2174.94

**Run Time Totals:**

- **Run Time Totals:**
  - Actf./Wk. 0.0287
  - Actf./Mo. 0.1156
  - Actf./Ssn. 0.3471
  - Actf./Day 0.0067

**Run Time Totals:**

- **Run Time Totals:**
  - Actf./Wk. 0.0287
  - Actf./Mo. 0.1156
  - Actf./Ssn. 0.3471
  - Actf./Day 0.0067
**Seasonal Irrigation Schedule**  
**Summer (May-June-July-Aug.-Sept.)**

**Project Name:** Hollenbeck Replacement Station  
**Firm Name:** EDIC  
**Water Meter Number:** 1  
**Date:** 12/22/04  
**Reclaimed/Potable:** P

### Evapotranspiration Rates:
- **Historical:** 50.20 In./Yr.
- **Seasonal:** 28.40 Inches
- **Seasonal:** 1.42 In./Week

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.7</td>
<td>40</td>
</tr>
<tr>
<td>18</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.7</td>
<td>40</td>
</tr>
<tr>
<td>24</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.7</td>
<td>40</td>
</tr>
<tr>
<td>4</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.7</td>
<td>40</td>
</tr>
<tr>
<td>19</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.7</td>
<td>40</td>
</tr>
<tr>
<td>12</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.7</td>
<td>40</td>
</tr>
<tr>
<td>28</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>13</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>16</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>19</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>22</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>23</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>25</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>26</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>27</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>28</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>29</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>30</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>31</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>32</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>33</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>34</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>35</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>36</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>37</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>38</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>39</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
<tr>
<td>40</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.8</td>
<td>27</td>
</tr>
</tbody>
</table>

**Run Time Totals:**  
- **729.2121559** Min./Wk.  
- **12.15353593** Hrs./Wk.  
- **1.736219419** Hrs./Day

**Run Time Totals:**  
- **12699.2** Gal/Wk.  
- **54987.5** Gal/Mo.  
- **165090** Gal/Ssn.

**Water Cost Totals:**  
- **$ 630.00** Cost/Acft.  
- **106.3199723** Cost/Mo.  
- **319.2054595** Cost/Ssn.  
- **564.2293685** Cost/Yr.
## Seasonal Irrigation Schedule

**Fall (Oct.)**

<table>
<thead>
<tr>
<th>Project Name:</th>
<th>Hollenbeck Replacement Station</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Meter Number:</td>
<td>1</td>
</tr>
<tr>
<td>Firm Name:</td>
<td>EDIC</td>
</tr>
<tr>
<td>Reclaimed/Potable:</td>
<td>P</td>
</tr>
<tr>
<td>Date:</td>
<td>12/22/04</td>
</tr>
</tbody>
</table>

### Evapotranspiration Rates:

- **Historical:** 50.20 In./Yr.
- **Seasonal:** 3.90 Inches
- **Seasonal:** 0.98 In./Week

<table>
<thead>
<tr>
<th>Plant Factors (% of Eto):</th>
<th>Irr. Efficiency%:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turf: 0.8</td>
<td>Spray Heads: 0.70</td>
</tr>
<tr>
<td>Low Water Use Shrubs: 0.3</td>
<td>Rotors: 0.75</td>
</tr>
<tr>
<td>Medium Water Use Shrubs: 0.4</td>
<td>Bubbler Heads: 0.85</td>
</tr>
<tr>
<td>High Water Use Shrubs: 0.5</td>
<td>Drip Systems: 0.90</td>
</tr>
</tbody>
</table>

### Controller: A

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>6</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.2</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>18</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.2</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.2</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.2</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>19</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.2</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>12</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.2</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>28</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.2</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>13</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.2</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>23</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.2</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>16</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.2</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>18</td>
<td>0.4</td>
<td>1.83</td>
<td>0.70</td>
<td>3</td>
<td>0.2</td>
<td>6</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>11</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.2</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>16</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.2</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td>25</td>
<td>0.8</td>
<td>1.00</td>
<td>0.75</td>
<td>6</td>
<td>0.3</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>25</td>
<td>0.8</td>
<td>1.00</td>
<td>0.75</td>
<td>6</td>
<td>0.3</td>
<td>21</td>
<td>1</td>
</tr>
<tr>
<td>16</td>
<td>19</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.2</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>17</td>
<td>5</td>
<td>0.4</td>
<td>1.00</td>
<td>0.85</td>
<td>6</td>
<td>0.2</td>
<td>9</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>19</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>20</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>21</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>22</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>23</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>24</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>25</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>26</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>27</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>28</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>29</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>30</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>31</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>32</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>33</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>34</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>35</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>36</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>37</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>38</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>39</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>40</td>
<td>0</td>
<td>0</td>
<td>0.00</td>
<td>0.00</td>
<td>0</td>
<td>0.0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

### Run Time Totals:

- **Min./Wk.:** 166,897,1484
- **Gal/Wk.:** 2906.51
- **Actf./Wk.:** 0.0089
- **Gal/Mo.:** 12585.2
- **Actf./Mo.:** 0.0386
- **Gal/Ssn.:** 37784.6
- **Actf./Ssn.:** 0.116
- **Gal/Yr.:** 968,835
- **Actf./Yr.:** 0.003

### Water Cost Totals:

- **$630.00**
- **Cost/Acft.: 24.33379647**
- **Cost/Mo.: 73.05758755**
- **Cost/Ssn.: 0.92720638**
- **Cost/Yr.: 940.3822808**

---

**MASTER BUILDING SPECIFICATION**

**IRRIGATION**

02810 - 23
SECTION 02824
ORNAMENTAL ALUMINUM BI-PARTING GATES

PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install ornamental aluminum bi-parting gates, with pickets, as indicated on the drawings and specified.

B. Provide gates complete operating assemblies including gate operators, guides, motors, hardware, and installation accessories.

C. Field painting is specified in Section 09900.

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330.

A. Manufacturer's Catalog Data: Submit data in sufficient detail to show that proposed materials meet specified requirements.

1. Provide templates for cane sleeves, anchor bolts and other items encased in concrete in sufficient time so as not to delay the work.

B. Shop Drawings

1. Indicate profiles, sizes, connection attachments, hardware, anchorage, size and type of fasteners, and accessories.

2. Include erection drawings, elevations, and details where applicable.


C. Welders' Certificates: Submit statements certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

D. Manufacturer's Instructions: Manufacturer's printed instructions installation of components and assemblies.

E. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures.

PART 2 PRODUCTS

2.1 ORNAMENTAL ALUMINUM BI-PARTING GATES

A. Subject to compliance with specified requirements, the aluminum overhead slide gates shall be a Fortress Gate as manufactured by Tymetal Corp., or equal.
B. The gate frames shall be fabricated from 6063-T6 aluminum alloy extrusions. The top member shall be a 3” x 5” aluminum structural channel/tube weighing not less than 3.9 lb/lf. The bottom member shall be a 2” x 5” aluminum structural tube weighing not less than 2.0 lb/lf. The outside vertical members shall be “P” shaped in cross section weighing not less than 1.6 lb/lf. Intermediate vertical members shall alternate between 2” x 2” and 1” x 2” in cross section weighing not less than 1.1 lb/lf and .82 lb/lf respectively. Intermediates shall be spaced at a maximum of 3’ centers.

C. Diagonal “X” bracing of 3/16” minimum diameter stainless steel aircraft cable shall be installed throughout the gate to ensure squareness of the gate frame.

D. The separate semi-enclosed overhead track, extruded from 6105-T5 aluminum alloy, shall weigh a minimum of 2.7 lb/lf. Aluminum overhead track shall be bolted to the overhead aluminum angle or “W” beam by means of ½” diameter bolts at intervals not exceeding two ft.

E. The gate frame is to be supported from the overhead track by a minimum of two swivel type, self-aligning, 4-wheeled, sealed lubricant, ball-bearing truck assemblies. The bottom of each center support post shall be equipped with a 3” guide wheel.

F. Filler shall be 1” x 1” square aluminum pickets not weighing less than .25lb/lf. Pickets to be spaced 4” o.c. Pickets shall be internal, not extend above the top primary or below the bottom primary.

G. Finish shall be finish aluminum, color coated with polyester powder primed and painted. Prior to coating the gate, support posts, and all accessories shall be pretreated chemically by sandblasting or other acceptable methods to ensure proper coating adhesion. Color shall be as selected by Architect from manufacturer’s standard colors.

PART 3   EXECUTION

3.1    PREPARATION

A. Anchorage devices, anchor bolts, and items having integral anchors which are to be embedded in cast-in-place concrete shall be delivered in time to be installed before the start of concrete operations.

B. Aluminum bi-parting gates shall be hung from three sets of 4” O.D. galvanized steel posts. A 3” x 3” x 3/16” steel angel shall be welded between them to support the “I” or “W” beam. The “I” or “W” beams shall extend for a distance approximately twice the width of the gate.

C. Excavate and place footing as detailed. Install track hanger brackets and guide roller assemblies. Insert truck assemblies into the track and attach gate frame to hanger bolt. Make final adjustments to line up and level gate frame to align gate with latch. Install equipment of this section in accordance with the printed instructions.

3.2    INSTALLATION

A. Install fencing, gates and operating hardware as recommended by the manufacturer. Properly hang or set gates in plumb and level position for full opening without interference. Adjust the hardware for smooth and trouble-free operation.

B. Anchors shall be provided for securing frames into adjoining concrete, or masonry construction.
C. Fasteners, anchoring devices, finish hardware, accessories, field bracing, and other components shall be provided as required for a complete installation.

D. Gates shall operate freely without excessive looseness.

E. Upon completion of installation including work by other trades, lubricate, test and adjust gate to operate easily, free from warp, twist or distortion. Test the radio operation from a distance of approximately 50 feet.

END OF SECTION
SECTION 02826
ORNAMENTAL ALUMINUM SWING GATES

PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install ornamental aluminum swing gates, with pickets, as indicated on the drawings and specified.

B. Provide complete operating assemblies including gate operators, guides, motors, hardware, and installation accessories.

C. Field painting is specified in Section 09900.

1.2 SUBMITTALS

The following shall be submitted in accordance with Section 01330.

A. Manufacturer's Catalog Data: Submit data in sufficient detail to show that proposed materials meet specified requirements.

1. Provide templates for cane sleeves, anchor bolts and other items encased in concrete in sufficient time so as not to delay the work.

B. Shop Drawings

1. Indicate profiles, sizes, connection attachments, hardware, anchorage, size and type of fasteners, and accessories.

2. Include erection drawings, elevations, and details where applicable.


C. Welders' Certificates: Submit statements certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

D. Manufacturer's Instructions: Manufacturer's printed instructions installation of components and assemblies.

E. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures.

PART 2 PRODUCTS

2.1 ORNAMENTAL ALUMINUM SWING GATES

A. Subject to compliance with specified requirements ornamental aluminum swing gates shall be Fortress gates as manufactured by Tymetal Corp., or equal.
B. The gate frames shall be fabricated from 6063-T6 aluminum alloy extrusions. The top member shall be a 3”x5” aluminum structural channel/tube weighing not less than 3.9 lb/lf. The bottom member shall be a 2” x 5” aluminum structural tube weighing not less than 2.0 lb/lf. The outside vertical members shall be “P” shaped in cross section weighing not less than 1.6 lb/lf. Intermediate vertical members shall alternate between 2” x 2” and 1” x 2” in cross section weighing not less than 1.1 lb/lf and 0.82 lb/lf respectively. Intermediates shall be spaced at a maximum of 3’ centers.

C. Diagonal “X” bracing of 3/16” minimum diameter stainless steel aircraft cable shall be installed throughout the gate to provide additional vertical adjustment.

D. Each gate leaf shall be provided with a minimum of two pivoting hinges to allow proper operation, and shall be connected to the gate side of the hinge by means of two through-bolts.

E. Gate hanger posts shall be sized in accordance with gate dimensions as specified by the manufacturer. Height of the post and depth of footing shall be as required to support the gate.

F. Double gates shall have a drop-bar mechanism extending into the ground, and a center locking kit to provide a means for locking with a padlock.

G. The gate shall be completed by installation of approved filler. Filler shall be 1” x 1” square aluminum pickets not weighing less than 0.25 lb/lf. Pickets to be spaced 4” o.c. Pickets shall be internal, not extend above the top primary or below the bottom primary. The filler shall extend the entire length of the gate and shall be secured at the ends by standard fence industry tension bars and tied with standard fence industry tied at each vertical member.

H. Finish shall be finish aluminum, color coated with polyester powder primed and painted. Prior to coating the gate, support posts, and all accessories shall be pretreated chemically by sandblasting or other acceptable methods to ensure proper coating adhesion. Color shall be as selected by Architect from manufacturer’s standard colors.

PART 3 EXECUTION

3.1 PREPARATION

A. Anchorage devices, anchor bolts, and items having integral anchors which are to be embedded in cast-in-place concrete shall be delivered in time to be installed before the start of concrete operations.

B. Excavate, place concrete and install specified sized posts as detailed, and in accordance with approved shop drawings. Install hinges on gate frame and gate posts. Make final adjustments to maintain alignment of gate leaves. Install equipment of this section in accordance with the manufacturer’s printed instruction.

3.2 INSTALLATION

A. Install fencing, gates and operating hardware as recommended by the manufacturer. Properly hang or set gate(s) in plumb and level position for full opening without interference. Adjust the hardware for smooth and trouble-free operation.

B. The gate and installation shall conform to ASTM F-900-94 standards for aluminum swing gates.
C. Fasteners, anchoring devices, finish hardware, accessories, field bracing, and other components shall be provided as required for a complete installation.

D. Gates shall operate freely without excessive looseness.

E. Upon completion of installation including work by other trades, lubricate, test and adjust gate to operate easily, free from warp, twist or distortion. Test the radio operation from a distance of approximately 50 feet.

END OF SECTION
SECTION 02831
CHAIN LINK FENCES AND GATES

PART 1 - GENERAL

1.1 SUMMARY
A. Chain link fence
B. Swinging gates.
C. Supplementary parts and components, such as slat inserts, clips, bracing, anchors, fasteners and other miscellaneous supports required for a complete installation.

1.2 SUBMITTALS
A. Shop drawings: Submit shop drawings showing the fence layout, footings, gate details and typical elevations in accordance with Drawings.
B. Samples:
   1. Fence fabric: 12 in. square.

1.3 QUALITY ASSURANCE
A. Applicable provisions of the Chain Link Fence Manufacturers Institute (CLFMI) standards govern the work of this Section.
B. This requirement does not limit manufacture of the fencing components to CLFMI members.

1.4 HANDLING
A. Handle and store components to avoid damaging the finish. Store off the ground in a protected location.

PART 2 - PRODUCTS

2.1 MATERIALS
A. Structural and roll-formed shapes: ASTM A 36.
B. Tubular members: ASTM A 120, Schedule 40 for weight and coating.
C. Chain link fabric: Complying with CLFMI standards, one piece width, 2 in. mesh, 9 gage.
D. Accessories:
   1. Accessories, except for tie wires, shall be galvanized to comply with ASTM A 153, except that the coating weight may comply with the requirements of CLFMI standards for coating thickness.
   2. Tension wire: 7 gage high strength steel wire.
3. Stretcher bars: One piece length equal to full height of fabric with a minimum cross section of 3/16 in. x 3/4 in. Provide one stretcher bar for each gate and end post, and 2 for each corner and pull post.

4. Stretcher bar bands: Heavy pressed steel to secure stretcher bars to intermediate, corner and gate posts.

5. Post tops: Steel or malleable iron designed as a weathertight closure cap. Design caps with opening to permit passage of the top rail, when rail is provided.

6. Wire ties: For tying fabric to line posts, use 11 gage steel wire clips spaced 14 in. o.c. For tying fabric to tension wire use 11 gage hog rings spaced at 24 in. o.c.

2.2 GATES

A. Fabricate gate frames of steel tubes as indicated. Provide additional horizontal and diagonal members to insure that gates stay square and operate properly, and for attachment of fabric, hardware and accessories.

B. Assemble gate frames by welding mitered corners on all four sides.


2. Tie fabric to top and bottom edges. Attach stretcher bars to gate frame at not more than 15 in. o.c.

3. Attach hardware with rivets or by other means which will provide security against removal and breakage.

4. Install other materials by welding as shown on drawings.

C. Gate Hardware: Provide following for each gate:

1. Swinging Gate: Provide hinges and hasp for padlock.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify conditions and measurements affecting the work of this Section at site. Make sure that detrimental conditions are corrected before proceeding with installation.

3.2 INSTALLATION

A. General: Comply with ASTM F 567 and the following.

B. Posts: Provide corner, end, and intermediate posts. Erect posts plumb and level, in straight alignment, and set in concrete footings. Support and brace until concrete sets.

C. Post cap: Provide on each post.

D. Tension wire: Install before stretching fabric and tie to each posts with ties or clips.
E. Bracing: Brace gates, corner, end, and pull posts to the nearest post with a horizontal brace used as a compression member and a diagonal truss rod and truss tightener used as a tension member.

F. Top, bottom and intermediate rail: Install before installing fabric. Pass top rail through intermediate post caps. Provide expansion coupling spaced at no more than 20 ft. o.c.

G. Tension wire: Install before installing fabric. Pull wire taut and anchor securely to the posts.

H. Fabric:
   1. Install fabric within 2 in. of grade or paving on security side of fencing and anchor to framework so that fabric remains in tension after pulling force is released.
   2. Pull taut and tie to posts, rails, and tension wire.
   3. Attach to rails and tension wires. Attach to posts with stretcher bars as specified below.

I. Stretcher bars: Thread through fabric and secure to posts with steel bands.

J. Gates: Install plumb, level, square, free of rack and secure for full opening without interference. Adjust hardware for smooth operation.

END OF SECTION
SECTION 02836
SLIDING GATES AND OPERATORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Sliding gate assembly consisting of, but not limited to, the following:
      2. Steel gates.
      3. Operating hardware.
      4. Electric operator.
      5. Control system.
      6. Embedded loops and vehicle detectors.
      7. Supplementary parts and components, such as clips, fasteners, supplementary framing, and other miscellaneous accessories required for a complete installation.

B. Related work:
   1. Division 5 for metal fabrications.
   2. Division 7 for sealants.
   3. Division 9 for finish painting gate assembly.
   4. Sections 13700 and 13720 for interface to security system.
   5. Division 16 for electrical power to electric operator control box, and conduit from electric operator to control unit.

1.2 REFERENCES

A. Vehicle gate operators shall be manufactured to UL requirements and shall be listed as an approved product by the UL testing laboratory. All vehicle gate operators shall be furnished with UL labels.

1.3 SUBMITTAL

A. Procedure: In accordance with Division One.

B. Product Data:
   1. Provide manufacturer’s catalog cuts with printed specifications and installation instructions.
   2. Furnish detailed sequence of operation (description of system).
   3. Provide 4 copies of operation and maintenance data covering the installed products, to the City Engineer. Including name, address and telephone number of the nearest fully equipped service center.

C. Shop Drawings:
   1. Supply shop drawings showing the relationship of operating systems with other work. Include details of all major components. Include parts list showing manufacturer’s names and part numbers for the complete installation.
   2. Include complete details of gate construction, gate height, post spacing dimensions and unit weights of structural components.
1.4 QUALITY ASSURANCE
A. Manufacturer’s supervision: Manufacturer authorized representative must supervise installation of the gates and submit a written report at completion of installation stating that installations were made in compliance with the equipment manufacturer’s instructions.
B. Installer’s qualifications: Firm approved by the equipment manufacturer and who has completed at least 5 installations similar in material, design, and extent to that indicated for Project which have resulted in installations with a record of successful in-service performance, for the 3 years preceding proposed installation on the Project.
C. Regulatory requirements: Electronic and electrical components of gate assembly must be UL listed and labeled.

PART 2 - PRODUCTS
2.1 MANUFACTURER
A. Fortress Cantilever Slide Gate System as manufactured by Tymetal Corp., (800) 328-4283 or equal.
B. Manufacturer shall submit test results stating that the gate panel and operator have been tested as a system for 200,000 cycles.

2.2 SYSTEM DIMENSIONS
A. Gate opening dimensions shown on the Drawings.

2.3 SYSTEM FUNCTION
A. General Description:
   1. System shall be designed to operate cantilever sliding gates. See Drawings for gate panel filler.
B. Operation:
   1. System shall be designed so that gate movement from the closed position is impossible except by electric or mechanical means.
C. Variable Speed-Rate of Travel:
   1. The 225 VS gate operator shall have the ability to achieve a maximum gate speed of 2.2 feet per second, and shall be equipped with soft-start and soft-stop function to prevent shock load to the gate panel and operator.

2.4 MOTOR
A. Motor Size: The electrical motor shall be 1 HP with the voltage and characteristics shown on the Drawings.
B. AC Drive: The variable frequency drive unit shall allow for programmable speeds and programmable soft-start and soft-stop features.
C. Overload Protection: Motors shall be protected against overload by either a thermal or a current sensing overload device.
D. Gear (Box) Reducer:
   1. The self-enclosed gear-head gearbox shall be manufactured as a single unit, and shall consist of a hardened steel, machine cut worm and mating bronze gear running in oil bath. Oil shall be a #634 specialty oil with a fluid pour point of –44 degrees F. The gearbox shall perform the following functions:
      a. Adjustable Clutching Device.
      b. Manual disconnect by crank handle.
E. Gear Box Heater: A 110 VAC electrical service shall provide power to the thermostat controlling the internal gearbox heater.

F. Drive – Chain: A #50 roller chain shall be utilized. All chain brackets and required attachment hardware shall be supplied.

G. Manual Operation:
   1. A crank handle, located in the motor box at ground level, shall provide a two-step emergency procedure for manual operation:
      a. Unlock and open motor-box door.
      b. Fold out handle and crank gate opened or closed.

H. Limits: The operator shall be equipped with an integral limit system, providing accurate settings to control the open and close positions of the gate, and shall not be affected by manual operation or motor removal.

I. Control Circuit: U.L. listed operator to include 24 VAC controls.

J. Control wiring: The electrical contractor shall supply all exterior control wiring.

K. Audio Alarm:
   1. This alarm shall have a dual function.
      a. The first function shall be as a warning prior to gate movement. When the motor control board recognizes a command, this alarm shall be activated 3 seconds before the motor is energized and the gate begins to move. This shall be continuously activated while the gate is in motion.
      b. The second function shall be as an entrapment notification alarm (for UL Class III). This alarm shall sound as a result of a second activation of the external primary entrapment prevention device before an end limit (open or close) is reached. The pulsing rate of the alarm in the entrapment notification mode shall be faster than the pulsing rate when in the warning mode prior to gate movement.

L. Main Power Disconnect Switch and Wiring Compartment: When this switch is in the OFF position, the main power shall be disconnected from the Variable Speed Drive, Motor Control Board and power transformers.

M. Speed: The gate operator speed shall be fully programmable from minimum/maximum of 1 foot to 2.2 feet per second.

N. Transformer: Operators shall have a 75 VAC transformer to provide Class II power.

O. Auto Close Timer: Adjustable from 2 to 60 seconds, the timer provides an automatic closure of the gate from the full open position.

2.5 MOTOR HOUSING

A. Water Resistant Motor Box: Shall be constructed of 10-gauge sheet steel, hot-dip galvanized per ASTM 123, gasketed and located at ground level for easy maintenance.

B. Security Hinges and Tamper Resistant Security Screws: Shall be furnished to secure operator enclosure components and as specified in Section 05560.

C. Motor Box Lock: Motor box shall be locked with a prison dead bolt. Provide 3 paracentric keys per key code.

2.6 STRUCTURAL SLIDING GATE PANEL

A. Gate Frame: The gate frame shall be fabricated from 6063-T6 aluminum alloy extrusions. The top member is a 3” x 5” aluminum structural channel/tube weighing not less than 3.0 lb/lf. This is also referred to as a “large primary”. This member shall be “keyed” to interlock with the
“keyed” track member. If fabricated as a single horizontal piece, the bottom member shall be a 2” x 5” aluminum structural tube weighing not less than 2.0 lb/lf. If fabricated in two horizontal pieces, the bottom member shall be a 5” aluminum structural channel weighing not less than 2.65 lb/lf. The two horizontal pieces or sections shall be spliced in the field. The vertical members at the ends of the opening portion of the frame shall be “P” shaped in cross sections with a normal base dimension of no less than 2” x 2” and weighing not less than 1.6 lb/lf. The intermediate vertical members shall alternate between 2” x 2” and 1” x 2” in cross section weighing not less than 1.1 lb/lf and 0.82 lb/lf respectively. The spacing for the vertical intermediates shall be less than 50% of the gate frame height.

B. Fabrication: The gate frame shall be fabricated in one or multiple sections depending on size requirements or constraints.

C. Gate Track: The gate shall have 2 separate semi-enclosed “keyed” tracks, extruded from 6105-T5 aluminum alloy weighing not less than 2.9 lb/lf. Track members to be located on each side of the top member. When interlocked and welded to the “keyed” top member, it forms a composite structure with the top of the gate frame. Welds to be placed alternately alone the top and side of the track at 9” centers with welds being a minimum of 2”.

D. Gate Trucks: The gate frame is to be supported from the tracks by four, swivel-type, self-aligning, 4-wheeled, sealed lubricant ball-bearing truck assemblies. These are to be attached to double 4” O.D. support posts, the bottom of which shall be equipped with two pairs of 3” rubber guide wheels.

E. Diagonal Bracing: Diagonal “X” bracing of 3/16” minimum diameter stainless steel aircraft cable shall be installed to brace the gate panels and to provide a ready means of vertical adjustment.

F. Posts: Double set of support posts shall be 4” OD galvanized steel with concrete footings as specified by the gate Contractor.

G. Gate Filler: Louvered, the gates will have angle installed as louvers as detailed on the drawings.

H. Gate Finish: Gate to be mill finish aluminum.

I. Gate Lock: Gate system shall be furnished with an electro-mechanical lock. Lock shall be supplied with status indication and with a five tumbler mechanical lock. All gates shall be keyed alike. Lock to be supplied by gate manufacturer.

2.7 CONTROLS

A. UL Class III installations (Non-Supervised– Automatic Gate system)
   1. For Class III installations, an external primary entrapment protection system must be installed for both close and open gate directions. When this equipment is installed, momentary contact on the pushbutton control will start or stop gate movement. The built-in auto-close timer may be used to automatically close the gate from a full open position after a user-defined interval (from 2-60 seconds).

B. Two Albano IR-55 Photo-beams are provided with the operator as devices to provide primary entrapment protection under the UL 325 guidelines. The inclusion of these photo-beams does not alleviate the contractor from the responsibility of identifying and providing protection from safety hazards under UL 325 standards for Class III operation. The secondary entrapment protection device shall be the inherent audio alarm.

C. It will be up to the installing contractor to ensure that the external primary entrapment safety devices (contact / non-contact or some combination of) be installed for the specific site conditions.

2.8 CONTROLS FOR ELECTRICALLY, NON-SUPERVISED, CANTILEVER SLIDING GATES

A. Controls to Enter Facility: Card access reader, coordinate with Sections 13700 and 13720.
B. Controls to Exit Facility: Reversing device (Loop Detector), Model PEEK 625X, to detect the presence of transit of a vehicle over an embedded loop of wire. The loop of wire shall produce a magnetic field which is charged by the presence of a vehicle. The vehicle detector shall detect the change in the inductance and generate an electrical signal to operate the control equipment.

C. Roadway sealant: One-part moisture curing, flexible, self-leveling and non-shrink sealant specifically designed for traffic control loops and wiring, Gold Label 1P Loop Sealant by Chemrex or equal.

PART 3 - EXECUTION

3.1 INSPECTION

A. Final Grades and Installation Conditions:
   1. Final grades and installation conditions shall be examined. Work shall not begin until all unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Equipment: Equipment in this section shall be installed in strict accordance with the manufacturer’s printed instructions unless otherwise shown on the Drawings.

3.3 SYSTEMS TEST

A. Adjustment: The complete system shall be adjusted to assure it is performing properly.

B. Preliminary Test: The system shall be operated for a period of time long enough to determine that the system is in suitable condition.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes appurtenances for parking areas as follows:

1. Pavement-marking paint.
2. Recycled plastic wheel stops.

B. Related Sections include the following:

1. Division 1 Section "Environmental Procedures" for procedures for achieving an environmentally conscious Work Product.
2. Division 1 Section "LEED Quality Control" for additional LEED requirements.

1.03 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Samples: For each type of manufactured material and product indicated.

C. Qualification Data: For manufacturer.

D. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance with requirements indicated, based on comprehensive testing of current materials:

E. LEED Submittals, Credit MR 4.2: Product Data indicating percentages by weight of postconsumer and preconsumer recycled content for products having recycled content.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Manufacturer of precast concrete wheel stop products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. Testing Agency Qualifications: An independent agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548.
1.05 PROJECT CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Epoxy-Coated Reinforcing Bars: ASTM A 775/A 775M or ASTM A 934/A 934M; with ASTM A 615/A 615M, Grade 60 (Grade 420) deformed bars.

B. Epoxy Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and of grade to requirements. Types IV and V, load bearing, for bonding plastic to hardened concrete.

2.02 PAVEMENT MARKINGS

A. Pavement-Marking Paint: Latex, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, with drying time of less than 45 minutes. Color: White.

2.03 WHEEL STOPS

A. Wheel Stops: Plastic units conforming to the following:

1. Available Manufacturers: Subject to conformance with requirements, Manufacturers offering products that may be incorporated into the Work include the following:
   b. Vortex Composites, “BetterStop.”

2. Material: 100% recycled, post-consumer, commingled plastic waste.
3. Length: 48 inches.
5. Location: As indicated on Drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine exposed surfaces for compliance with requirements for dimensional and elevation tolerances. Proceed with appurtenances installation only after nonconforming conditions have been corrected and surface is ready to receive appurtenances.
3.02 PAVEMENT MARKING

A. Do not apply pavement-marking paint until layout, colors, and placement have been verified with Construction Manager.

B. Allow pavement to cure for 28 days and be dry before starting pavement marking.

C. Sweep and clean surface to eliminate loose material and dust.

D. Apply paint with mechanical equipment to produce pavement markings of dimensions indicated with uniform, straight edges. Apply at manufacturer's recommended rates to provide a minimum wet film thickness of 15 mils. Conform to pattern layouts indicated, including pavement accessibility symbol.

3.03 WHEEL STOPS

A. Securely attach wheel stops to substrate with metal dowels and bonding adhesive as recommended by manufacturer. Remove excess adhesive from substrate at perimeter of stop.

3.04 REPAIRS AND PROTECTION

A. Remove and replace appurtenances that are broken, damaged, or defective or that do not comply with requirements in this Section.

B. Protect appurtenances from damage. Exclude traffic from areas of pavement marking for at least 7 days after placement. When construction traffic is permitted, maintain parking areas as clean as possible by removing surface stains and spillage of materials as they occur.

C. Maintain appurtenances free of stains, discoloration, dirt, and other foreign material. Sweep parking areas not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION
SECTION 02847
DECOMPOSED GRANITE PATHS

PART 1   GENERAL

1.1    SUMMARY

A. Furnish and install decomposed paths as indicated on the drawings and specified.

1.2    SAMPLES

A. Provide one pound sample in a clear plastic bag.

PART 2   PRODUCTS

2.1    DECOMPOSED GRANITE

A. Decomposed granite shall be Paving Grade, and shall conform to Section 400-2.3 of SSPWC. Material supplied shall match the sample approved by the Architect.

B. Color shall be determined by the Architect.

PART 3   EXECUTION

3.1    INSTALLATION

A. Apply a weed killer to the subgrade before installing the decomposed granite.

B. The underlying subgrade shall be cleaned of all foreign substances. Ruts or soft yielding spots in the underlying subgrade areas having inadequate compaction shall be corrected by loosening unsatisfactory material and reshaping to line and grade and recompacting. The completed underlying course shall not be disturbed by traffic or other operations and shall be maintained by the Contractor in a satisfactory condition.

C. Spread, level, moisten, and compact decomposed granite to a finished thickness of not less than 3.5 inches, using vibrating rollers or tampers, or other approved mechanical means. Continue cutting or filling, watering and rolling until the surface is hard and true to grade and cross section; until it is firm and ceases to creep in front of roller and the compaction is at least 90 percent.

D. The surface shall not show any deviations in excess of 3/8 inch when tested with a 10-foot straightedge applied both parallel with and at right angles to the centerline of the area paved. Deviations exceeding this amount shall be corrected by the Contractor by removing material, replacing with new material, or reworking existing material and compacting, as directed.

E. The aggregate surface course shall be maintained in a condition that will meet all specification requirements until accepted.

END OF SECTION
PART 1   GENERAL

1.1 SUMMARY
A. Furnish and install precast concrete fencing as indicated on the drawings and specified.

1.2 SUBMITTALS
A. Mix Design: Submit a concrete mix design for each mix that will be used on the job. Include water cement ratio, size of coarse aggregate and dosage of any admixture.
   1. Predict minimum compressive strength, maximum slump and air content percentage.
B. Shop Drawings: Show sizes and spacings of reinforcing steel. Include illustrations of the steel gate system.
C. Submit samples of finished colored and textured surfaces for approval.
D. The manufacturer of concrete shall deliver to the Architect a certificate of compliance. The certificate shall bear the signature of the representative of the Testing Laboratory, and shall state the quantity of cement, water, fine and coarse aggregate, and admixture, if any, contained in the load.
E. Laboratory Test Reports: Aggregate shall be tested in accordance with ASTM C33 and ASTM method C227. Tests shall be less than one year old.
F. Certificates: Submit a notarized certificate that each of the following conform to the appropriate ASTM standards:
   1. Aggregates
   2. Admixtures
   3. Curing materials

1.4 DELIVERY, STORAGE AND HANDLING
A. Delivery: Deliver precast concrete units to the job-site in such quantities and at such times as to assure the continuity of construction.
B. Storage: Store precast concrete units at the job-site where directed by the General Manager, in such a manner to prevent cracking, distortion, warping, staining or other physical damage, and in a manner to keep markings visible.
C. Handling: Properly support precast concrete elements to prevent damage during curing, storage, handling and hauling.
   1. Provide lateral support to sufficiently prevent bowing, warping or permanent set due to creep.
2. Adequately protect edges of precast units by padding or other means to prevent staining, chipping or spalling of concrete.

3. Lift and support the precast units only at designated lifting points or supporting points as shown on the approved Shop Drawings.

PART 2 PRODUCTS

2.1 PRECAST CONCRETE FENCING

A. Products: Precast concrete fencing shall be “Smoothstone” as manufactured by Designer Concrete Fences, or Superior Concrete Products, or equal. Compressive strength of concrete shall be not less than 5000 psi at 28 days.

1. Cement: ASTM C150 Type II or Type V Portland Cement.

2. Aggregates:
   a. Aggregates for Normal Weight Concrete: ASTM C 33 with maximum size conforming to ACI 318-83, Article 3.3.
   b. Clean, hard, durable, inert aggregate, free from staining or deleterious materials.

3. Water: Clean, potable, free from injurious amounts of oil, alkalies, organic materials, and other deleterious substances.

4. Coloring Admixture: Conform to ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures, free of carbon black; color stable, nonfading, and resistant to lime and other alkalis. Colors shall be as selected by the Architect. Admixtures shall be as manufactured by one of the following (or equal).
   a. Davis Colors Inc.
   b. L. M. Scofield Company
   c. Southern Colors and Chemical Co.

5. Reinforging Steel:
   a. Bars: ASTM A 615, Grade 60.
   b. Welded Steel Wire: ASTM A 185.

6. Embedded Items and Anchorage Devices:
   a. Use hot-dipped galvanized steel, embedded items, inserts, and anchorage devices exposed to view, moisture, or weather.
   b. Anchorage Devices: Fabricate from ASTM A 36, hot-dip galvanized in accordance with ASTM A 123.

7. Concrete Formwork: Comply with PCI MNL 117, Division V, Section 2, Article 5.2.1.
8. Sealants shall comply with Section 07900 and the fence manufacturer’s recommendations.

   a. Selection of materials for molds shall be at manufacturer’s option, except that wood shall not be used without specific prior approval of the Engineer.
   b. Cast elements in molds of rigid construction, accurate in detail with precise corners and arises, and designed to provide close control of dimensions, radii, and details as indicated on the Contract Drawings.
   c. Prior to casting of precast elements, molds shall have surface joints, radii, and corners filled, ground, filed, straightened, or otherwise removed to provide finished concrete surface that is smooth and dense, free of honeycombing, air pockets, offsets, sinkages, or other irregularities.

10. Mold Release Agents: Synthetic resin or organic compound containing no wax, oil, silicates, or varnish, and compatible with specified coatings, sealants, fresh concrete, curing process, and adhesives. Cast molds with release agents to facilitate removal of elements from molds.

2.2 CASTING

A. Formwork: Conform to accepted Shop Drawings.

B. Molds: Conform to accepted Shop Drawing and PCI MNL 117, Division V, Section 2.
   2. Fabricate molds in manner to result in mold surfaces which will cast smooth fresh concrete with no irregularities or discernable joint marks.

C. Concrete Reinforcement: PCI MNL 117, Division V, Section 3.

D. Embedments: PCI MNL 117, Division V, Section 4.

E. Lifting Devices: Conform to accepted Shop Drawings.

F. Placing and Consolidating Concrete: Comply with PCI MNL 117, Division v, Section 5.

G. Finishes: Provide exposed face matching approved samples.

H. Color: Consistent and uniform throughout, and as selected by the Architect.

I. Curing:
   1. Methods Other Than Steam: Section 03300 - Cast-in-Place Concrete.
   2. Steam Curing: PCI MNL 117, Division II.
      a. Keep concrete continuously covered for not less than 24-hours after casting.
      b. Initial Curing: Maintain temperature of concrete at its placement temperature, but not warmer than 100°F, until concrete has developed its final set, but for not less than two hours after casting has been completed.
c. Final Curing: Allow concrete temperature to increase, in increments of not more than 27°F per hour, to not warmer than 150°F; maintain that temperature until concrete has developed indicated design strength.

d. Cooling: Cool concrete gradually, at rate of not more than 20°F per hour.

e. Protection: After removing castings from casting bed, or mold, prevent castings from cooling at rate faster than 20°F per hour.

2.3 STEEL GATE SYSTEM

A. Hot rolled steel plates, and shapes shall conform to ASTM A36.

B. Hot rolled bars and bar sizes shall conform to ASTM A575, Grade M1020.

C. Anchorage devices shall be expansion shields conforming to Federal Specifications FF-S-325, Type, and Class suitable for the construction involved.

D. Machine screws shall be carbon steel, cross-recess drive, flat-head, conforming to FS FF-S-92, Type III.

E. Welding materials shall conform to AWS D1.1 and be of the type required for materials being welded.

F. Provide cylinder locks, hinges, latches, cane bolts, keepers, stops and other operating hardware for proper operation of the gates.

G. Shop Priming: All steel shall be shop primed. Shop priming shall be preceded by pretreatment to ensure proper adhesion of the primer. The shop primer shall be a rust inhibitive product, customarily used in the fabricator's plant, or one of the following products (or equal):

   1. Tnemec Co., "No. 99 Metal Primer".
   2. Rust-Oleum Co., "No. 769 Demo-Proof Red Primer".

H. Finish painting shall be accomplished after installation at the jobsite, and in the colors selected by the Architect.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install the precast concrete fencing in accordance with the approved Shop Drawings, and the manufacturer's recommended installation procedures as approved by the Architect.

END OF SECTION
SECTION 02870
SITE FURNISHINGS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

A. The requirements of the "General Provisions of the Contract" and of Division 1, "General Requirements", shall apply to all work of this Section with the same force and effect as though repeated in full herein.

1.2 SUMMARY

A. Work included: Furnish all labor, material, equipment and services necessary to provide all site furnishings, complete in place, as shown on the drawings or specified herein.

1. Trash Urns.
2. Bike Racks.

B. Related work:

1. Site Concrete - Section 02510.
2. Irrigation System - Section 02810.
3. Landscape Planting - Section 02900.
4. Landscape Maintenance and Plant Establishment - Section 02970.

1.3 SUBMITTALS

A. Submit for acceptance manufacturers catalogue information or shop drawings indicating size, materials, finishes and quantities of items being supplied. Submit one sample of each clay pot specified and color sample for precast concrete planters.

1.4 COORDINATION

A. The Contractor shall notify all other Contractors, such as plumbers, electricians, etc., in ample time to install work including sleeves, before concrete is placed.

PART 2 - PRODUCTS

2.1 See SHT L-001

PART 3 - EXECUTION

3.1 Furnish all labor, material, equipment and services necessary to provide all concrete, complete in place, as shown on the drawings or specified herein.

3.2 Work shall be set plumb level, and true to line and shall present a neat and finished appearance. Include setting each item in its correct place, fastening it, connecting it, or incorporating it into other portions of the work, as each item may require; and testing and operating equipment to assure proper functioning.

3.3 The work of this Section shall include the furnishing of anchors and adhesives required for installing and attaching the equipment specified herein. All furnishings shall be installed per manufacturer's recommendations unless noted in drawing or herein.
3.4 Adequately protect all work from damage by subsequent construction operations. Damaged work shall be replaced.

3.5 The Contractor shall at all times keep the premises free from accumulation of waste materials and rubbish caused by his employees. Upon completion of work, rubbish and excess materials are to be removed from the site, leaving the areas acceptably clean.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes labor, materials and equipment necessary for bicycle racks where shown on the contract drawings and specified herein.

B. Related Work:
   1. Division 2 for asphaltic concrete paving.
   2. Division 3 for cast-in-place concrete.

1.2 SUBMITTALS

A. Procedure: In accordance with Division One.

B. Product data: Submit a list of proposed products and materials to be provided for a complete assembly, along with manufacturer’s product data, specifications, typical installation details and other data for each material listed to prove compliance with the specified requirements.

C. Samples: Submit finish sample.

1.3 QUALITY ASSURANCE

A. Installer’s qualifications: Firm and individuals with a minimum of 3 consecutive years of experience in the installation of specified products on projects similar in material, design, complexity and extent to this Project, and whose work has resulted in applications with a record of successful in-service performance.

B. Regulatory Requirements: Conform to applicable Los Angeles City Building Code and Amendments.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Procedure: In accordance with Division 1.

B. Comply with pertinent provisions of Section 01150 of the Project Manual.

C. Promptly remove units that are chipped, dented, or damaged and replace with new units meeting the specified requirements.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. Basis of design is for Bike-Stanchions BS-4B, Adult Expanded Version AE, Below-Grade Mounted, Moderate Security Bike Rack, 5 bikes on 1'-5" center, as manufactured by Bike Security Racks Co., Inc., or equal complying with the following:
   1. Materials:
a. Rack: 2-inch nominal, ASTM A312 Schedule 40, Type 304 Stainless Steel Construction, welded seamless steel pipe, extended 2 feet into embedded sleeve.
b. Sleeve: 2-1/2 inches nominal, ASTM A312 Schedule 40, Type 304 Stainless Steel Construction, 2'-3" long, welded seamless steel pipe sleeve.

2. Accessories: 1/2-inch diameter, ASTM A276, Type 304 Stainless Steel rod lock – retaining yokes.

2.2 FABRICATION

A. Accurately fabricate bicycle rack to form uniform loops or bend.
B. Bending shall be performed with jigs, mandrills, or other fixtures that will result in smooth curves, formed with out distortion, indentation or warping.
C. Join all components with continuous MIG welds, unless otherwise noted.
D. Weld lock-retaining yokes to each vertical element to prevent bicycles from sliding to ground.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which work of this Section will be performed.
B. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Coordinate the arrangement of bicycle rack with the site layout indicated on the Contract Drawings.
B. Embed 2'-3" pipe sleeve in concrete foundation and extend pipe sleeve 3 inches above the top of concrete foundation. Top of concrete foundation shall be one-inch above the adjacent paving and shaped/sloped to drain in accordance to provisions specified herein.
C. After concrete has reached the specified strength, install bicycle rack end pipes into the pipe sleeves.
D. Fix into final position and secure in compliance with manufacturer’s installation instructions.
E. Upon completion of the installation, visually inspect installed bicycle rack and verify that it is properly set.
3.3 ADJUSTING AND CLEANING

A. Adjust all operating parts and/or assembles as may be required to provide the necessary function and smooth operation.

B. Clean the field welds, bolted connections, and abraded areas of the finish. Paint the bare areas with same material used for shop finishing.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Furnish all labor, material, equipment and services necessary to provide all landscape planting, complete in place, as shown and specified herein, including soil preparation, planting, seeding, staking and clean-up.

B. Related Sections include the following:

1. Landscape Irrigation System - Section 02810.
2. Palm Planting - Section 02951.
3. Landscape Maintenance and Plant Establishment - Section 02970.

C. Any plant deemed Not Available shall be noted in the bid. Failure to qualify availability of specified material shall make the Contractor responsible for all supplying of all material. Maintenance period may not begin until specified materials are installed.

1.3 SUBMITTALS

A. The City Engineer reserves the right to take and analyze samples of materials for compliance with these specifications at any time. The Contractor shall furnish samples upon request by the City Engineer. Rejected materials shall be immediately removed from the site at the Contractor's expense. Cost of testing of materials not meeting these specifications shall be paid by Contractor.

B. Provide soil tests as noted on the drawings. Planting recommendations may be revised based on soil test results.

C. Submit documentation to the City Engineer within forty-five (45) calendar days after date of award of Contract that all plant material is available. The Contractor shall be responsible for all material listed on plant list. Any and all substitutions due to availability shall be requested in writing prior to confirmation of ordering. All materials shall be subject to observation by the City Engineer at any time after confirmation of ordering.

D. Plants shall be subject to observation and preliminary acceptance by the City Engineer at place of growth or upon delivery for compliance with these specifications. Such observation shall not impair the right of observation and rejection during progress of the work. Tagging of plant material by the City Engineer is for design intent only and does not constitute the City Engineer's approval of the plant materials in regards to their health and vigor. The health and vigor of the plant materials is the sole responsibility of the Contractor. Submit written request for observation of plant material at place of growth to the City Engineer. Written request shall state the place of growth and quantity of plants to be observed. The City Engineer reserves the right to refuse observation at this time if, in his judgment, a sufficient quantity of plants is not available for inspection.

E. The Contractor shall submit specifications of any item being used on site upon the request of the City Engineer.
F. The Contractor shall submit color photos of plant materials as noted on the drawings.

G. For contract-grown materials, Contractor shall submit contract growing nursery’s name to City Engineer for approval prior to start of contract growing activity. It shall be the Contractor’s responsibility to coordinate any contract growing activities so as to meet the approved construction schedule requirements. All cost associated with contract growing shall be the Contractor’s responsibility.

1.4 QUALITY ASSURANCE

A. In all cases where observations are required, notify the City Engineer and the Owner at least four working days in advance of the time of observation.

B. Required observations are listed below:

1. Materials:
   a. Specimen and box size plant materials shall be observed at source prior to delivery to site.
   b. Upon delivery of plant material to site:
      (1) All plant material shall be observed and approved by the City Engineer for quality, size and variety prior to installation. Such approval shall not impair the right of observation and rejection during the progress of work for size and condition of ball or root mass, latent effects, diseases, pests or injuries.
      (2) A maximum of two observations for approval of plant material will be made by the City Engineer. For the first observation, the Contractor shall present not less than 50% of the total of required plant material. The Contractor shall submit the remainder at the second observation.
      (3) If any defective or non-complying plants are found during observations, they will be rejected.
      (4) All rejected plant material shall be removed from the site within a minimum of two working days.

2. Workmanship: Observation of site at critical stages of work.
   a. Observation of drainage material on-structure prior to installation of soil separator if required.
   b. Observation of soil separator on-structure prior to installation of soil if required.
   c. Observation for approval of landscape finish grading and soil preparation before installation of plant material:
      (1) During this observation the City Engineer may request that samples of the prepared soil be analyzed by an approved laboratory to assure its compliance with these Specifications.
      (2) Notification of exception shall be for the Contractor to correct deficiencies in the soil preparation to render it in compliance with these specifications. Corrections shall be made prior to any planting or, at the City Engineer’s option, the installation of container sized plants may proceed if the corrections can be made later without affecting the quality of the work. The Contractor shall notify the City Engineer in writing when the deficiencies have been corrected.
   d. Observation of planting installation.
e. Observation of tree staking.

3. Material and Workmanship:
   a. Observation by the City Engineer will be made at substantial completion of all materials, construction and installation work required by the Contract prior to commencement of the plant establishment period. The plant establishment period shall not commence until all deficiencies found by this observation have been corrected and written notice of start of commencement has been received from the City Engineer. All materials shall be installed prior to this observation with the following exceptions:
      (1) Items waived by the City Engineer for this observation for reasons of substantiated unavailability, or in appropriate season or weather.
      (2) Items which do not affect the health or growth of the plantings.
   b. Periodic observation shall be made of the work of the Contract during plant establishment period. See Landscape Maintenance Specification.

C. Certifications:
   1. Submit a certificate if requested by the City Engineer of delivery slip with each delivery of material in containers or in bulk. Certificates shall state source, quantity, or weight, type and analysis and date of delivery. Materials which are not pre-packaged shall have analysis completed by an approved independent testing laboratory (see plans). Deliver all certificates to the City Engineer prior to installation, incorporation or application of the material.
      a. Quantities of fertilizer.
      b. Quantities of soil amendments.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery:
   1. Deliver fertilizer to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, name, trademark, and compliance with all applicable laws.
   2. Deliver all plant blocks with legible identification labels.
      a. State correct plant name and size indicated on plant list.
      b. Use durable waterproof labels with water-resistant ink which will remain legible for at least 60 calendar days.
   3. Protect plant material during delivery to prevent damage to root ball, trunk, crown, branches, leaves, and fronds.
   4. The Contractor shall notify the City Engineer fourteen (14) calendar days in advance of delivery of all plant materials and shall submit an itemized list of the plants in each delivery.

B. Storage:
   1. Store plant material in shade and protect from weather.
2. Maintain and protect plant material not to be planted within four (4) hours in a healthy, vigorous condition.

C. Handling: The Contractor shall exercise care in handling, loading, unloading and storing of plant materials. Plant materials that have been damaged in any way shall be discarded and if installed, shall be replaced with undamaged materials at the Contractor’s expense.

1.6 PROJECT CONDITIONS

A. Perform actual planting only when weather and soil conditions are suitable and will not be detrimental to the plant material.

1.7 SCHEDULING

A. Prior to commencement of landscaping work, the Contractor shall arrange a conference at the site with the City Engineer. The conference shall include the Contractor, the Superintendent appointed to oversee the work of this Section and the City Engineer. At least eight (8) working days notice shall be given prior to the conference. The Contractor shall prepare a schedule of work items and this shall be reviewed at the conference.

1.8 WARRANTY

A. All plant material installed under the Contract shall be guaranteed against any and all poor, inadequate or inferior materials and/or workmanship.

PART 2 - PRODUCTS

2.1 MATERIALS

A. The following soil amendments and fertilizers are to be used for bid price basis only. Specific amendments and fertilizer specifications will be made after rough grading operations are complete and soil samples are tested by the Contractor.

B. All materials shall be of standard approved and first-grade quality and shall be in prime condition when installed and accepted. Any commercially processed or packaged material shall be delivered to the site in the original unopened container bearing the manufacturer’s guaranteed analysis. The Contractor shall supply the City Engineer with a sample of all supplied materials within fourteen (14) days after award of contract, accompanied by analytical data from an approved laboratory source or bearing the manufacturer’s guaranteed analysis. Amendments may be modified based on analysis provided.

C. Organic Amendment:

1. Type 1:

Nitrogen Fortified Wood Compost: Derived from Fir or Cedar sawdust, or from the bark of Fir or Pine treated with a non-toxic agent to absorb water quickly and comply with the following requirements:

GRADATION

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4-inch</td>
<td>95% minimum</td>
</tr>
<tr>
<td>#8</td>
<td>80% minimum</td>
</tr>
<tr>
<td>#35</td>
<td>30% maximum</td>
</tr>
<tr>
<td>Nitrogen Content</td>
<td>%, Dry Weight</td>
</tr>
</tbody>
</table>

MASTER BUILDING SPECIFICATION    LANDSCAPE PLANTING
02900 -4
Redwood 0.4 - 0.6%
Fir 0.56 - 0.84%
Cedar 0.56 - 0.84%
Fir Bark 0.8 - 1.2%
Pine Bark 0.8 - 1.2%

Salinity: Maximum saturation extract conductivity 2.5 millimhos/centimeter at 25 degrees Celsius.

Wetability: When one teaspoon of tap water is applied to 4 cubic inches of the air-dried products, the material shall become completely damp in a period not exceeding 2 minutes. (Kellogg KRA, Sequoia Redwood/Cedar blend or white fir, Long Beach soil prep., Bandini #1201 Redwood Soil Builder or nitrogenized wood amendment).

D. Soil Amendments:

1. Soil Sulfur: Agricultural grade sulfur containing a minimum of 99% sulfur (expressed as elemental).

2. Iron Sulfate: 20% Iron (expressed as metallic iron), derived from ferric and ferrous sulfate, 10% sulfur (expressed as elemental).

3. Calcium Carbonate Lime: 95% lime as derived from oyster shells.


5. Dolomite Lime:

   21% calcium
   11% magnesium

E. Fertilizer:

1. Planting Fertilizer: Pelleted or granular form shall consist of the following percents by weight and shall be mixed by commercial fertilizer supplier:

   6% nitrogen
   20% phosphoric acid
   20% potash


3. Single Super Phosphate: Commercial product containing 18-20% available Phosphoric Pentoxide, or equal.

4. DAP (Di-Ammonium Phosphate): 18-46-0

5. Planting Tablets:

   a. Shall be slow-released type with potential acidity of not more than 5% by weight containing the following percentages of nutrients by weight:
b. Shall be 21-gram tablets as manufactured by Agriform or approved equal, applied per manufacturer's instructions.

F. Import Top Soil: Silt plus clay content of the import soil shall not exceed 20% by weight with a minimum 95% passing the 2.0 millimeter sieve. The sodium absorption ratio (SAR) shall not exceed 6 and the electrical conductivity (ECe) of the saturation extract of this soil shall not exceed 3.0 millimhos per centimeter at 25 degrees centigrade. The boron content shall be not greater than 1 part per million as measured on the saturation extract. In order to insure compliance with these specifications, samples of the import soil shall be submitted to an approved laboratory for analysis prior to, and following, backfilling.

G. Herbicide: Round-up.

H. Plant Material:

1. Plants shall be in accordance with the California State Department of Agriculture's regulation for nursery inspections, rules and rating. All plants shall have a normal habit of growth and shall be sound, healthy, vigorous and free of insect infestations, plant diseases, sunscalds, fresh abrasions of the bark, excessive abrasions, or other objectionable disfigurements. Tree trunks shall be sturdy and have well 'hardened' systems and vigorous and fibrous root systems which are not root or pot-bound. In case the sample plants inspected are found to be defective, the City Engineer reserves the right to reject the entire lot or lots of plants represented by the defective samples. Any plants rendered unsuitable for planting because of this inspection shall be considered as samples and shall be provided at the expense of the Contractor.

2. The size of the plants shall correspond with that normally expected for species and variety of commercially available nursery stock or as specified on drawings. The minimum acceptable size of all plants measured before pruning with the branches in normal position, shall comply with the measurements, if any, specified on the drawings in the list of plants to be furnished. Plants larger in size than specified may be used with the approval of the City Engineer, but the use of larger plants shall not change the contract price.

3. All plants not in compliance with the requirements herein specified, will be considered defective and such plants, whether in place or not, shall be marked as rejected and immediately removed from the site of the work and replaced with new plants at the Contractor's expense. The plants shall be of the species, variety, size, and conditions specified herein or as shown on the drawings. Under no conditions shall there be any substitutions of plants or sizes listed on the accompanying plans, except with the express consent of the City Engineer.

4. Pruning: At no time shall trees or plant materials be pruned, trimmed or topped prior to delivery and any alteration of their shape shall be conducted only with the approval and when in the presence of the City Engineer.

5. Plant material shall be true to botanical and common name and variety as specified in "Sunset Western Garden Book" (current edition).

6. Nursery Grown and Collected Stock:
a. Plants shall be grown under climatic conditions similar to those in locality of project.

I. Guying and Staking Materials:

1. Wood Tree Stakes: Lodge pole pine fully treated with Coppernaphthanate Wood Preservative in strict accordance with Federal Spec. TT-W-572 Type 1 Composition B, 2” min. nominal size diameter x 10’ long, no split stakes.

2. Ties:
   a. 'Twist Brace' Nail-bracket style (lodgepole) or Bolt style (pipe) as noted on drawings.

<table>
<thead>
<tr>
<th>Tree Size</th>
<th>Metal stake</th>
<th>Wood stake</th>
</tr>
</thead>
<tbody>
<tr>
<td>5 - 15 g.</td>
<td>-</td>
<td>TB 18</td>
</tr>
<tr>
<td>24&quot; box</td>
<td>TB 36</td>
<td>TB 24</td>
</tr>
<tr>
<td>30&quot; box</td>
<td>TB 36</td>
<td>-</td>
</tr>
<tr>
<td>36&quot; box</td>
<td>TB 42</td>
<td>-</td>
</tr>
<tr>
<td>42&quot; box-larger</td>
<td>TB 42</td>
<td>-</td>
</tr>
</tbody>
</table>

   Manufactured by V.I.T. Products, San Diego, CA, 760/480-6702.

3. Guying Hardware:
   a. "Duck Bill" anchoring system as manufactured by Foresight Products LLC, Commerce City, CO 80022, (303) 286-8955 or approved equal.

      (1) For trees up to 3" (75 mm) diameter use:

      Model 40 Duckbill Anchors with 12 feet (3.6 m) of cable attached to each anchor, 3 tree collars, and 3-1/16" (1.6 mm) cable clamps - all pre-assembled. Each anchor holds 300# (135 kg).

      (2) For trees up to 6" (150 mm) diameter use:

      Model 68 Duckbill Anchors with 13 feet (4.0 m) of cable attached to each anchor with a turnbuckle in line, 3 tree collars, and 6-1/8" (3.2 mm) cable clamps - all pre-assembled. Each anchor holds 1,100# (500 kg).

      (3) For trees up to 11" (280 mm) diameter use:

      Model 88 Duckbill Anchors with 15 feet (4.5 m) of cable attached to each anchor with a turnbuckle in line, 3 tree collars, and 6-3/16" (4.8 mm) cable clamps - all pre-assembled. Each anchor holds 3,000# (1,360 kg).

   b. Wall Anchors (alternative): 1/2" dia. x 3" galv. eyebolts with expansion shield.

J. Water: Furnished by Contractor; transport as required.

K. Mulch:

1. "Walk On-Bark" as supplied by Kellogg Garden Products, Sequoia Forest Products, or equal.

2. The mulch shall consist of fibrous, woody bark mixture of varied particle size such that:
Physical Properties:

<table>
<thead>
<tr>
<th>Percent Passing</th>
<th>Sieve Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>90-100</td>
<td>25.4 mm (1&quot;)</td>
</tr>
<tr>
<td>80-100</td>
<td>12.7 mm (1/2&quot;)</td>
</tr>
<tr>
<td>20-60</td>
<td>6.35 mm (1/4&quot;)</td>
</tr>
</tbody>
</table>

L. Metal Header:

1. Headers shall be ‘Permaloc Aluminum Edging’ 3/16" x 5 1/2", Black Anodized-electrically absorbed dyes into the outer layers of the aluminum, 16"-0" sections with stake loops every 24" along the section, 0.110" for 3/16" gauge wall thickness; and to include eight (8)-12" aluminum stakes (see drawings for lengths). Stakes are to be 6061 alloy, T-6 hardness. Manufactured by Permaloc Corp. 1-800-356-9660.

2. Headers shall be furnished as shown on the drawings and herein specified. They shall be laid true to line and grade and in a workmanlike manner. Care shall be exercised in laying headers to project adjacent improvements, shubbery and other properties from damage. All stakes shall be placed on ground cover side of headers. Install per details and manufacturers recommendations.

M. Potting/Container Soil: Soil shall be “Supersoil” by Rod McLellan Co., 800/468-7645.

N. Soil Separator: Non-woven polypropylene fabric, “Mirafi 160N” manufactured by Mirafi 800/869-8905. Material shall be:

<table>
<thead>
<tr>
<th>Property/Test method</th>
<th>Units</th>
<th>160N</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Mechanical Properties</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grab Tensile Strength</td>
<td>kN (lbs)</td>
<td>0.71 (160)</td>
</tr>
<tr>
<td>Strength @ Ultimate</td>
<td></td>
<td>50</td>
</tr>
<tr>
<td>Elongation @ Ultimate</td>
<td>%</td>
<td></td>
</tr>
<tr>
<td>Mullen Burst Strength</td>
<td>kPa</td>
<td>2239</td>
</tr>
<tr>
<td>ASTM D 3786</td>
<td>(psi)</td>
<td>(325)</td>
</tr>
<tr>
<td>Trapezoidal Tear Strength</td>
<td>kN</td>
<td>0.27</td>
</tr>
<tr>
<td>ASTM D 4533</td>
<td>(lbs)</td>
<td>(60)</td>
</tr>
<tr>
<td>Puncture Strength</td>
<td>kN</td>
<td>0.42</td>
</tr>
<tr>
<td>ASTM D 4833</td>
<td>(lbs)</td>
<td>(95)</td>
</tr>
<tr>
<td>UV Resistance after 500 hrs.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2. Hydraulic Properties

| Apparent Opening Size     | US Sieve | 70   |
(AOS) ADTM D 4751  mm  0.212
Permittivity

ASTM D 4491  soc  1.5
Flow Rate  l/min/m'  4889
ASTM D 4491  (gal/min/ft') (120)

3. Packaging

Roll Width  m (ft)  4.6 (15.0)
Roll Length  m (ft)  91.5 (300)
Est. Gross Weight  kg (lbs)  93 (205)
Area  m'(yd')  418 (500)

O. Drainage Rock: Drainage rock to be 1/4" to 1/2" pea gravel and shall be clean, hard, sound, durable, uniform in quality, and free of any detrimental quantity of soft, friable, thin, elongated, or laminated pieces, disintegrated material, organic matter, oil, alkali, or other deleterious substance.

P. Sub-Surface Drain Pipe: Perforated or non-perforated as indicated on plans, size noted, manufactured by LASCO, available from Advanced Drainage Systems, Inc., Madera, CA 209/674-0903.

Q. Root Barrier: Barrier shall be Deep Root Barrier, manufactured by Deep Root Corporation, Westminster, CA, 714/898-0563

R. Jute Mesh: Mesh shall be "Anti-Wash Geojute" by Pacific Soil Stabilization, 800/473-1965, or approved equal. Install per manufacturer's specifications and recommendations.

S. Trunk Guard: 'Trim Guard' TG4 by V.I.T. products.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The Contractor to obtain Certification that final grades to +/-0.10' have been established prior to commencing planting operations. Provide for inclusion of all amendments, settling, etc. Contractor shall be responsible for shaping all planting areas as indicated on plans or as directed by the City Engineer.

B. Inspect trees, shrubs and liner stock plant material for injury, insect infestation and trees and shrubs for improper pruning.

C. Do not begin planting of trees until deficiencies are corrected or plants replaced.

3.2 PREPARATION

A. Soil Preparation:

1. If live weeds exist on site, strip and remove and replace top 1" of soil.

2. After approximate finished grades have been established, soil shall be conditioned and fertilized in the following manner. Soil should be slightly damp, but not muddy during rototilling.
a. Prior to amending, the surface soil shall be cross riped to a minimum nine (9) inch depth.
b. The following shall be uniformly broadcast and blended to a six (6) inch depth:
   
   (1) Organic amendment - 6 cu. yds.
   (2) Planting fertilizer - 15 lbs.
   (3) Agricultural gypsum - 200 lbs.
   (4) Soil sulfur - 20 lbs.
   (5) Urea formaldehyde - 8 lbs.

3. At time of planting, the top two inches of all areas to be planted or seeded shall be free of stones, stumps, earth clods, or other deleterious matter 1" in diameter or larger, and shall be free from all plastic, wire, plaster, obvious foreign matter or similar objects that would be a hindrance to planting or maintenance. The top 12" of soil shall be free of all stones, stumps or other deleterious matter 3" in diameter or larger.

B. Final Grades:

1. Bring soil to grades as indicated on drawings, importing soils as necessary and anticipating the installation of soil amenders and settling and/or compaction.
2. Finish grading shall insure proper drainage of the site as determined by the City Engineer.
3. All areas shall be graded so that the final grades will be 1" below adjacent paved areas, sidewalks, valve boxes, headers, tree well grates, planter rims, clean-outs, drains, manholes, etc., or as indicated on plans for turf, and 1 1/2" for shrubs and ground covers.
4. Surface drainage shall be away from all building foundations.
5. Eliminate all erosion scars prior to commencing maintenance period.
6. Compact all soil to final grades: min. 65%, max. 75%, unless otherwise required by soils report or for structural reasons.

C. Disposal of Excess Soil: Dispose of any unacceptable or excess soil at an off-site location approved by the Owner.

3.3 INSTALLATION

A. General:

1. Actual planting shall be performed during those periods when weather and soil conditions are suitable and in accordance with locally accepted practice as approved by the City Engineer.
2. Only as many plants as can be planted on that same day shall be distributed in a planting area. All plants shall be watered within 2 hours of planting.
3. Containers shall be opened and plants shall be removed in such a manner that the ball of earth surrounding the roots is not broken and they shall be planted and watered as herein specified immediately after removal from the containers. Containers shall not be opened prior to placing the plants in the planting area.

B. Pre-Plant Weed Control:

1. After soil preparation, irrigate and fertilize all planting areas for approximately 7-14 calendar days to achieve weed germination.
2. If live weeds exist on site after irrigating and at the beginning of work, spray with a non-selective systemic contact herbicide, as recommended and applied by an approved licensed landscape pest control advisor and applicator. Leave sprayed plants intact for at least fifteen (15) days to allow systemic kill.

3. Clear and remove all weeds by grubbing off all plant parts at least 1/4" below the surface of the soil to be planted.

4. Repeat process as necessary, or as directed by the City Engineer.

5. Do not plant until herbicide manufacturer indicates planting will not be affected by herbicide residue.

6. Maintain site weed-free at all times. Degree of acceptability shall be solely determined by City Engineer.

C. Lay-Out of Major Plantings: Locations for container plants shall be spotted and outlines of ground cover areas to be planted shall be marked on the ground by the Contractor before any planting or excavation begins. All such locations shall be approved by the City Engineer. Layout shall be accomplished by setting container plants or grade stakes with plants identified in locations indicated on plans, and with gypsum lines for ground cover areas. If underground construction or utility lines are encountered in the excavation of planting areas, other locations for planting will be selected as approved by the City Engineer.

D. Planting of Trees and Shrubs:

1. Excavate planting pits at twice the diameter of rootball with roughened surfaces and one and one half times the depth.

2. The top of the rootball should be slightly above final grade.

3. Uniformly blend 2 lbs. of iron sulfate and 1/2 lb. planting fertilizer per cubic yard of backfill soil.

4. Organic material is not required in the backfill. A soil blend consisting of no more than 20% by volume organic matter shall be placed in the upper twelve (12) inches of backfill only. Soil below this depth shall not contain any organic matter.

5. Place slow release fertilizer tablets in the upper twelve (12) inches of backfill at manufacturers recommended rates.

6. Construct a two (2") inch water berm on the outside edge of rootball.

7. Cover the rootball with a mulch.

8. Excess soil generated from the planting holes and not used as backfill or in establishing the final grades shall be removed from the site.

9. Install Root Barriers, as specified on plans.

10. Protect all areas from excessive compaction when trucking plants or other material to the planting site. Cross rip all compacted areas to a 12 inch minimum depth.

11. Center plant in pit or trench.

12. Face plants with fullest growth into prevailing wind or as directed by the City Engineer.

13. Set plant plumb and hold rigidly in position until soil has been placed firmly around ball or roots.
14. All plants which settle deeper than the surrounding grade shall be raised to the correct level.

15. Box Removal: Remove bottom of plant boxes before planting. Remove sides of box without damage to rootball after positioning plant and partially backfilling.

16. Pruning: Pruning shall be limited to the minimum necessary to remove injured twigs and branches. Pruning may not be done prior to delivery of plants.

17. Staking and Guying: Staking and guying of trees as directed by the City Engineer shall be completed immediately after planting. All stakes shall be installed plumb and as indicated on the drawings.

E. Planting of Groundcovers:

1. Flat grown plants shall remain in those flats until transplanting. The flat's soil shall contain sufficient moisture so that it will not fall apart when lifting the plants.

2. Groundcover shall be planted in straight rows and evenly spaced, unless otherwise noted, and at intervals called out in the drawings. Triangular spacing shall be used unless otherwise noted on the drawings.

3. Each rooted plant shall be planted with its proportionate amount of flat soil. Plantings shall be immediately sprinkled after planting until the entire area is soaked to the full depth of each hole.

4. Care shall be exercised at all times to protect the plants after planting. Any damage to plants by trampling or other operations of this Contract shall be repaired immediately.

F. Mulch Cover: All groundcover, perennial, and annual beds to be dressed with 3" deep layer of mulch.

G. Jute Mesh:

1. Clear away trash, large stones. Grade smoothly, eliminate footprints, tracks, ruts. Be sure Soil Saver is in complete contact with ground.

2. Confirm there is no tension on Soil Saver to prevent its contact with the soil.

3. Overlap Soil Saver at least 4" on sides and 18" on ends. Staples shall be inserted at intervals no greater than 3' along overlaps and down center of each jute mesh length.

4. Junction overlap: Joining two rolls shall be installed at the down-channel end of installed roll which should overlap up channel end of roll being installed. Overlap should be 18". Use five (5) staples on 12" centers.

5. Anchor Slot: (Top of slope) shall be installed by burying up channel end in trench 6" deep. Use five (5) staples on 12" centers.

6. On slopes less than six (6) feet in height, Soil Saver may be installed with roll width perpendicular to the contours.

7. Terminal fold shall be installed by bringing jute mesh down to level area before terminating. Turn ends under 6". Use five (5) staples across fold 12" centers.

3.4 CLEANING

A. The Contractor shall leave the site area broom-clean daily leaving the premises in a clean condition. All walks shall be left in a clean and safe condition.
B. After all planting operations have been completed, remove all trash, excess soil, empty plant containers and rubbish from the property. All scars, ruts or other marks in the ground caused by this work shall be repaired and the ground left in a neat and orderly condition throughout the site. The Contractor shall pick up all trash resulting from this work no less frequently than each Friday before leaving the site or the last working day of each week. All trash shall be removed completely from the site.

3.5 SCHEDULES

A. When observations are conducted by someone other than the City Engineer, the Contractor shall show evidence in writing of when and by whom these observations were made.

B. No site visits shall commence without all items noted in previous Observation Reports either completed or remedied unless such compliance has been waived by the City Engineer. Failure to accomplish punch list tasks or prepare adequately for desired observations shall make the Contractor responsible for reimbursing the City Engineer at his current billing rates per hour (plus transportation costs). No further observations shall be scheduled until this charge has been paid and received.

END OF SECTION
PART 1   GENERAL

1.1  DESCRIPTION OF WORK
A. Protect existing plant material specified on the drawings during the duration of the construction period in a healthful state, free from damage or harm as the result of any work performed.

1.2  JOB CONDITIONS
A. Prior to construction of any nature on the site, Contractor shall call for a site meeting with the General Manager. The purpose of the meeting shall be to establish the conditions of all existing plant material to be preserved upon receipt of the site by the Contractor. Failure to call for said meeting implies acceptance by the Contractor of plant material to be preserved in its existing condition.
B. An irrigation system and/or quick coupler valve will be fully operational so that plant material can be regularly watered.
C. Coordinate and cooperate with other work to enable the work to proceed as rapidly and efficiently as possible.

1.3  WORK INCLUDED
A. The work of this section includes all labor, materials, equipment, transportation and services necessary to complete the work in this section as shown on the drawings and as specified herein, including but not necessarily limited to, the following:
1. Protection and welfare of all existing plant material within the Contract Limits which is noted to remain, including trimming, cabling, and repair of such plant material as necessary and all labor, materials and equipment necessary.
2. Perform all pruning operations.
3. Submit plant material maintenance plan before commencing landscape work for review by the General Manager.

1.4  RELATED WORK
A. Clearing and Grubbing. Section 02102
B. Landscape Irrigation. Section 02810
C. Landscape. Section 02900
D. Maintenance. Section 02920

1.5  DEFINITIONS
A. "Injury" is defined, without limitation, as any bruising, scarring, tearing, or breaking of roots, branches, or trunk.
B. "Dripline" is defined as the outermost limits of the tree or shrub canopy.

C. "Certified Arborist" is a consulting arborist certified by the International Society of Arboriculture.

1.6 QUALITY ASSURANCE

A. Reference Standards:
   1. International Society of Arboriculture (ISA) “Guide for Plant Appraisal” prepared by the Council of Tree and Landscape Appraisers (CTLA).

B. Qualification of Workman:
   1. Trimming and pruning of trees shall be performed only under the direction of a certified Arborist.

1.7 SUBMITTALS

A. Pruning materials
B. Fencing materials.
C. Maintenance plan.

1.8 GUARANTEE

A. During the Guarantee to Repair Period specified in the General Conditions the Contractor shall be liable for damages to all trees covered by the provisions of this Section. Compensation to the Owner shall be as outlined in section 3.04.

B. Contractor will not be held responsible for damages due to vandalism or freak acts of nature during the guarantee period. Immediately report such conditions to the General Manager.

PART 2 PRODUCTS

2.1 FENCING MATERIALS

A. Fencing-11 gauge galvanized 6' high chain-link fence with galvanized steel posts at 10' o.c. minimum.

2.2 PRUNING MATERIALS

A. Pruning materials shall be in accordance with current horticultural practices.
B. Pruning sterilant shall be Physan 20 Fertiliome Type A, or diluted bleach.

PART 3 EXECUTION

3.1 FENCING
A. Fencing-A continuous 6’ high temporary chain-link fence will be erected around trees with a caliper of 4” or larger at the dripline, in order to prevent soil compaction, limb damage, or the accidental introduction of toxic materials into the root zone. Fence can be erected around groups of adjacent trees where possible. Otherwise, fence to be erected around individual tree.

B. The fence will be removed only at the end of construction, as approved by the General Manager.

3.2 PLANT MATERIAL PROTECTION

A. Provide protection for all plant materials designated to be retained. Contractor is responsible for replacing damaged plant life with approved equivalent.

B. New and existing plant materials shall not be allowed to deteriorate and shall be maintained in a healthy and vigorous condition during the course of construction and maintenance period.

C. During the course of construction the Contractor shall take all necessary precautions, as outlined herein, to protect existing plant materials to be preserved from injury and death. Protection shall be given to the roots, trunk, and foliage.

D. The Contractor shall conduct operations continually to completion, unless weather conditions are prohibitive.

E. Provide ample water supply of potable quality and sufficient quantity for all operations required under this Section.

F. Trees subject to the provisions of this Section, which have been injured, shall be repaired immediately by a certified Arborist. Repairs shall include removal of rough edges, sprung bark and severely injured branches as directed by the Arborist.

G. Necessary measures shall be taken to maintain healthy living conditions for existing plant materials to be preserved. Such measures shall include monthly washing of leaves for the removal of dust, regular irrigation, root feeding, etc.

H. Tree protection fencing shall be installed for the protection of existing trees to be preserved. No construction, demolition, or work of any nature will be allowed within the fenced area without prior written approval by the General Manager.

1. Approval by the General Manager for work within the fenced area shall not release the Contractor from any of the provisions specified herein for the protection of existing trees to be preserved.

2. During the course of construction of approved work within the fence area, no roots shall be cut without prior written approval by the General Manager.

I. During construction, the existing site surface drainage patterns shall not be altered within the area of the drip line of existing plant materials.

J. Contractor shall not alter the existing water table within the area of the drip line of existing plant materials.

K. Do not permit the following within the drip line of any existing tree or shrub to be preserved:
1. Storage or parking of automobiles or other vehicles.
2. Stockpiling of building materials, refuse or excavated materials.
3. Skinning or bruising of bark.
4. Use of trees as support posts, power poles, or signposts; anchorage for ropes, guy wires, or power lines; or other similar functions.
5. Dumping of poisonous materials on or around plant materials and roots. Such materials include but are not limited to paint, petroleum products, dirty water, or other deleterious materials.
6. Cutting roots by utility trenching, foundation digging; placement of curbs and trenches, and other miscellaneous excavation without prior written approval by the General Manager.
7. Damage to the trunk, limbs, or foliage caused by maneuvering vehicles or stacking material or equipment to close to the plant.
8. Compaction of the root area by movement of trucks or grading machines; storage of equipment, gravel, earth fill, or construction supplies; etc.
9. Excessive water or heat from equipment, utility line construction, or burning of trash under or near shrubs or trees.
10. Damage to root system from flooding, erosion, and excessive wetting and drying resulting from watering and other operations.

L. Excavation Around Trees

1. Excavation within the drip lines of trees shall be done only where absolutely necessary, under the direction of a Certified Arborist and with prior approval from the General Manager.
2. Where trenching for utilities is required within driplines, tunneling under and around roots shall be by hand digging. Main lateral roots and taproots shall not be cut. Smaller roots that interfere with installation of new work may be cut with prior approval from certified Arborist.
3. Where excavation of new construction is required within drip line of trees, hand excavation shall be employed to minimize damage to root system. Roots shall be relocated in backfill areas wherever possible. If large, main lateral roots are encountered, they shall be exposed beyond excavation limits as required to bend, and relocate without breaking. If encountered immediately adjacent to location of new construction and relocation is not practical, roots shall be cut approximately 6 inches back from new construction under the direction of a certified Arborist.
4. Exposed roots shall not be allowed to dry out before permanent backfill is placed. Temporary earth cover shall be provided, or roots shall be packed with wet peat moss or four layers of wet, untreated burlap and temporarily supported and protected from damage until permanently relocated and covered with backfill. The cover over the roots shall be wetted to the point of runoff daily.
5. Branching structure shall be thinned in accordance with National Arborists Association “Pruning Standards and Principles” to balance loss of root system caused by damage or cutting of root system. Thinning shall not exceed 30 percent of existing branching structure.

3.3 TREE TRIMMING

A. A Certified Arborist, shall be engaged to direct removal of branches from trees if necessary to protect the health of the tree or if required to clear for construction.

B. In company with the General Manager, Owner and a certified Arborist, ascertain the limbs and roots which are to be trimmed. Clearly mark them to designate the approved point of cutting.

C. Dead and damaged trees that are determined by the Certified Arborist to be incapable of restoration to normal growth pattern shall be removed.

D. Cut evenly, using proper tools and skilled workmen, to achieve neat severance with the least possible damage to the tree.

E. In the case of root cuts, apply wet burlap or other protection, approved as noted herein, to prevent drying out, and maintain in a wet condition as long as necessary for temporary protection.

3.4 REPAIR COMPENSATION

A. Damage:

1. Damage to existing tree crowns or roots over 1” in diameter shall be immediately reported to the General Manager.

2. A Certified Arborist shall direct all repairs to trees. Repairs shall be made promptly after damage occurs to prevent progressive deterioration of damaged trees. Repairs shall be at the Contractor’s expense.

B. Irreparable Damage: Any tree to be protected which is irreparably damaged owing to the Contractor’s negligence or failure to provide adequate protection shall be compensated for in accordance with the following schedule of values using the “tree caliper” method (greatest trunk diameter, measured 18 inches above the ground):

1. For trees with diameters up to and including 6 inches, compensation shall be the actual cost of replacement with item similar in species, size, and shape, including:

   a. Actual cost of item boxed out of the ground.

   b. Transportation or delivery of boxed item to site.

   c. Planting and staking.

   d. Maintenance, including watering, fertilizing, pruning, pest control, and other care to bring replacement to same general condition of original item.

2. For trunks up to:

   7"..........................................................$ 1,200
   8"....................................................... 1,700
9".......................... 2,200
10".......................... 2,600
11".......................... 3,100
12".......................... 3,600
13".......................... 4,100
14".......................... 4,600
15".......................... 5,000
16".......................... 5,500
17".......................... 6,000
18" and over, add for each caliper inch.... $600

3.5 MAINTENANCE

A. Plant material will be maintained throughout the duration of the construction period in a healthful manner. Plant material identified which requires special pruning, insect control, fertilization or other remedial health action will be treated during this period. Methods and rates of pesticide and fertilizer application will be reviewed by the General Manager prior to approval.

B. Watering: Plant materials will be watered on a regular basis, at a rate consistent with their particular requirements. Verification of the proposed watering schedule shall be reviewed by the General Manager prior to commencement of the maintenance.

1. The maintenance of the plant materials shall comply with standard horticultural practice for the correct watering, fertilizing, pruning and spraying of the specimen boxed trees.

2. The maintenance and quality of the plant materials shall be subject to monthly checks. The dates of these checks shall be outlined in the General Manager field notification relating to the establishment of the plant maintenance period. Additional checks shall be scheduled as determined by the General Manager.

3. Contractor shall be responsible for performing periodic inspections of existing plant materials to be protected and relocated throughout the construction period, and submit written proposals to the General Manager for additional maintenance work as may be required to ensure the health and general well-being of the plant material. Contractor shall retain, at the direction of the General Manager, additional specialists as may be required to perform this work.

C. Contractor shall keep plant material free from weeds and debris at all times.

3.6 FIELD QUALITY CONTROL

A. General: The Contractor guarantees the protection of all plant material included as part of this work, in a healthful manner during the duration of the construction period. Destruction of, or significant damage to, any or all of the plant materials to be protected, as determined by the General Manager, will result in compensation by the Contractor of 3-36" box trees, installed on the site, for each existing tree damaged.

END OF SECTION
PART 1   GENERAL

1.1 SUMMARY

A. The work includes all materials, labor, services, transportation, and equipment necessary to perform the work as described in this specification section.

1.2 RELATED WORK IN OTHER SECTIONS

A. Site Clearing. Section 02110
B. Landscape Irrigation. Section 02810
C. Landscaping. Section 02900

PART 2   PRODUCTS (NOT USED)

PART 3   EXECUTION

3.1 MAINTENANCE

A. All work shall be continuously maintained in all areas within the limit of work during the progress of the job, the 180 day maintenance period and until the final acceptance of the work.

B. The one hundred eighty (180) day plant maintenance period shall not commence until written notice of approval of landscape and irrigation installation (see Landscape Irrigation Section 02810) has been received from the General Manager.

C. Provide the following during the final one hundred eighty (180) calendar day maintenance period:

1. All plants and planted areas shall be kept watered.
2. Weeds, Dallis, Johnson, Kikuyu, Nut and Bermuda Grass shall be removed.
3. The entire project shall be so cared for that a neat and clean condition will be presented at all times to the satisfaction of the Owner and General Manager.

D. General Weeding:

1. Weeding Program: The Contractor shall be responsible for providing a continuous weeding program for all project areas. Weeding shall be done on a weekly basis and shall include any undesirable or misplaced plant.

2. Shrubs: Weeds shall be removed from beds regularly, no less than once a week, chemically or manually. Bermuda grass and other noxious weeds shall not be allowed to become established.
3. **Ground Cover:** Weeds shall be removed completely, on a regular basis, chemically or manually, no less than once a week. Weeds may be controlled with pre-emergent herbicides, preferably, but also may be controlled with post-emergent herbicides, and/or by hand pulling.

E. **Insect, Disease and Pest Control:** The Contractor shall regularly inspect all landscaped areas for presence of disease, insect or rodent infestation. The Contractor shall advise the General Manager within four (4) days if disease, insect or rodent infestation is found; he shall identify the disease, insect or rodent and specify control measures to be taken using legally approved materials and methods. Upon written approval of the General Manager, the Contractor shall implement the approved control measures, exercising extreme caution in the application of all spray material, dusts or other materials utilized. The use of any chemicals for insect and disease control shall be done by a state licensed pest control operator who shall follow all guidelines governing his license. Extreme caution shall be used when spraying insecticides and fungicides. Only spray when there is no wind. General Manager's approval must be obtained prior to spraying any insecticides or fungicides.

1. Approved control measures shall be continued until the disease, insect or rodent is controlled to the satisfaction of the General Manager. The Contractor shall utilize all safeguards necessary during disease, insect or rodent control operations to ensure safety of the public and the employees of the Contractor.

F. **Staking and Guying:** Tree stakes, ties and guys shall be checked to prevent bark wounds caused by abrasion and corrected as needed. Ties shall be adjusted to prevent girdling. When trees attain a trunk caliper of approximately 4” consider removing stakes and guys based on the following guidelines. The tree must retain its upright position and this position must be held regardless of moisture content of the soil. Before any stakes are removed, remove tree ties and allow the tree to remain without support for a period of time to observe structural stability of the tree. Remove tree stakes only when tree has been proven to be structurally stable. Any restaking shall be done with originally specified materials. Guying will, over time, stretch or loosen. Adjust as needed to retain a taut position, until such time when guying is removed. Any tree that is damaged due to improper staking or typing shall be replaced at the Contractor's expense.

G. **Plant Replacement:** Any tree and shrub that appears to have more than one-half (1/2) of its foliage in a declining state shall be brought to the attention General Manager immediately. Check plant for over-watering, or drainage problems; and repair the problem prior to replacement. Replacement plants shall be of a size, condition and variety acceptable to the General Manager. The Contractor shall replace plant material at no cost to the Owner and subject to acceptance by the General Manager.

1. Plants that show signs of failure to grow at any time during the maintenance period, or those plants so injured or damaged as to render them unsuitable for the purpose intended shall be replaced immediately at the expense of the Contractor.

2. Any trees, shrubs or grass that die or loose form and size as originally specified shall be replaced even though they have taken root and are growing after die-back or loss of form and size.

H. **Shrub and Vine Care:** All shrubbery shall be checked weekly for any breakage or damage, special watering needs, etc. and treated as necessary. All undesirable conditions shall be eliminated as per accepted landscape maintenance practices. All shrubs shall be maintained in a healthy vigorous condition. Remove all spent flowers, flower spikes and remove all leaves and debris from plant areas daily. Hose off all plant material monthly to remove accumulated dirt and soot.
1. Pruning: Pruning shall be performed as a continuous ongoing operation not allowing plants to develop stray, undesirable growth, and shall be done under the direction of a certified Arborist. Trimming, pruning, thinning and training are functions to be done at any time as needed to maintain a pleasing appearance. Accomplish pruning by removing woody stems from inside shrubs on an as-needed basis as directed by the Arborist. Excessive pruning or stubbing back will not be permitted. Top shrubs only when necessary for appearance and after interior selective branch pruning has been completed or as directed by the Arborist. Where trees and shrubs occur in close proximity to walks or parked cars, prune to allow movement without interference from branches and foliage.

a. Shrub Pruners: Shrubs shall be pruned and thinned using hand-held shrub pruners, Hedge shears and clippers shall not be used.

I. Irrigation Systems Care

1. Irrigation Repair and Operation:

a. Systems Components Damage: Irrigation system components damaged as a result of Contractor's neglect shall be repaired or replaced by the Contractor at no cost to the Owner. Normal wear and tear of systems, accidental breakage by others, or so-called acts of God, are conditions under which the Contractor is not directly responsible and repairs shall be paid for by the Owner. The Contractor shall notify the General Manager the same day of discovery of damage to irrigation system components caused by acts of God, that do not result from the performance of the work by the Contractor. Upon receipt of the General Manager’s written authorization, the Contractor shall repair said damage as soon as possible and submit a change order related to the cost of said work to the General Manager. Failure to report any damages will constitute Contractor making repairs at his own expense. Any replacement of irrigation system components under this subparagraph 1. shall be original equipment types. Any substitutions for replacement equipment shall be approved in writing from the University prior to doing work.

b. Replacement includes: sprinkler system laterals (piping), sprinkler mains (pressure lines), sprinkler control valves, sprinkler controllers, sprinkler heads, sprinkler caps, sprinkler head risers, valve covers, boxes and lids, including electrical pull boxes and lids, valve sleeves, quick couplers, and hose bibs.

c. Automatic Irrigation System Failure: Irrigation shall be done by the use of automatic sprinkler systems, where available and operable; however, failure of the existing irrigation system to provide full and proper coverage shall not relieve the Contractor of the responsibility to provide adequate irrigation with full and proper coverage to all areas in the work site.

d. Property Damage: Any damages to property resulting from excessive irrigation water or irrigation water runoff due to the Contractor's negligence shall be charged to the Contractor.
e. Controller and Valve Boxes: The Contractor shall keep controller and valve boxes clear of solids and debris and maintain the irrigation system including the replacement, readjustment, raise or lower, straighten, and any other operation required for the continued proper operation of the system from the water meter throughout the work site.

f. Immediately after planting, apply water to each tree, shrub and vine by means of a hose in a moderate stream in the planting hole until the material around the roots is completely saturated from the bottom of the hole to the top of the ground.

g. Following the planting of ground cover, each plant shall be immediately and thoroughly watered by means of a hose with a slow stream of running water.

h. Apply water in sufficient quantities and as often as seasonal conditions require to keep the ground wet, but not soaking, at all times, well below the root systems of the plants and grass.

2. System Monitoring:

a. Contractor Monitoring: The Contractor shall inspect the irrigation system for broken and clogged heads, malfunctioning or leaking valves, or any other condition which hampers the correct operation of the system. Authorization must be obtained from the General Manager before proceeding with work not covered under normal maintenance work. The malfunctioning sprinkler system landscape area shall be irrigated by a portable irrigation method until all authorized repairs have been completed to the satisfaction of the General Manager. Each system shall be checked daily and all necessary adjustments made to heads which throw onto roadways, walks, windows, or out of intended area of coverage. The Contractor shall clean and adjust sprinkler heads as needed for proper coverage. Each system shall be individually operated and observed on a regular basis.

b. Suspension of Irrigation Operation: The Contractor shall turn off irrigation systems during periods of rainfall and times when suspension of irrigation is desirable to conserve water while remaining within guidelines of good horticultural acceptable maintenance practices.

c. System Operation Knowledge: One maintenance person shall have the responsibility of operating and knowing the irrigation systems adjust controllers, observe the effectiveness of the irrigation systems, and making minor adjustments and repairs to systems.

3. Coverage/Application Rate: Generally, watering shall be done at night, between the hours of 12:00 A.M. and 6:00 A.M., unless otherwise approved by the General Manager. The Contractor shall operate systems and irrigation heads as seasonal conditions require. During extremely hot weather, extended holiday periods and during or following breakdown of systems, the Contractor shall provide adequate personnel and materials as required to adequately water all landscaped areas. When breakdowns or malfunctions exist, the Contractor shall water manually by whatever means necessary to maintain all plant material in a healthy condition.
4. Ground Cover Trimming: Grass and ground covers are to be neatly trimmed away from sprinkler heads to ensure proper coverage and operation. Weed or turf killer shall not be used. Trim ground covers away from sprinkler heads by tapering away from head. Holes shall not be cut in to ground cover areas. As ground covers grow in height, risers may need to be extended to properly clear top of ground covers.

5. Tests: The Contractor shall test the soil and ground cover areas and around trees and shrubs monthly or as necessary with soil probes to determine that the proper amount of water is being applied at all times. This information shall be used to adjust watering times on the controller and supplemental hand or deep watering as necessary.

   a. Soil Probe: The Contractor shall make the soil probe available at all walk-through inspections.

6. Maintenance Work not Included:

   a. Backflow Prevention Device: Testing, certification and service of the backflow prevention shall be done by the Contractor, and it shall be the Contractor's responsibility to notify the General Manager should a malfunction occur.

J. Grades: Damage to planting areas through any of the following shall be replaced or repaired immediately by refilling with topsoil and leveling:

   1. Depressions caused by vehicles, bicycles or foot traffic.
   2. Damage caused by gophers and moles.
   3. Erosion due to irrigation runoff.
   4. Unnatural soil settling.
   5. Excessive soil compaction.

K. Walkway Care

   1. Sweeping, Vacuuming and Blowing off Walks: All public walkways shall be swept, vacuumed or blown off once a week. This work shall be coordinated with mowing or other maintenance work in the area. All gutters within the maintenance area shall be kept clean of grass clippings and miscellaneous trash.

   2. All walks shall be kept free of dirt, leaves and other debris from the maintenance by or visiting the site. Debris shall be collected on a daily basis. In general, all areas shall be policed once daily. All paper, trash, etc., shall be disposed of off-site.

   3. Hosing off Walks Option: In general, all public walkways shall be hosed off once a month in place of sweeping or blowing as described above. Care shall be taken so that this does not inhibit or endanger pedestrians utilizing walkways. This work should be scheduled to coincide with mowing or other maintenance work in the area.

L. The Contractor shall be on site once weekly for a minimum of four (4) hours.

M. The Contractor is to work closely with the Owner's maintenance division, and establish a weekly meeting with the Owner's maintenance crew.
N. The Contractor shall replace all annual color as necessary during the maintenance period.

O. The Contractor shall remove dead flower buds.

P. The Contractor shall adjust and maintain the low voltage lighting system in fully operational condition. Maintenance of lighting shall run inclusive with landscape and irrigation maintenance period.

Q. The Contractor may be relieved of the maintenance work when the final (180) calendar day plant establishment work has been satisfactorily completed.

R. Extension of Maintenance Period: Continue the maintenance period at no additional cost to the Owner until previously noted deficiencies have been corrected.

END OF SECTION
PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provision of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:
   1. Provide planting of palms complete, as shown and as specified.

B. Related Sections include the following:
   1. Landscape Irrigation System - Section 02810.
   2. Landscape Planting - Section 02950.
   3. Landscape Maintenance and Plant Establishment - Section 02970.

1.3 REFERENCES


1.4 SUBMITTALS

A. Comply with pertinent provisions of Division I if a part.

B. Product Data: Prior to delivery to site, submit manufacturers' current literature of the following:
   1. Fertilizer.
   2. Drainage material.
   3. Fungicide.
   4. Backfill material.

C. Test Reports: Physical and chemical composition of fertilizers, fungicide and sand.

D. Percolation test.

1.5 QUALITY ASSURANCE

A. Qualifications: Written documentation of at least three (3) years successful experience at planting of specified palm trees.

B. All palms shall have straight trunks unless otherwise noted on plans.

1.6 DELIVERY, STORAGE, ANDHANDLING
A. Delivery: Arrange delivery time so a minimum amount of time elapses between delivery to site and installation. Do not permit delivery more than a week prior to installation.

B. Labeling: For all field-dug palms, attach label to palm showing genus, species, height and name of grower or point of origin. For containerized palms, furnish standard products in standard containers bearing original labels, legibly showing genus, species and name of grower.

C. Storage: Store palms with protection from weather or other conditions which would damage or impair their vigor. Protect metal containers from sun during summer months with temperatures above 80 degrees F. Protection of palms during transport and storage shall be Contractor's responsibility.

D. Handling: Do not bind or handle palms with wire or rope at any time. Transport palm trees with crown thinned per standard nursery practice, and with remaining fronds wrapped securely around the crown bud. See "Pruning" below.


1.7 PROJECT/SITE CONDITIONS

A. Subsurface Improvements:
   1. Protection: Protect all existing underground and surface utility structures.
   2. Repair: Restore all damaged improvements to original condition.

1.8 SEQUENCING AND SCHEDULING

A. Ordering of Palms:
   1. Documentation: Submit documentation within (30) days after award of Contract that all palms have been reserved. Arrange procedure for review of palms at time of submission. If palms are unavailable in quantities specified, substantiate such proof in writing no later than 30 days after award of contract.
   2. Submit documentation that all palms have been reviewed by a certified Arborist or qualified plant pathologist. Document shall indicate all palms are disease free.
   3. Review: Submit a written request for review of palms and quantity at place of growth at least thirty (30) working days prior to shipment. The City Engineer reserves the right to refuse review at this time if, in his judgment, a sufficient quantity of palms is not available.
   4. Schedule delivery dates with City Engineer. Note: Planting of palms shall not begin until May 1 nor after October 1, or until approved by the City Engineer. Planting of palms outside of recommended season does not diminish any of the Contractor's responsibility, including that of the palm's health.

B. Coordination: Coordinate delivery and installation of palms with work in other sections to insure the following:
   1. Subdrainage: All subdrainage systems are to be installed under Landscape Drainage work as described below. Coordinate palm planting with other work to insure the following:
      a. Concealed Work: Verify and locate existing non-perforated drainage pipe to be coordinated with palm planting pit subdrainage systems.
      b. Field Measurements: Establish lines and levels for each section of non-perforated outfall drain line from all palm planting pits to existing non-perforated drainage pipe. Adjust elevations of outfall pipes from plant pit as required to accommodate varying depths of plant pits.
c. Notification: Notify the City Engineer of discovered conflicts at the site which would preclude successful installation of palm subdrainage system as specified and shown on the Drawings.

2. Paving: Install palms in paved areas prior to beginning paving installation in a timely manner so as not to delay the paving work.

1.9 WARRANTY

A. Warrant that all palms planted under this Contract will be healthy and in a flourishing condition of active growth two years from date of Final Acceptance. Warrant palms against, but not limited to, the vascular disease Penicillium (Gliocladium) vermoeseni, the fungus Fusarium oxysporum, and the root rot disease phytophora and similar vascular infections during Warranty Period.

B. Delays: All delays in completion of planting operations which extend the planting into more than one planting season shall extend the Warranty Period correspondingly.

C. Condition of Plants: Palms shall be free of dead or dying fronds with all fronds of a normal size and color. Excessive scarring of the trunk will not be permitted, the City Engineer, will be the sole determinant of the degree of scarring permitted. After tagging by the City Engineer, remove all dried thatch from older leaves and cut back all resulting stems.

D. Replacements: Replace without additional cost to City Engineer all dead palms and all palms not in a vigorous, thriving condition as determined by the City Engineer during and at the end of Warranty Period. Match replacements to adjacent specimens of the same species. Apply all requirements of this Specification to all replacements.

E. Repair: Repair adjacent site improvements damaged by replacement work. Restore all to their original condition, as acceptable to the City Engineer.

F. Exclusions: Contractor shall not be held responsible for failures due to neglect by City Engineer, vandalism, or Acts of God, during Warranty Period. Report such conditions in writing.

1.10 MAINTENANCE PERIOD AND FINAL ACCEPTANCE: See Section 02970 - Landscape Maintenance and Plant Establishment.

PART 2 – PRODUCTS

2.1 PLANT MATERIALS

A. General:

1. Growing Conditions: Palms shall be orchard grown in accordance with good horticultural practices under climatic conditions similar to those of project for at least (2) two years.

2. Appearance: All palms shall be well-grown, symmetrical, without curvature or leaning of the trunk from the perpendicular, unless specified, and so trained or favored in development and appearance as to be superior in form, compactness and symmetry of crown. All palms shall be within 12" above or below the average height of the entire palm planting, measured from the bottom of the crown bud to finish grade after installation.

3. Vigor: All palms shall be sound, healthy and vigorous, well foliated prior to pruning and showing no signs of previous disease. They shall be free of disease, insect pests, eggs, or larvae. They shall have healthy, well-developed root systems. All palms shall be free from physical damage or adverse conditions which would prevent thriving growth.

4. Field Dug Stock: Verify that all field-dug palms contain adequate root ball to guarantee successful transplantation. Do not wrap rootball with plastic. Do not install field-dug palms that have cracked or broken balls of earth when unpacked from their wrapping or boxes.
5. When digging out the rootball, no excavation shall be done closer than 24" to the trunk at ground level and the excavation shall extend below the major root system to a minimum depth of six (6) feet. The bottom of the rootball shall be cut off square and perpendicular to the trunk below the major root system. Under no conditions shall the Contractor cut down the size of the rootball in width or depth.

6. Rootballs shall meet the following minimum sizes:
   a. Washintonia robusta
      16 to 20 feet of brown trunk - 3 foot cubed
      21 to 30 feet of brown trunk - 3 1/2 foot cubed
      31 to 40 feet of brown trunk - 4 1/2 foot cubed
      40 to 50 feet of brown trunk - 5 1/2 foot cubed

7. The Contractor shall not free-fall, drag, roll, or abuse the tree or put a strain on the crown at any time. A protective device shall be used around the trunk of the tree while lifting and relocating so as not to scar or skin the trunk in any way. This device shall consist of either a rubber or leather sling made out of timbers sufficiently sized to withstand the cable/choker pressure. At no time will trees be balled out and laid on the ground with rootball left exposed to direct sunlight and air. The rootball shall be kept moist and shaded at all times.

8. Palms shall not be stockpiled for replanting unless approved in writing by City Engineer.

B. Selection of Palm Trees:
   1. Transportation: The City Engineer will review palms at place of growth and will again review upon delivery for conformity to specifications. Protect palm fronds and rootballs during transport.
   2. Distant Material: Submit photographs with a person adjacent to each palm for preliminary review. Such review shall not impair the right of review and rejection during progress of the work.
   3. Unavailable Material: If proof is submitted that palm trees are not obtainable in the size and quantity specified, a proposal will be considered for use of the nearest equivalent size, a change in variety, or an adjustment in quantity. A corresponding adjustment of contract price will be made.
   4. Special Conditions: The above provisions shall not relieve Contractor of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials.

C. Pruning:
   1. Pre-Inspection Pruning: Palms shall be rejected if they are found to have been pruned within five (5) months prior to review by the City Engineer as specified herein.
   2. Pre-Shipment Pruning: Reduce crown of palm per standard nursery practice prior to shipping. Drench crown with fungicide as specified by manufacturer. Use soft rope to tie remaining fronds to protect crown bud. Do not permit fronds to become damaged by means of restraint.
   3. Disease Prevention: Exercise extreme caution while pruning palms, to prevent spread of vascular diseases. Dip pruning tools in a sterilizing agent before beginning pruning and before moving from one palm to another. Replace with matching specimens all palms showing symptoms of vascular disease.
4. Equipment: Do not use chain type saws for any pruning of the palms.

2.2 ACCESSORIES

A. Water: Clean, fresh and potable. Provided by Contractor. Transport as required.

B. Gravel Mulch:
   1. Size: Crushed rock, 3/4 in. x No. 10 size, free of sticks, dirt or other debris.

C. Sand: Washed concrete sand (wcs), free of all organic contaminants or impurities. S.E. shall be 80 or greater.

D. Frond Tie: Minimum 1/2 in. diameter soft sisal rope capable of maintaining frond in tied condition throughout the Warranty Period. Use no wire.

E. Sub-Surface Drain Pipe: See Landscape Planting - Section 02900.

F. Soil Separator: See Landscape Planting - Section 02900.

2.3 BACKFILL MIX

A. Sand – 100% with no organic matter.

2.4 FUNGICIDES/FERTILIZER

A. Foliar Spray: S.T.E.M. (Soluble Trace Element Mix) by Scotts Company.

B. Fertilizer: "Wood Ace Palm Special" 11-4-6 by W.D. Young, Western Farm Service, Vigoro Industries or equal.

C. Fungicide: Bordeaux (copper based) by Acme.

D. Fungicide: "Subdue-GR" by Ciba-Giegy Co., Novartis, Western Farm Service or equal.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Verification of Conditions: Do not commence planting work prior to acceptance of soil preparation.

B. Finish Grades: Finish grades for all planting areas shall have been established in another section. Verify that all grades are within 1 in. plus or minus of required finish grade and that all soil amendments have been installed. Maintain positive surface drainage of planted areas.

C. Protection: If palms must be delivered prior to planting date, insure that they are properly protected on site to prevent loss of vigor or damage to roots.

D. Drainage and Obstructions:
   1. Verification: Prior to commencing work, verify that specified or required depth of palm pits can be accommodated under the existing site conditions.
   2. Testing: Test drainage of all on-grade palm pits by filling with water twice in succession. No water shall be retained in planting pits after a twenty-four (24) hour period. Submit test results to City Engineer.
3. Obstructions: If rock, underground construction work, tree roots or other obstructions are encountered in the excavation of palm pits, alternate locations may be used as directed. Where locations cannot be changed, submit cost required to remove the obstructions to a depth of not less than 6 in. below the required pit depth. Proceed with work after acceptance.

3.2 HANDLING

A. Field-dug Palms: Lift and handle field-dug palms with extreme care. Remove wrapping or boxes carefully. If rootball is cracked or broken during handling, palm shall not be used.

3.3 INSTALLATION

A. Layout and Staking: Layout palms at locations shown on drawings. Use 3 ft. lath, color coded for each palm. The City Engineer will check location of palms in the field and adjust to exact position before planting begins. The City Engineer reserves the right to refuse review at this time if, in his opinion, an insufficient quantity of palms is available.

B. Preplanting: Where palms are to be preplanted to permit site improvements to be installed around them, be responsible for the accurate layout of those palms, measured to their centerlines. Be responsible for the protection of those palms while other work is taking place. Provide regular irrigation as necessary prior to installation and functioning of irrigation systems specified in another section.

C. Palm Pit Excavation:

1. On-grade Palm Pits: A minimum of 24 inches wider than the root ball.

2. Partial Burial of Trunk: Palms may not be planted deeper than previously grown (top of crown to bottom of rootball).

3. Height Alignment: After installation, crown buds of all palms in a planting shall be the same height from finish grade. Heights noted on plans refer to planted heights.

D. Palms shall be carefully lifted off the truck setting the choker to the outside so to turn the palm to the inside as it is lifted. Use nylon chokers only. Heads shall not be caught, pulled on, banged into or shaken; which can damage the bud.

E. Center palm in pit or trench; align with existing palms if appropriate.

F. Set palm plumb and hold rigidly in position until soil has been compacted around ball or roots.

G. Palms shall be backfilled with specified backfill. All voids around rootball shall be eliminated.

H. Trees shall be watered in as they are backfilled. Backfill shall be supersaturated and all air packets eliminated. Watering shall be done with a 6' long pipe sticker topped with a 90 degree elbow placed at the end of at least 3/4 inch hose with adequate volume. The sand shall be washed down around the rootball as the backfilling is accomplished by working the sticker up and down. The backfill should be thoroughly saturated before going on to the next palm.

I. After planting, and at 60 day intervals, apply "Wood-Ace Palm Special" at rates and frequency recommended by Manufacturer. Apply a 12 inches wide band around the base of each palm 12 inches from the trunk.

J. Prior to planting and then bi-monthly, spray the fronds (foliar drench) with ‘Bordeaux’ - fungicide. Follow label instructions.

K. Soil Application: After planting, drench the soil with the fungicide "Subdue" by flooding the planting basin. Reapply at three (3) week intervals through the maintenance period.

L. Spray with Foliar spray at rates and frequency recommended by Manufacturer.
M. Planting of Palms (Palms with subdrainage system):

1. Review of Palm Pits: Do not install palms prior to review and acceptance of subdrainage systems under another section if included in drawings.

N. Excess soil generated from the planting holes, not used as backfill or in establishing the final grades, shall be removed from the site.

O. Protect all areas from excessive compaction when trucking plants or other material to the planting site.

P. Watering Basin: Form saucer with berm centered around plant pits 12 in. wider than rootball diameter. Remove saucer around palms in lawn areas, prior to lawn planting.

Q. Labels: Remove all nursery-type plant labels from plants.

R. Watering: Soak planting pit to a depth of six (6) feet or to depth of subdrainage system as required to maintain healthy growth. Use a tensiometer to verify correct watering schedule throughout Maintenance Period.

3.4 CLEAN UP

A. Following planting work, all remaining excavation shall be backfilled and compacted in accordance with the requirements of the City Engineer. Burying of debris in holes will not be permitted. All excess soil and debris from the relocation work shall be disposed of off the site by the Contractor. This site shall be left neat and clean to the satisfaction of the City Engineer.

3.5 RECORD DRAWING

A. The Contractor shall prepare on a reproducible sepia mylar of the planting plan a drawing recording each palm location with each palm identified by number. Drawing to be turned over to the City Engineer for approval prior to the start of maintenance.

3.6 MAINTENANCE

A. The Contractor will be responsible for maintenance and guarantee of all installed new palms and existing palms to the satisfaction of the City Engineer. Maintenance will include weekly water management to include soil probing and observation of soil moisture sensing devices and palm tree pruning. Pruning shall be done with reciprocal saws (chain saws will not be allowed). Saw blades will be sterilized between each tree with 50% household bleach and 50% water for ten minutes. Pruning will be done to maintain a neat appearance as approved by the City Engineer. Proposed pruning schedule will be submitted to the City Engineer for review. Remove ties as recommended by grower. Do not cut any fronds that are green, or partially green, unless absolutely necessary, within three years of transplanting.

B. Fertilize and apply fungicides as noted above.

END OF SECTION
PART 1   GENERAL

1.1    SUMMARY

A. Furnish and install bollards (concrete filled pipe) as indicated on the drawings and specified.

B. Material selection:
   1. Select materials that have the highest possible recycled content while still meeting performance criteria.
   2. Select materials from local manufacturers wherever possible.

1.2    SUBMITTALS

A. Submit shop drawings showing materials and installation bollards.

B. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:
   1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials:
      a. Bollards
   2. LEED Credit MRc5.1: Provide manufacturer name and location data for the following materials:
      a. Bollards

1.3    FIELD MEASUREMENTS

A. Make field measurements to ensure that bollards are installed in the proper location, and in correct relationship to the adjacent facilities. Where bollards are designed to protect other construction, check actual dimensions of the other construction to verify the suitability of positioning.

PART 2   PRODUCTS

2.1    BOLLARDS

A. Provide galvanized and prime coated, standard weight steel pipe as specified in ASTM A53. Embed or anchor posts in concrete.

B. Concrete Footings: Provide Class 500-6-2500 concrete prepared as prescribed in Section 201-1 "Concrete, Mortar and Related Materials" of the Standard Specifications for Public Works Construction.

C. Concrete footings shall be not less than 18 inches in diameter, cast not less than 36 inches deep into solid ground.

PART 3 EXECUTION

3.1 INSTALLATION

Install bollards in accordance with the approved shop drawings. Anchor After posts have been inserted into holes, fill annular space between post and the cavity wall with nonshrink, nonmetallic grout.

END OF SECTION
PART 1 GENERAL

1.1 Summary

A. Section Includes:

1. Design and construction of formwork for concrete.
2. Setting in forms, all anchor bolts, metal inserts, sleeves, etc., embedded in concrete.
3. Miscellaneous concrete work, including but not limited to areaways, cast-in-place valve boxes, pits, splash blocks, equipment bases, and other items as shown or required to complete all Work.

B. Related Work Specified Elsewhere:

1. Furnishing and placing reinforcing for cast-in-place concrete per Section [03200].
2. Furnishing, placing, finishing, and curing of cast-in-place concrete per Sections [03300].
3. Placing of embedded anchor bolts and inserts per Section [03300].
4. Screeds for slabs per Section [03300].
5. Metal decking per Section [05310].
6. Submittals per Sections [01305] and [01330] except as specified herein.

1.2 Submittals

A. Shop Drawings: Submit shop drawings showing form pattern layouts of all exposed exterior and interior concrete dimensioned to precisely locate grooves, form panel jointing, and similar features. Review and approval will not include form strength and adequacy.

B. Record Document: Keep an accurate record of the dates of removal of forms, form shores and reshores, and furnish copies to the ENGINEER.

1.3 Quality Assurance

A. Construct forms according to ACI 347 "Recommended Practice for Concrete Formwork", and conforming to tolerances specified in ACI 301, "Specifications for Structural Concrete for Buildings", as applicable, unless exceeded by City of Los Angeles Building Code requirements or otherwise indicated or specified.
B. Prior to construction of formwork for concrete beams and slabs above grade, Contractor shall conduct a meeting at the site to determine and define all cambers required for the project. ENGINEER, Contractor and Contractor's formwork installer shall be in attendance at this meeting.

C. Placement:

1. Before placement, check lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.

2. During placement, check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.

3. Engage a licensed surveyor to verify that work is within specified tolerances. Surveyor shall report in writing to the ENGINEER, with copy to Contractor, certifying work as acceptable or indicating deviations from allowable tolerances.

1.4 Delivery, Storage, and Handling

A. Deliver materials for forms in timely manner to ensure uninterrupted progress.

B. Store materials by methods that prevent damage and permit ready access for inspection and identification.

PART 2 PRODUCTS

2.1 Materials

A. Form lumber: WCLIB "Construction" grade or better, WWPA No. 1 or better, or equal.

B. Form plywood: Use new and undamaged overlaid plywood complying with US Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete Form", "Class I", Exterior Grade or better, mill oiled and edge sealed, with each piece bearing legible inspection trademark for all exposed concrete. Use BBX for all non-exposed surfaces where indicated acceptable or as approved by ENGINEER.

C. Coated form plywood: For exposed painted concrete, plastic overlaid plywood of grade specified above, factory coated with a form coating and release agent equal to "Noxcrete".


E. Form ties: High strength taper ties or other type bolt through ties, for complete removal.
F. Form coating: Non-staining clear coating free from oil, silicone, wax, not grain-raising, "Formshield" by A.C. Horn, Inc., "Release" by Burke Concrete Accessories, or "Cast-Off" by Sonneborn Building Products. Where form liners are used, provide form coatings recommended by form liner manufacturer. Form release agent shall be VOC complaint.

G. Earth forms: Unless otherwise indicated or required, concrete for footings and pile caps may be placed directly against vertical excavated surfaces, provided the material will stand without caving, that minimum reinforcing steel clearances are maintained, and suitable provisions are taken to prevent raveling of top edges or sloughing of loose material from walls of excavation. Sides of excavation shall be made with a neat cut and the width made as indicated. Concrete which is exposed to viewed on exterior shall be formed to maintained depth of 6 inches below finished grade.

PART 3 EXECUTION

3.1 Workmanship

A. Rigidly construct forms to prevent mortar leakage, sagging, displacement or bulging between studs. Use clean, sound, approved form material, coated with specified materials only, not oil. Provide backing on all plywood joints.

3.2 Form Erection and Removal

A. Conform to ACI 301 and ACI 347 except as exceeded by the requirements of City of Los Angeles Building Code, regulatory agencies, or herein.

B. Construction: Coat forms with the specified resin coating, not form oil. Construct forms to exact shapes, sizes, lines, and dimensions required to obtain level, plumb, and straight surfaces. Provide openings, offsets, keys, reglets, anchorages, recesses, moldings, chamfers, blocking, screeds, drips, bulkheads, and all other required features. Make forms easily removable without hammering or prying against concrete. Space forms apart with metal spreaders. Construct forms to accurate alignment, location and grades, and provide against sagging, leakage of concrete mortar, or displacement occurring during and after placing of concrete. Coordinate installation of inserts and anchors in forms according to Shop Drawings and requirements for work of other sections.

C. Camber: Place suitable jacks, wedges, or similar means to induce camber and to correct settlement in forms before and during concrete placing. Camber shall be as determined in pre-installation meeting specified above. In general, formwork shall be capable of accommodating camber of 1/8" per 10' of span plus 1/4".

D. Corners and Angles: Provide 3/4" by 3/4" beveled chamfer strips for all exposed concrete corners and angles unless otherwise indicated. Form concealed concrete corners and angles square unless otherwise indicated.

E. Reglets and Rebates: Form required reglets and rebates to receive frames, flashing, and other equipment. Obtain required dimensions, details, and precise positions for work to be installed under other sections and form concrete accordingly.
F. Form Joints: Fill joints to produce smooth surfaces, intersections, and arrises. Use polymer foam or equivalent fillers at joints and where forms abut or overlap existing concrete to prevent leakage of mortar.

G. Recesses, Drips, and Profiles: Provide smooth milled wood or preformed rubber or plastic shapes of types shown and required.

H. Cleanouts and Cleaning: Provide temporary openings in all wall forms and other vertical forms for cleaning and inspection. Clean forms and surfaces to receive concrete prior to placing.

I. Re-Use: Clean and recondition form material before re-use.

J. Form Removal: Do not remove concrete forms until concrete attains sufficient strength to support its own weight and all superimposed loads as determined by testing field cured concrete cylinders, but not sooner than specified in ACI 347, paragraph 3.6.2.3. Load supporting forms may be removed when concrete has attained 75% of required 28 day compressive strength, but no sooner than 10 days provided construction is reshored.

1. Reshore structural members as specified below because of design requirements or construction conditions to permit successive construction.

2. Remove formwork progressively so unbalanced loads are not imposed on the structure.

3. Avoid damage concrete surfaces during form removal.

4. Store reusable forms for exposed architectural concrete to prevent damage to contact surfaces.

5. Remove formwork in the same sequence as concrete placement to achieve similar concrete surface coloration.

6. Contractor shall submit shoring/reshoring plans and calculations for review and approval. Calculations and plans shall be stamped and signed by a licensed civil or structural engineer. Reshoring loads to the lower floors shall be consistent with the design loads specified on the construction documents and with the acquired strength of the lower floors based on the time they have been allowed to cure before being loaded.

K. Reshoring:

1. Minimum reshoring shall consist of not less than half the full required shoring added under last placed floor over which full shoring is to be placed for the next floor above. Leave reshoring in place for at least 10 days after the floor above is placed, but in no case remove reshoring until next concrete placing has attained a compressive strength equal to 75% of that required for the 28 day age as determined by control test cylinders specified hereinafter.

2. Record: Maintain a form and shoring removal record.

3.3 Formwork Tolerances
A. Deflection: Limit deflection of forming surfaces from concrete pressure to L/240.

B. Finish Lines: Position formwork to maintain hardened concrete finish lines within following permissible deviations.

1. Variation from Plumb:
   - In 10'-0" 1/4" max.
   - In any story or 20'-0" 3/8" max.
   - In 40'-0" or more 3/4" max.

2. Variation from Level or Grades Indicated
   - In 10'-0" 1/4" max.
   - In any bay or 20'-0" maximum 3/8"
   - In 40'-0" or more 3/4" max.

3. Cross-Sectional Dimensions
   - Minus 1/4"
   - Plus 1/2"

C. Building Lines: Variation of linear building lines from established position in plan and related position of columns, walls and partitions:

1. In any bay or 10'-0" maximum 1/2"

2. In 40'-0" or more 1"

D. Slab Openings: Variations in size and location of sleeves and slab openings shall not exceed 1/4".

3.4 Survey and Adjustment

A. Check forms before and during placement of concrete, using an instrument, and make corrections as work proceeds.

3.5 Embedded Piping and Rough Hardware

A. Where work of other sections require openings for passage of pipes, conduits, ducts, and other inserts in the concrete, obtain all dimensions and other information. All necessary pipe sleeves, anchors, or other required inserts shall be accurately installed as part of the work of other sections, according to following requirements.
B. Conduits or Pipes: Locate so as not to reduce strength of concrete. In no case place pipes, other than conduits, in a slab 4-1/2" thick or less. Conduit buried in a concrete slab shall not have an outside diameter greater than 1/3 the slab thickness nor be placed below the bottom reinforcing steel or over top reinforcing steel.

C. Sleeves: Pipe sleeves may pass through slabs or walls if not exposed to rusting or other deterioration and are of uncoated or galvanized iron or steel. Provide sleeves of diameter large enough to pass any hub or coupling on pipe, including any insulation.

D. Conduits: Conduits may be embedded in walls only if the outside diameter does not exceed 1/3 the wall thickness, are spaced no closer than 3 diameters on centers, and do not impair the strength of the structure.

3.6 Field Quality Control

A. Inspection: Obtain inspection and approval of forms by Contractor's Independent Testing/Inspection Laboratory before placing structural concrete.

END OF SECTION
PART 1 GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

A. Gas vapor barrier providing protection from the methane gas.

B. Related work not in this section:
   1. Excavation and backfilling.
   2. Parge coat on masonry to receive gas vapor barrier membrane.
   3. Mortar beds or concrete toppings over gas vapor barrier membranes.
   4. Latex waterproofing.
   5. Damp-proofing.
   6. Flashing and sheet metal.
   7. Joint sealers.
   8. Soil sterilant.
   10. Drainage.

1.3 Quality Assurance

A. Gas vapor barrier contractor/applicator shall be trained and approved by gas vapor barrier manufacturer, [LBI Technologies, Inc. (LBI)].

B. A pre-installation conference shall be held prior to application of gas vapor barrier to assure proper substrate and installation conditions, to include contractor, applicator, architect/engineer and special inspector (if any).

1.4 Submittals

A. Project Data - Submit manufacturer’s product data and installation instructions for specific application.

B. Samples - Submit to the methane engineer representative samples of the following for approval:
1. Gas vapor barrier membrane material.
2. Geotextiles.
3. Perforated piping.
4. Sub-membrane gravel course material.
5. Membrane protection sand course material.

1.5 Delivery, Storage, and Handling

A. Deliver materials to site in original unbroken packages bearing manufacturer’s label showing brand, weight, volume, and batch number. Store materials at site in strict compliance with manufacturer’s instructions.

1.6 Job Conditions

A. Protect all adjacent areas not to receive gas vapor barrier. Where necessary, apply masking to prevent staining of surfaces to remain exposed wherever membrane abuts to other finish surfaces.

B. Perform work only when existing and forecasted weather conditions are within manufacturer’s recommendations for the material and product used.

C. Minimum clearance required for application of product:
   1. 90 degree spray wand – 2 feet.
   2. Conventional spray wand – 4 feet.

D. Ambient temperature shall be within manufacturer’s specifications. (Greater than +32°F/+0°C).

E. All plumbing, electrical, mechanical and structural items to be under or passing through the gas vapor barrier shall be positively secured in their proper positions and appropriately protected prior to membrane application.

F. Gas vapor barrier shall be installed before placement of reinforcing steel. When not possible, all exposed reinforcing steel shall be masked by General Contractor prior to membrane application.

G. Expansion joints must be filled with a conventional waterproof expansion joint material.

H. Surface preparation shall be per manufacturer’s specification.

PART 2 PRODUCTS

2.1 Materials
A. Fluid applied gas vapor barrier system – [LIQUID BOOT®]; a single course, high build, polymer modified asphaltic emulsion. Water borne and spray applied at ambient temperatures. A minimum thickness of [100 dry mils], unless specified otherwise as some cities and engineers may require a thicker membrane. Nontoxic and odorless. [LIQUID BOOT® Trowel Grade] has similar properties with greater viscosity and is trowel applied. [Manufactured by LBI Technologies, Inc., Santa Ana, CA (714) 384-0111].

B. Gas vapor barrier physical properties:

<table>
<thead>
<tr>
<th>GAS VAPOR MEMBRANE</th>
<th>TEST METHOD</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrogen Sulfide Gas Permeability</td>
<td>ASTM D1343</td>
<td>None Detected</td>
</tr>
<tr>
<td>Benzene, Toulene, Ethylene, Xylene, Gasoline, Hexane, Perchloroethylene</td>
<td>ASTM D543, D412, D1434 (tested at 20,000 ppm)</td>
<td>Passed in gas permeability and weight change</td>
</tr>
<tr>
<td>Sodium Sulfate (2% water solution)</td>
<td>ASTM D543, D412, D143</td>
<td>Passed in gas permeability and weight change</td>
</tr>
<tr>
<td>Acid Exposure (10% H₂SO₄ for 90 days)</td>
<td>ASTM D543</td>
<td>Less than 1% weight change</td>
</tr>
<tr>
<td>Radon Permeability</td>
<td>Tested by US Dept. of Energy</td>
<td>Zero permeability to Radon (222Rn)</td>
</tr>
<tr>
<td>Bonded Seam Strength Tests</td>
<td>ASTM D6392</td>
<td>Passed</td>
</tr>
<tr>
<td>Micro Organism Resistance (Soil Burial)</td>
<td>ASTM D4068-88</td>
<td>Passed</td>
</tr>
<tr>
<td>Methane Permeability</td>
<td>ASTM 1434-82</td>
<td>Passed</td>
</tr>
<tr>
<td>Oil Resistance Test</td>
<td>ASTM D543-87</td>
<td>Passed</td>
</tr>
<tr>
<td>Heat Aging</td>
<td>ASTM D4068-88</td>
<td>Passed</td>
</tr>
<tr>
<td>Dead Load Seam Strength</td>
<td>City of Los Angeles</td>
<td>Passed</td>
</tr>
<tr>
<td>Environmental Stress-Cracking</td>
<td>ASTM D1693-78</td>
<td>Passed</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GAS VAPOR MEMBRANE</th>
<th>TEST METHOD</th>
<th>VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coefficient of Friction (with geotextile both sides)</td>
<td>ASTM D5321</td>
<td>0.72</td>
</tr>
<tr>
<td>Cold Bend Test</td>
<td>ASTM D146</td>
<td>Passed. No cracking at –25°F</td>
</tr>
<tr>
<td>Freeze-Thaw Resistance (100 Cycles)</td>
<td>ASTM A742</td>
<td>Meets criteria. No spalling or disbondment</td>
</tr>
<tr>
<td>Accelerated Weathering and Ultraviolet Exposure</td>
<td>ASTM D822</td>
<td>No adverse effect after 500 hours</td>
</tr>
<tr>
<td>Hydrostatic Head Resistance</td>
<td>ASTM D751</td>
<td>Tested to 138 feet or 60 p.s.i</td>
</tr>
<tr>
<td>Elongation</td>
<td>ASTM D412</td>
<td>1,332% without reinforcement, 90% recovery</td>
</tr>
<tr>
<td>Elongation with 8oz. non-woven geotextile</td>
<td>ASTM D751</td>
<td>100% (same as geotextile</td>
</tr>
<tr>
<td>Property</td>
<td>Test Method</td>
<td>Specification</td>
</tr>
<tr>
<td>----------------------------------------------</td>
<td>-----------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>Tensile Strength</td>
<td>ASTM D412</td>
<td>58 p.s.i. without reinforcement</td>
</tr>
<tr>
<td>Tensile Strength with 8oz. non-woven geotextile both sides</td>
<td>ASTM D751</td>
<td>196 p.s.i. (same as geotextile tested separately)</td>
</tr>
<tr>
<td>Tensile Bond Strength to Concrete</td>
<td>ASTM D413</td>
<td>2,556 lbs/ft² uplift force</td>
</tr>
<tr>
<td>Puncture Resistance with 8oz. non-woven geotextile both sides</td>
<td>ASTM D4833</td>
<td>286 lbs. (travel of probe = 0.756 inches) (same as geotextile tested separately)</td>
</tr>
<tr>
<td>Flame Spread</td>
<td>ASTM E108</td>
<td>Class A with top coat (comparable to UL790)</td>
</tr>
<tr>
<td>Electric Volume Resistivity</td>
<td>ASTM D257</td>
<td>1.91 x 10¹⁰ ohms-cm</td>
</tr>
</tbody>
</table>

C. Agency Approval


D. Protection - On horizontal surfaces, use: (a) [Mirafi 1120N] Geotextile, followed by 2 inches of sand. The geotextile protection course shall be placed above the membrane. A 2-inch course of clean sand shall be placed below the membrane. On vertical surfaces, use [LIQUID BOOT® UltraDrain 6200] drain mat or equivalent.

E. Geotextile – [Typar 3401 non-woven geotextile], unless otherwise specified and approved by membrane manufacturer. The heat-rolled side shall be used as the application surface.

PART 3 EXECUTION

3.1 Examination

A. All surfaces to receive gas vapor barrier shall be inspected and approved by the applicator and inspector at least one day prior to commencing work.

3.2 Surface Preparation

The application surface shall be prepared and provided to the applicator in accordance with manufacturer’s specifications listed below:

A. Concrete/Shotcrete/Masonry

1. Concrete surfaces shall be light broom finish or smoother, free of any dirt, debris, loose material, release agents or curing compounds. Fill all voids more than ¼-inch deep and ¼-inch wide. Masonry joints, cold joints, and form joints shall be struck smooth.
2. All penetrations shall be prepared in accordance with manufacturer’s specifications. Provide a ¾-inch minimum cant of [LIQUID BOOT®], or other suitable material as approved by manufacturer, at all horizontal to vertical transitions and other inside corners of 120 degrees or less. Allow to cure before the application of [LIQUID BOOT®]. If [LIQUID BOOT® Trowel Grade] is used for the cant, allow to cure overnight (12 hours minimum) before the application of [LIQUID BOOT®].

3. All cracks or cold joints greater than 1/16 inch must be completely grouted with non-shrink grout as approved by engineer.

4. Install Hardcast reinforcing tape over all cold joints, cracks and form tie holes (after holes and cracks are grouted).

B. Soil and Gravel

1. The soil subgrade shall be moisture conditioned and compacted as specified by registered geotechnical engineer. The finished surface shall be smooth, uniform, free of debris and standing water. Prior to placement of gravel layer, a 4-oz. woven geotextile filter fabric ([Mirafi 140N] or equivalent) shall be placed. (NOTE: Aggregate sub-bases shall be rolled flat). All penetrations shall be prepared in accordance with manufacturer’s specifications. All form stakes that penetrate the membrane shall be of rebar, which shall be bent over and left in the slab.

2. Trenches shall be cut oversize to accommodate waterproof membrane and protection course with perpendicular to sloped sides and maximum obtainable compaction. Adjoining grade shall be finish graded and compacted. Excavated walls shall be vertical or sloped back, free of roots and protruding rocks. Specific sub-grade preparation shall be designed by a qualified civil or geotechnical engineer.

3. If organic materials with potential for growth (i.e.: seeds or grasses) exist within the subbase, spray apply soil sterilant at the sterilant manufacturer’s recommended rate.

C. Foundation Vent Piping

1. The foundation vent piping system installed within the gravel layer below the membrane shield is designed so that all portions of the foundation are within 30 feet from a ventilation pipe. The ventilation pipes will be a minimum [4-inch] slotted ADS drain pipe or approved equal. The total pipe perforated area will not be less than 5% of the total surface area of the pipe. Ventilation pipe shall not pass through any of the column footings. Ventilation pipes passing through the grade beams shall be sleeved in accordance with the methane plan details.

3.3 Installation On Concrete/Shotcrete/Masonry

A. Refer to section 3.5, "Sealing Around Penetrations", for procedures to seal around penetrations.
B. Provide a ¾-inch minimum cant of [LIQUID BOOT®], or other suitable material as approved by manufacturer, at all horizontal to vertical transitions and other inside corners of 120 degrees or less. Allow to cure before the application of [LIQUID BOOT®]. If [LIQUID BOOT® Trowel Grade] is used for the cant, allow to cure overnight (12 hours minimum) before the application of [LIQUID BOOT®].

C. For vertical surfaces, delineate a test area on site with a minimum dimension of 10 feet by 10 feet (3m by 3m). Apply [LIQUID BOOT®] to a thickness of [100 mils] and let it cure for 24 hours. Observe for blisters. If minor or no blistering occurs, proceed to the next step. (See note regarding blisters). If significant blistering does occur, apply a thin (10 mil) tack coat of [LIQUID BOOT®] “A” side without catalyst to the entire concrete surface and allow to cure before proceeding. (See also information regarding blister repair).

D. Spray apply [LIQUID BOOT®] to a [100 mil] minimum dry thickness. If a second coat is required, remove any standing water from the membrane before proceeding with the second application.

E. Do not penetrate membrane. Keep membrane free of dirt and debris and traffic until a protective cover is in place. It is the responsibility of the General Contractor to insure that the membrane and the protection system are not penetrated.

F. After membrane has cured and checked for proper thickness and flaws, install protection material pursuant to manufacturer’s instructions.

NOTE: All testing or inspection to be performed prior to placing protection course.

NON-HORIZONTAL SURFACES: Spray on non-horizontal surfaces should begin at the bottom and work towards the top. This method allows the product to adhere to the surface before hitting catalyst runoff.

NOTE: Due to the nature of concrete as a substrate, it is normal for some blistering to occur. This is caused by either concrete's tendency to off-gas or water that is temporarily trapped between the concrete and the membrane. With time and the applied pressure of backfill or over-slab, blisters will absorb into the concrete without detriment to the membrane.

A small number of blister heads should be sampled and checked for proper membrane thickness. If the samples have the minimum required membrane thickness, then the remaining blisters should not be punctured or cut. If the samples have less than the minimum required membrane thickness, then the area can either be resprayed to obtain the proper thickness, or the blisters can be cut out and the area resprayed or patched with [LIQUID BOOT® Trowel Grade].

3.4 Installation On Gravel Surfaces

A. Apply a 4-oz. woven geotextile filter fabric ([Mirafi 140N] or equivalent) followed by a minimum 2-inches of sand. Roll out geotextile application base ([Typar 3401]) on sub-grade with the heat-rolled side facing up. Overlap seams a minimum of 6-inches. Lay geotextile tight at all inside corners. Apply a thin (10 mil) tack coat of [LIQUID BOOT®] “A” side without catalyst within the seam overlap.
Line trenches with geotextile extending at least 6-inches onto adjoining sub-grade if slab and footings are to be sprayed separately. Overlap seams a minimum of 6-inches. Lay geotextile tight at all inside corners. Apply a thin (10 mil) tack coat of [LIQUID BOOT®] "A" side without catalyst within the seam overlap.

B. Minimize the use of nails to secure the geotextile to the subgrade. Remove all nails before spraying membrane, if possible. Nails that cannot be removed from the subgrade are to be patched with geotextile or Hardcast reinforcing tape overlapping the nail head by a minimum of 2-inches. Apply a thin tack coat of [LIQUID BOOT®] under the geotextile patch, when patching with geotextile.

C. Refer to Section 3.5, "Sealing Around Penetrations", for procedures to seal around penetrations.

D. Spray apply [LIQUID BOOT®] onto geotextile to an [100 mil] minimum dry thickness. If a second coat is required, remove any standing water from the membrane before proceeding with the second application.

E. Do not penetrate membrane. Keep membrane free of dirt, debris and traffic until a protective cover is in place. It is the responsibility of the General Contractor to insure that the membrane and the protection system are not penetrated.

F. After membrane has cured and checked for proper thickness and flaws, install protection material pursuant to manufacturer's instructions.

NOTE: All testing or inspection to be performed prior to placing protection course.

3.5 Sealing Around Penetrations

A. Clean all penetrations. All metal penetrations shall be sanded clean with emery cloth.

B. For applications requiring geotextile, roll out geotextile on sub-grade with the heat-rolled side facing up, overlapping seams a minimum of 6-inches. Cut the geotextile around penetrations so that it lays flat on the sub-grade. Lay geotextile tight at all inside corners. Apply a thin (10 mil) tack coat of [LIQUID BOOT®] "A" side without catalyst within the seam overlap.

C. At the base of penetration install a minimum ¾-inch thick membrane cant of [LIQUID BOOT®], or other suitable material as approved by manufacturer. Extend the membrane at [100 mil] thickness up the penetration a minimum of 3-inches and a minimum of 3-inches on the substrate. Allow to cure before proceeding to D, the application of [LIQUID BOOT®]. If [LIQUID BOOT® Trowel Grade] is used for the cant, allow to cure overnight (12 hours minimum) before the application of [LIQUID BOOT®].

D. Spray apply [LIQUID BOOT®] membrane at a [100 mil] thickness three inches (3") around the base of penetration and up the penetration, completely encapsulating the collar assembly, to a height of one and 1½-inches minimum above the membrane as described in C above.

E. Allow [LIQUID BOOT®] to cure completely (8 hours minimum) before proceeding to step "F".
F. Wrap penetration with polypropylene cable tie at a point 2-inches above the base of the penetration. Tighten the cable tie firmly so as to squeeze, but not cut, the cured membrane collar.

3.6 Field Quality Control

A. General

Field Quality Control is a very important part of all [LIQUID BOOT®] applications. Applicators should check their own work for coverage, thickness, and all around good workmanship before calling for inspections.

1. The membrane must be cured at least overnight (12 hours minimum) before inspecting for dry-thickness, holes, shadow shrinkage, and any other membrane damage. If water testing is to be performed, allow the membrane to cure at least 72 hours prior to the water test.

2. When thickness or integrity is in question the membrane should be tested in the proper manner as described below. However, over-sampling defeats the intent of inspections. Inspectors should always use visual and tactile measurement to guide them. Areas suspected of being too thin to the touch should be measured with the gauges to determine the exact thickness.

B. On Concrete/Shotcrete/Masonry & Other Hard Surfaces

1. Membrane may be checked for proper thickness with a blunt-nose depth gauge, taking one reading every 500 square feet. Record the readings. Mark the test area for repair, if necessary.

2. If necessary, test areas are to be patched over with [LIQUID BOOT®] to a [100 mils] minimum dry thickness, extending a minimum of 1-inch beyond the test perimeter.

C. On Soil And Gravel Substrates

1. Samples may be cut from the membrane and geotextile sandwich to a maximum area of 2 square inches. Measure the thickness with a mil-reading caliper, per 500 square feet. Deduct the plain geotextile thickness to determine the thickness of [LIQUID BOOT®] membrane. Mark the test area for repair.

2. Voids left by sampling are to be patched with geotextile overlapping the void by a minimum of 2-inches. Apply a thin tack coat of [LIQUID BOOT®] under the geotextile patch. Then spray or trowel apply [LIQUID BOOT®] to a [100 mils] minimum dry thickness, extending at least three 3-inches beyond geotextile patch.

D. Smoke Testing

The membrane installation contractor shall smoke test the membrane applied on horizontal surfaces for leaks. This involves pumping smoke under the membrane and checking for leaks using the following procedure:
1. The gas membrane shall be visually inspected. Any apparent deficiencies and/or installation problems shall be corrected prior to smoke testing.

2. Smoke testing of the [Liquid Boot®] membrane to be conducted by approved [Liquid Boot®] applicator and observed by qualified inspector as designated.

3. The date, time, testing reference area, temperature, wind speed/direction, and cloud cover shall be recorded on the smoke testing record. The ambient air temperature at the time of testing should be in excess of 45° f and the wind speed at ground level should be 15 mph or less. (note: visual identification of leaks becomes more difficult with increasing wind speed.)

4. Delineate a smoke testing area of 2,000 - 5,000 ft² (maximum). Assemble and situate smoke testing system to inject smoke beneath membrane. Only inert, non-toxic smoke is to be utilized for membrane smoke test.

5. Designate testing control areas by cutting openings in an “x” pattern (min. 4” x 4”) in the membrane at selected locations. Mark testing control areas for identification prior to conducting the smoke test.

6. Activate smoke generator / blower system (nominal 150 – 950 cfm). Apply sufficient pressure as to ensure that smoke will permeate the designated testing area. For verification, ensure that smoke is leaking through testing control areas.

7. Pump smoke beneath the membrane (min. 1 – 2 minutes). Observe for leaks in the membrane. Reduce pressure / flow rate if excessive lifting of the membrane occurs.

8. Thoroughly inspect entire membrane surface within area delineated for testing. Use marking device as approved by [LBI Technologies Inc.] To mark / label any leak locations. Mark / label leak locations on floor plan and corresponding testing reference area.

9. Repair leak locations marked in step #7 by spraying [Liquid Boot®] or using [trowel grade liquid boot®].

10. Repeat step #’s 7 and 8, as necessary to confirm integrity of the membrane.

11. Once the membrane has passed the smoke test inspection, the successful completion should be documented and signed off by a qualified inspector as delineated by the engineer, general contractor, or owner.

3.7 Utility Trench Dams

A. Utility trench dams shall be placed for new trenches entering the building. Trench dams will have a minimum length twice the width of the trench or 36-inches. Trench dam material shall consist of 2-sack cement sand slurry with added 2% bentonite by weight of active ingredients.

3.8 Electrical Conduit Seals
A. New electrical conduits placed below grade shall be of the type permitted by, and provided with seals as required by the appropriate sections of Article 501 of the National Electrical Code for Class 1, Division 1, Group D locations.

END OF SECTION
PART 1 GENERAL

1.1 Summary

A. Section Includes:

1. Reinforcing bars for cast-in-place concrete.
2. Reinforcing mesh for cast-in-place concrete.
3. Accessories, including but not limited to, chairs and tie wires.
4. Reinforcing bars for site-cast precast concrete.
5. Miscellaneous concrete work, including but not limited to areaways, cast-in-place valve boxes, pits, splash blocks, equipment bases, and other items as shown or required to complete all Work.

B. Related Work Specified Elsewhere:

1. Division 1 Sections.
2. Submittals per Sections [01305] and [01330] except as specified herein.

1.2 Submittals

A. Shop Drawings: Submit including complete layouts, sections, and details for placement of reinforcing, typical bending diagrams and offsets, splice lengths and locations, proposed layout where vertical and horizontal bars intersect, and wherever welding is proposed, detailed to conform to AWS and City of Los Angeles Building Code requirements. After approval of initial submission, subsequent submittal may be waived.

B. Product Data: Manufacturer’s product data, specifications, and installation instructions for proprietary materials and accessories.

C. Mill Certificates: Steel producer’s certificates of mill analysis, tensile and bend tests for reinforcing steel.

D. Certification: Submit copies of welding operator's certificate.

E. Chemical Analysis: Provide for bars to be welded, in accordance with City of Los Angeles Building Code.

1.3 Quality Assurance

A. Source Quality Control: Refer to Division 1 for general requirements and to following paragraphs for specific procedures. Testing Laboratory engaged and paid for by Contractor shall perform following conformance testing, shall select...
test samples of bars, ties, and stirrups from the material at the site or from place of distribution, each sampling including at least two 18" long pieces, and perform the following tests according to ASTM A615.

1. Identified Bars: If samples are obtained from bundles as delivered from the mill, identified as to heat number, accompanied by mill analyses and mill test reports, and properly tagged with Identification Certificate so as to be readily identified, perform 1 tensile and 1 bend test for each 10 tons or fraction thereof of each size of bars. Submit mill reports when samples are selected.

2. Unidentified Bars: When positive identification of reinforcing bars cannot be made and when random samples are obtained, perform tests for each 2.5 tons or fraction thereof, 1 tensile and 1 bend test from each size of bars.

B. Certification of Welders: All welding both in shop and in field shall be performed by certified welding operators

1.4 Marking and Shipping

A. Bundle bars, tag with identification and transport and store so as not to damage any material. Use metal tags indicating size, length and other marking shown on placement drawings. Maintain tags after bundles are broken.

PART 2 PRODUCTS

2.1 Materials

A. Reinforcing bars: ASTM A615, Grade [60], unless otherwise indicated on drawings.

B. Reinforcing bars for wall boundary elements and welding: ASTM A706, Grade [60].

C. Reinforcing mesh: ASTM A185, mesh size and gauge as shown, [60] ksi minimum tensile strength. Provide mesh in flat sheets only.


E. Chairs and similar support items:


2. Use dense precast concrete supports with embedded wire ties for reinforcement placed on grade. Elsewhere, use wire bar supports.

F. Welding electrodes: AWS D1.4, Table 5.1 and 5.5 low hydrogen electrodes, [E9018 for Grade 60 steel].

G. Reinforcing bar couplers: Contractor shall submit proposed coupler and proposed location for review and approval by the ENGINEER.

2.2 Fabrication of Reinforcing Bars

B. Bending and Forming: Fabricate bars of the indicated sizes and bend and form to required shapes and lengths by methods not injurious to materials. Do not heat reinforcement for bending. Bend bars No. 6 size and larger in the shop only. Bars with unscheduled kinks or bends are subject to rejection. Use only tested and approved bar materials.

C. Welding: Use only ASTM 706 steel where welding is proposed. Perform welding, where shown or approved, by the direct electric arc process in accordance with AWS D1.4 using specified low-hydrogen electrodes. Preheat 6" each side of joint. Protect joints from drafts during the cooling process; accelerated cooling is prohibited. Do not tack weld bars. Clean metal surfaces to be welded of all loose scale and foreign material. Clean welds each time electrode is changed and chip burned edges before placing welds. When wire brushed, the completed welds must exhibit uniform section, smooth welded metal, feather edges without undercuts or overlays, freedom from porosity and clinkers, and good fusion and penetration into the base metal. Cut out welds or parts of welds found defective with chisel and replace with proper welding. Prequalification of welds shall be in accordance with City of Los Angeles Building Code.

D. Galvanizing: Hot-dip galvanize fully completed reinforcing assemblies in accordance with ASTM A123 where indicated.

PART 3 EXECUTION

3.1 Installation of Reinforcing

A. Provide additional reinforcing bars at wall and slab openings as required. Before placing bars, and again before concrete is placed, clean bars of loose mill scale, oil, or any other coating that might destroy or reduce bond.

B. Securing in Place: Accurately place bars and wire tie in precise position where bars cross. Bend ends of wire ties away from the forms. Wire tie bars to corners of ties and stirrups. Support bars according to the current edition of "Recommended Practice for Placing Bar Supports" of Concrete Reinforcing Steel Institute, using approved accessories and chairs. Place precast concrete cubes with embedded wire ties to support reinforcing steel bars in concrete placed on grade and in footings. Use care not to damage vapor barriers where they occur.

C. Exposed Concrete Surfaces: Provide stainless steel or exterior quality vinyl plastic tipped chairs, bolsters, and accessories where exposed on exterior or interior concrete surfaces not to be painted or permanently covered.

D. Clearances: Maintain minimum clear distances between reinforcing bars and face of concrete as indicated or directed.

E. Splices: Do not splice reinforcing bars at the points of maximum stress except where indicated. Lap splices as shown or required to develop the full strength or stress of bars. Stagger splices in horizontal wall bars at least 48" longitudinally in alternate bars and opposite faces.

F. Field Welding of Bars: As specified for fabrication.
G. Maintaining Bars In Position: Take adequate precautions to assure that reinforcing position and spacing is maintained during placement of concrete.

H. Reinforcing Mesh: Lap one full mesh plus 2", or 6" whichever is greater, at splices, wire tie, and support the same as specified for bars.

I. Splice Devices:
   1. Contractor shall submit proposed coupler and proposed location for review and approval by the structural engineer.
   2. Install in accordance with manufacturer's written instructions.
   3. Splice in a manner developing at least 125% of the yielding strength of the bar.

3.2 Field Quality Control

A. Inspection: Obtain inspection and approval by Contractor’s Independent Testing/Inspection Laboratory of reinforcing before concrete is placed.

B. Welding Inspection. Whether welding is done in the shop or at the site, perform welding of reinforcing bars under inspection of the Contractor’s Independent Testing/Inspection Laboratory Welding Inspector.

END OF SECTION
PART 1 - GENERAL

1.01 Description

A. Work included: Provide labor, material, tools, equipment appliances, transportation and services required to completely furnish and install post-tensioning for cast-in place concrete, all as shown on the Drawings and herein specified, including but not limited to the following:

1. Furnishing, installation and stressing or post-tensioning tendons or strands.
2. Furnishing and installation of anchorages, distribution plates, spacers and tendon enclosures.

B. Related Work Specified Elsewhere:

1. Cast-in-Place Concrete - Section [03300].
2. Concrete Reinforcement - Section [03200].
3. Patching of blockouts for anchorage: See Sections [03300 & 03340].
4. Concrete Formwork - Section [03100].
5. Quality Control - Section [01400].

1.02 References, Codes and Standards

A. The following references, codes and standards are hereby made a part of this Section and prestressing work shall conform to the applicable requirements therein except as otherwise specified herein or shown on the Drawings. Nothing contained herein shall be construed as permitting work that is contrary to code requirements.

4. "Recommendations for Concrete Members Prestressed with Unbonded Tendons", ACI 423.3R-8.

1.03 Qualifications

A. Prestressing work shall be performed by an organization that has successfully performed previous installations of a major nature similar to the one involved in this Contract for a minimum of five (5) years.
1.04 Source Quality Control

A. Prestressing steel shall be tested for tensile strength and elongation at rupture. Two (2) tests shall be made for each reel, heat or lot number and shall be tagged for identification purposes. Each size of wire, strand or bar to be shipped to the site shall be assigned as individual lot number and shall be tagged accordingly.

B. If adequate information concerning the suitability of prestressing system cannot be furnished to the Owner's Representative's Consultant, the Owner's Representative's Consultant may require tests to be made of the system. Contractor shall bear costs of these tests.

C. Tests shall be performed by the Owner's Representative's Consultant's testing agency.

D. Costs of testing will be paid by the Contractor, if the work is found defective.

E. Furnish materials handling which testing agency requires for analysis. Samples so submitted shall be accompanied by vendor's certification that the samples are representative of the materials to be furnished.

F. The following is subject to Special Inspection as per Uniform Building Code.

   1. Placing of tendons and reinforcing steel.
   2. Placing of concrete for prestressed elements.
   3. Stressing and grouting operations.

1.05 Submittals

A. Shop Drawings: Include the following:

   1. Tendon layout and dimensions locating tendons in horizontal plane at all points. Detail horizontal curvature of tendons at block-outs and anchorages. Show openings in slabs and beams.

   2. Provide tendon profiles showing chair heights and locations, and any required placement steel. Show clearly the location of each tendon and the method of tendon support.

   3. Furnish details of reinforcement around stressing pockets and closures, or where interference with tendons may occur.

   4. Include calculations of friction losses, elongations and long-term stress losses on shop drawings to determine that design forces are obtainable.

   5. Show required elongation of each tendon at jacking point.

B. Manufacturer's Data

   1. Furnish complete prestressing procedure to include the following:

      a. Jacking force and jacking pressure.
b. Maximum temporary jacking force and jacking pressure.

c. Certified jack calibrations and method of jack identification (use no non-calibrated jack and pump combination on the job).

d. Method of determining slack, if any.

e. Method of determining anchor force, or force remaining in tendons after anchoring.

2. Furnish method of burning off excess tendon after anchorage.

3. Provide Method of sealing tendons.

4. Provide grouting method (if used).

5. Provide manufacturer's written certification that post-tensioning materials are of strengths specified.

C. When reviewed and returned, the shop drawings and data shall not be changed nor shall construction operations be deviated from, unless resubmitted and reviewed.

D. Review of details and construction operations will not relieve the Contractor of his responsibility for completing the Work successfully in accord with Contract Drawings and Specifications.

1.06 Record Documents

A. Provide Record Documents showing actual installed locations of post-tensioning tendons.

1.07 Protection

A. Prestressing steel shall be satisfactorily protected from rust or other physical damage prior to placement and shall be free from detrimental substances when tensioned. Apply corrosion protection, such as grease cap, to stressing end.

PART 2 - PRODUCTS

2.01 Materials

A. Prestressing Steel:

1. Prestressing steel shall be high-tensile cold-drawn wire conforming to ASTM Designation A421-77; high-tensile cold-drawn wire strand conforming to ASTM Designation A416-74; or high-tensile alloy bars. High-tensile alloy bars shall have a minimum ultimate tensile strength of 145,000 psi. Minimum elongation for high-tensile alloy bars shall not be less than 5% in a 10-inch gauge length.
High-tensile alloy bars shall be proof-loaded to 80% of their minimum specified ultimate strength.

2. Broken strands and strands showing severe fabrication defects shall be removed and replaced.

3. All prestressing steel within every group of the same type of members, shall be of the same heat where practicable. All steel shall be assigned a heat number and tagged accordingly.

4. Unbonded tendons for post-tensioning shall be coated with a rust-preventative, lubricating mastic and enclosed in a sheath that will permit the stressing of the tendons after the concrete has attained the proper strength. The sheathing should have been applied using a hot extrusion process. Torn and damaged wrapping shall be patched and sealed off before placing concrete.

B. Distribution Plates and Anchorages:

1. Post-tensioned prestressing steel shall be secured at the ends by means of approved anchoring devices which shall be of such nature that wires will not kink, break down or otherwise be damaged.

2. Anchorage devices shall hold the prestressing steel without slip of more than 1/8 inch at a load equal to the applied load on the wire at prestressing.

3. Distribution plates shall consist of welded steel or cast steel bearing assemblies that will permanently support and distribute the load from the anchoring devices and shall develop at least 95% of the maximum specified ultimate strength of the prestressing steel without exceeding anticipated set.

4. Anchorage Stresses:

   a. The maximum concentrated bearing stress in the concrete shall not exceed that permitted by ACI 318.

   b. Bending stresses in the plates induced by the pull of the prestressing steel shall not exceed 20,000 psi for structural steel and 15,000 psi for cast steel, except as experimental data may indicate that higher stresses are satisfactory. For higher strength steel, corresponding stresses may be permitted.

   c. Materials shall meet requirements of ASTM A36-77a for structural shapes, or ASTM A148-73 for cast steel, or higher quality materials as required to meet stress requirements. Use the latest ASTM standards.

   d. Design, fabrication and erection shall meet the latest AISC Standard: Welding - AWS Standards including Qualification Test of Welders.

   e. Bolts and nuts shall be high-tensile bolts and nuts when so called for on the Drawings and shall conform to ASTM A325-78a. Use the latest ASTM standard.

   f. Distribution plates may be omitted if the bearing area of any anchoring device is sufficiently large so that the local concentrated bearing
compressive stresses do not exceed the stresses permitted above or cause local failure.

5. Couplers, if used, shall be of high-strength, stress relieved steel to develop the full strength of the tendon to be coupled.

PART 3 - EXECUTION

3.01 Placement

A. Inserts in concrete work shall be accurately installed and secured in place. This shall include all prestressing items, such as enclosures, tubes, ducts, spacer bars, anchorage, etc. The ENGINEER's approval of any powder driven studs shall be obtained before proceeding with the Work.

3.02 Stressing

A. Prestressing shall be done by methods and related equipment that are in conformance with generally accepted systems of prestressing. Approved variations of such generally accepted methods and equipment will be permitted provided equal results can be obtained.

B. The post-tensioning shall be accomplished after the concrete has attained a compressive strength of (3000) psi minimum as determined from tests on concrete cylinders, unless noted otherwise on the relating structural drawing.

C. Prestressing steel shall be stressed by means of hydraulic jacks, equipped with accurate reading calibrated hydraulic pressure gauges to permit the stress in the prestressing steel to be computed at any time. A certificated calibration curve shall accompany each jack. If inconsistencies between the measured elongation and the jack gauge reading occur, the jack gauges shall immediately be recalibrated.

D. Jacking from each end of the tendons shall be required when, in the opinion of the Owner's Representative's Consultant, there is excessive friction between the prestressing steel and the enclosures. Proper allowance shall be made in any case for friction losses and one tendon shall be checked for friction losses at the start of post-tensioning.

E. No tensioning shall be permitted until it is demonstrated that the prestressing steel is reasonably free and unbonded in the enclosure. Evidence that the steel is unbonded will be considered satisfactory if inward movement of steel is observed at one end of the tendon when a nominal pull is applied to the steel at the other end, or when an auxiliary mild steel wire placed in the enclosure for the full length of the enclosure can be pulled intact from the enclosure. An agreement not exceeding 7% between the observed and the expected elongation after prestressing will be considered satisfactory evidence.

F. The prestressing steel shall be anchored at an initial anchor force or stress that will result in the ultimate retention of the working or effective force or stress shown on the drawings.

G. End bearing forces shall be uniformly distributed, or an end block properly designed and reinforced for induced stresses shall be provided.

H. Safety precautions shall be taken to prevent workers from standing directly behind, above or in front of the jacks.

I. Do not burn off excess strand of tendon until the ENGINEER has been notified and verifies that stressing has been satisfactorily completed.
3.03 Field Quality Control

A. Inspections shall be performed by qualified testing agencies or individuals, as the ENGINEER may require to establish the acceptability of the Work. Inspection services shall be retained by the ENGINEER at his expense except that when inspections reveal that work is defective, the Contractor will bear all the expenses of uncovering exposure observation, inspection, testing and of satisfactory reconstruction.

B. Before any concrete is cast, an inspection of the strands and reinforcing shall be made. Ensure that the anchorages are aligned normal to the tendon.

C. Continuous inspection during stressing operations and certification of compliance with Drawings and Specifications will be performed.

D. Records shall be kept of elongation after seating and maximum tension applied to each tendon. At the time of stressing the first member of each type, the stresses in the individual tendons shall be checked to establish a procedure for ensuring uniform results.

END OF SECTION
PART 1 GENERAL

1.1 Summary

A. Section Includes:

1. Furnishing, placing, patching, and initial curing of cast-in-place concrete unless otherwise specified.
2. Grout and drypack, except as otherwise specified.
3. Placing of embedded anchor bolts and inserts.
4. Vapor barrier under interior floor slabs on grade.
5. Miscellaneous concrete work, including but not limited to areaways, cast-in-place valve boxes, pits, splash blocks, equipment bases, and other items as shown or required to complete all Work.

B. Related Work Specified Elsewhere:

1. Preparation and grading of earth subgrade under concrete per Sections [02230], [02260], and [03200].
2. Furnishing, erection, and removal of forms per Section [03100].
3. Furnishing and placing reinforcing for cast-in-place concrete per Section [03200].
4. Finishing and final curing of cast-in-place concrete per Section [03300].
5. Gravel fill under interior floor slabs per Section [02300].
6. Under slab vapor/methane membrane barrier per Section [03106].
7. Subslab drainage fill per Section [02620].
8. Metal decking per Section [05310].
9. Submittals per Section [01305] and [01330] except as specified herein.

1.2 Submittals

A. Shop Drawings: Submit shop drawings for all horizontal and vertical concrete showing dimensioned locations of all construction, control, and expansion joints. Show pour sequencing. Show details for constructing construction and expansion joints, and method of keying. Submit shop drawings showing all sleeves indicated on plan and coordinate with reinforcing spacing.
B. Concrete Mix Design Data: Submit for each type and compressive strength of concrete required signed and sealed by a registered Civil Engineer in the State of California to the ENGINEER.

C. Certificates: Certify that materials meet requirements of paragraph "Quality Assurance".

D. Delivery Tickets: With each transit truck, provide delivery ticket, signed by an authorized representative of the batch plant, containing all information required by ASTM C94, as well as time batched, type and brand of cement, cement content, maximum size of aggregate and total water content.

1.3 Quality Assurance

A. Compliance with Regulations: All materials shall comply with the current rules and regulations of the local air quality management district, with the rules regarding volatile organic compounds, and with FDA rules and regulations for dangerous substances in construction products.

B. Concrete Manufacturer: Furnish concrete from licensed commercial ready-mix concrete plants conforming to ASTM C94 and approved by City of Los Angeles Building Official. Requirements herein govern when exceeding ASTM C94.

C. Allowable Tolerances: Construct concrete conforming to the tolerances specified in ACI 117 "Recommended Tolerances for Concrete Construction and Materials", as applicable, unless exceeded by requirements of regulatory agencies or otherwise indicated or specified.

D. Source Quality Control: Refer to the following paragraphs for specific procedures. Concrete materials which, by previous tests or actual service, have shown conformance may be used without testing when so approved by the ENGINEER. Engage and pay for Testing Laboratory to perform following conformance testing.

1. Portland Cement: Furnish Mill Certificates, acceptable to the ENGINEER, showing conformance with requirements specified; otherwise, the Contractor’s Independent Testing/Inspection Laboratory shall test each 250 barrels of cement in accordance with ASTM C150.

2. Aggregate For Normal Weight Concrete: Test the aggregate before and after concrete mix is designed and whenever character of aggregate varies or source of material is changed. Include a sieve analysis. Obtain samples of aggregates at the dry batching or ready-mix concrete plant in accordance with ASTM D75 and perform tests for the following properties:

3. Lightweight Aggregates: Test the lightweight aggregates before mix is designed and whenever the character of aggregate varies or source is changed in accordance with ASTM C330. Include a sieve analysis and report on unit weights, deleterious substances, unburned or underburned lumps, loss on ignition, soundness, and staining materials.

1.4 Concrete Mix Designs
A. Contractor’s Independent Testing/Inspection Laboratory shall design concrete mixes for concrete requiring 28-day compressive strength exceeding 2,000 psi. Mix designs shall be stamped and signed by a registered Civil or Structural engineer licensed in the state of California. Contractor shall bear all costs for concrete mix designs.

1. Strength Requirements: Design mixes for structural concrete for minimum 28-day compressive strengths required by Drawings and Specifications. All mix designs for structural concrete shall be proportioned in accordance with Section 3.9 of ACI 301. If trial batches are used, the mix design shall be prepared by an independent testing laboratory and shall achieve an average compressive strength 1,200 psi higher than the specified strength. This over-design shall be increased to 1,400 psi when concrete strengths over 5,000 psi are used.

<table>
<thead>
<tr>
<th>Physical Properties, units</th>
<th>Test Method</th>
<th>Minimum values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sieve analysis</td>
<td>ASTM C136</td>
<td></td>
</tr>
<tr>
<td>Organic impurities</td>
<td>ASTM C40</td>
<td>Fine aggregate not darker than reference standard color</td>
</tr>
<tr>
<td>Soundness</td>
<td>ASTM C88</td>
<td>Loss after 5 cycles not more than 8% of coarse aggregate, nor more than 10% of fine aggregate</td>
</tr>
<tr>
<td>Abrasion</td>
<td>ASTM C131</td>
<td>Weight loss not more than 10.5% after 100 revolutions, 42% after 500 revolutions</td>
</tr>
<tr>
<td>Deleterious materials</td>
<td>ASTM C33</td>
<td></td>
</tr>
<tr>
<td>Materials finer than No. 200 sieve</td>
<td>ASTM C117</td>
<td>Not over 1% for gravel, 1.5% for crushed aggregate</td>
</tr>
<tr>
<td>Reactivity potential</td>
<td>ASTM C227, C289, C342</td>
<td>Ratio of silica released to reduction in alkalinity not to exceed 1.0.</td>
</tr>
<tr>
<td>Sand equivalent</td>
<td>ASTM D2419</td>
<td>California sand equivalent values operating range not below 71 percent</td>
</tr>
</tbody>
</table>
2. Basis of Mix Designs: Design all mixes for workability and durability of concrete. Control mixes in accordance with ACI 301. Make adjustments in water/cement ratios as necessary for required concrete strengths at the Contractor's expense. Calcium chloride, thiocyanates or admixtures containing more than 0.05% chloride ions are not permitted.

3. Maximum Aggregate Sizes: Not exceeding 3/4 of minimum clear space between bars and between bars and forms, nor larger than 1/5 of least dimensions between the forms. Design the mixes with 1" maximum size, except maximum 1-1/2" size for foundations and maximum 3/8" size at congested reinforcing or thin sections, when approved by the Owner’s Representative.

4. Lightweight Structural Concrete: Design for air-dry density of 112 lbs. per cubic foot maximum. With each mix design, include test reports showing that concrete covered by the mix design meets shrinkage test requirements specified under Article "Field Quality Control" herein, or include certified test reports showing conformance as furnished by ready-mix concrete manufacturer.

1.5 Delivery, Storage, and Handling

A. Deliver all materials in timely manner to ensure uninterrupted progress of the Work.

B. Store materials by methods that prevent damage and permit ready access for inspection and identification.

1.6 Project Site Conditions

A. Do not place concrete during rain or adverse weather conditions without means to prevent all damage. Conform to requirements specified hereinafter whenever concrete placement is required during cold or hot weather.

PART 2 PRODUCTS

2.1 Materials

A. Portland cement: Use [ASTM C150, Colton Cement Type III], from one approved source for all Architectural Concrete. Use [ASTM C150, Type II] cement from one approved source for all other concrete as indicated and approved by the ENGINEER.

B. Aggregates:


2. Lightweight aggregates: ASTM C330, expanded shale type coarse aggregate, dry loose weight maximum 38 lbs. per cubic foot, maximum 9/16" size; all aggregate vacuum or thermally fully saturated for pumped concrete.

C. Admixtures:
1. Chemical (Water Reducing) Admixture: ASTM C494, Type A, D, or E. Only one brand. When used, are subject to approval of the ENGINEER, and must reduce the mixing water at least 10% without entraining air in excess of 2% by volume. If the water reducing agent entrains more than 2% air, the water reduction shall be at least 12 %, but in no case shall the water reducing agent entrain air in excess of 4 %.


3. Pozzolan: ASTM C618, Class F or C Fly Ash, 100 lbs. maximum per cubic yard, containing 1% or less carbon. Fly ash shall not be used in excess of 15% by weight of total cement quantity.

4. Super-Plasticizers (High Range Water Reducers): ASTM C494, Type F or G. Master Builders "Rheobuild", Euclid "Eucon 37" or equal, capable of producing concrete which can be placed at 8-11” slump without segregation, capable of maintaining slump within 2” of that initially mixed for 2 hours, and of maintaining concrete temperature within 2° F. from time of batching for 2 hours minimum.

5. Concrete Waterproofing Admixture: Xypex Concentrate Admix C-1000 (standard set time) or C-2000 (extended set time), or approved equal that shall be of the cementitious crystalline type that chemically controls and permanently fixes a non-soluble crystalline structure throughout the capillary voids of the concrete. Use of waterproofing admixture shall be at locations specified per the Architectural drawings and shall follow all manufacturer recommendations for quantity and preparation.

D. Water: From potable domestic source.

E. Curing Materials:


2. Curing sheet: ASTM C171, non-staining white types.


F. Vapor barrier: At typical locations use under slab vapor/methane membrane barrier as specified in Section 03106.

G. Non-shrink grout:

1. Pre-package, non-metallic, non-gaseous when tested in accordance with ASTM C117, Grade C at fluid (flow cone) consistency of 20- to 30-seconds. Grout shall attain 7,500 psi compressive strength in 28-days at specified flow and shall not bleed. [Master Builders "Masterflow 928", Euclid Chemical Co. "Euco Hi-Flow Grout", L&M Construction Chemicals "Crystex"].
2. Epoxy grout where indicated: Multi-component, premeasured, fast-curing combination of thermosetting resins and inert fillers, [Master Builders "Ceilcote 648", Sikadur 42 Industrial Group-Pak by Sika Chemical Corporation, or Euclid "Euco High Strength Grout"].

H. Drypack: Field mixture of 1 part Portland cement to 2 parts fine aggregate mixed to a damp consistency such that a ball molded in the hands will stick together and hold its shape. At Contractor's option, the specified admixture may be added for increased workability at lower water/cement ratio. In lieu of field mixing, Contractor may use factory mixed drypack material, such as [Master Builders "SetGrout" or Euclid "Euco Dry Pack Grout"].

I. Expansion Joint Filler: Asphalt impregnated fiber or non-extruding foam type, conforming to ASTM D994 and D1751, or D1752.

J. Construction Joint Materials: "[Key-Kold]" or "[Kwik-Joint]", of profiles indicated.

K. Bonding Agent: "[Weld-Crete]", manufactured by [Larsen Products Co., P.O. Box 2127, Rockville, MD 20852, Master Builders "Concrese"], or equal.

L. Integral Color Concrete: As specified in Section [03331]

2.2 Concrete Mixing

A. Furnish ready-mixed concrete from an approved concrete batch plant. Conform to ASTM C94, except materials, testing, and mix designs as specified herein. Use transit mixer trucks equipped with automatic devices for recording number of revolutions of drum.

B. Admixtures: All approved admixtures shall be introduced into the concrete at the batch plant. Field additions are not acceptable.

C. Slump: Adjust quantity of water so concrete at point and time of placing does not exceed the following slumps when tested according to ASTM C143. Use the minimum water necessary for workability required by part of structure being cast.

<table>
<thead>
<tr>
<th>Part of Structure</th>
<th>Maximum Slump</th>
<th>Maximum Water Cement Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Footings, foundation walls, and mass concrete, not Reinforced</td>
<td>4</td>
<td>0.5</td>
</tr>
<tr>
<td>Slabs on grade, reinforced and non-reinforced</td>
<td>4</td>
<td>0.45</td>
</tr>
<tr>
<td>Reinforced concrete over 8&quot; thick</td>
<td>4</td>
<td>0.5</td>
</tr>
<tr>
<td>Reinforced concrete 8&quot; or less thick</td>
<td>4</td>
<td>0.5</td>
</tr>
</tbody>
</table>
All other concrete & 4 & 0.5

*If super-plasticizers are used, slumps may be 8”-10” for all concrete, with water-cement ratio unchanged or lower than slumps without admixture.

2.3 Slurry Concrete

A. Slurry concrete shall conform to requirements of this section for regular concrete, except that testing will not be required. Slurring concrete shall contain not less than 2 sacks of cement per cubic yard. Aggregate may be material selected from excavation, free from organic matter, or imported fill, conforming to the following gradation:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Percent passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-1/2&quot;</td>
<td>100</td>
</tr>
<tr>
<td>1&quot;</td>
<td>80 - 100</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>60 - 100</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>50 - 100</td>
</tr>
<tr>
<td>No. 4</td>
<td>40 - 80</td>
</tr>
<tr>
<td>No. 100</td>
<td>10 - 40</td>
</tr>
</tbody>
</table>

B. Sufficient water shall be added to produce a fluid, workable mix that will flow and can be pumped without segregation of aggregate. Materials shall be mechanically mixed until the cement and water are thoroughly dispersed.

PART 3 EXECUTION

3.1 Preparation For Concrete Placing

A. Remove all free water from forms before concrete is deposited. Remove hardened concrete, debris, and foreign materials from interior surfaces of forms, exposed reinforcing, and from surfaces of mixing and conveying equipment.

B. Wetting: Wet wood forms sufficiently to tighten up cracks. Wet other materials sufficiently to reduce adsorption and to help maintain concrete workability.

C. Earth Subgrade: Dampen 24 hours before placing concrete, but do not muddy. Re-roll where necessary for smoothness and remove loose material.

D. Gravel Fill: Recompact disturbed gravel and bring to correct elevation.

E. Sand Beds or Subslab Drainage Fill: Recompact disturbed material and bring to correct elevation.
F. Vapor Barrier: Install under interior floor slabs on grade. Lap joints 6" in the direction of concrete spreading and tape seal. Seal the joints at walls and around penetrations with tape. Cover barrier with 2" layer of clean damp sand.

G. Screeds: Set screeds at walls and maximum 8' centers between. Set to provide level floor. Check with an instrument level, transit, or laser during placing operation to maintain level floor.

H. Screeds Over Vapor Barrier: Use weighted pad or cradle type screeds and do not drive stakes through the vapor barrier. Check with an instrument level, transit, or laser.

I. Metal Floor Decking: Verify that decking joints are sealed and there are no openings or voids that will permit concrete leakage.

J. Expansion Joint Filler: Install where slabs abut buildings and elsewhere as indicated. Install full depth of concrete with top level with finished surface of concrete.

3.2 Concrete Placing

A. Conveying and Placing: Do not place concrete until the reinforcing steel, forms, or metal decking have been approved. Do not use aluminum tubes or any aluminum equipment for pumping concrete, nor allow concrete to free fall from its point of release at mixer, hoppers, tremies, or conveying equipment more than 6' for concealed concrete and 3' for exposed concrete. Deposit concrete so that the surface is kept level throughout, a minimum being permitted to flow from one portion to another. Place concrete in horizontal layers not more than 18" thick within 45 minutes after water is first added to the batch. Place concrete by methods that prevent segregation of materials.

1. Where new concrete is placed against or on old or existing concrete, apply bonding agent to properly prepared surface of old concrete prior to placement of new concrete.

B. Joints In Concrete: Locate joints only where approved, and obtain prior approval for points of stoppage of any pour. Clean and roughen the surface of construction joints by removing the entire surface and exposing 1/4" amplitude of clean aggregate solidly embedded in mortar matrix by sandblasting, chipping, use of an approved surface retarder, or equal. Water and keep hardened concrete wet for not less than 24 hours and slush with portland cement slurry just before placing joining concrete. Cover horizontal surfaces of existing or previously placed and hardened concrete with a 2" thick layer of fresh concrete less 50% of coarse aggregate just before balance of concrete is placed.

1. Exception: When using super-plasticizers, the free fall, horizontal layer thickness and time limitations may be doubled.

C. Compacting: Compact each layer of the concrete as placed with mechanical vibrators or equivalent equipment. Transmit vibration directly to concrete and in no case through the forms unless approved. Accomplish thorough compaction. Supplement by rodding or spading by hand adjacent to forms. Compact concrete into corners and angles of forms and around reinforcement and embedded fixtures. Recompact deep sections with congestion due to reinforcing steel as required.
D. Operation of Vibrators: Do not horizontally transport concrete in forms with vibrators nor allow vibrators to contact forms or reinforcing. Push vibrators vertically into the preceding layers that are still plastic and slowly withdraw, producing maximum obtainable density in concrete without creating voids or segregation. In no case disturb concrete that has partially set. Vibrate at intervals not exceeding two-thirds the effective visible vibration diameter of the submerged vibrator. Avoid excessive vibration that causes segregation. Use and type of vibrators shall conform to ACI 309 "Recommended Practice for Consolidation of Concrete".

E. Correction of Segregation: Before placing next layer of concrete, and at the top of last placement for vertical elements, remove concrete containing excess water or fine aggregate or showing deficiency of coarse aggregate and fill the space with compacted concrete of correct proportions.

F. Waterproof Membranes: Perform work adjacent to waterproof membranes to prevent damage to membranes. Arrange work so that membrane is left unprotected for minimum period of time, as approved. Prior to placing concrete, inspect the membrane and arrange for repair to all damage which may have occurred.

G. Slabs:

1. Float Finish: Place, consolidate, strike off and level concrete slab to proper elevation. Use highway straightedge, bull float or darby. Remove all bleed water. After the concrete has stiffened sufficiently to permit the operation, and water sheen has disappeared, the surface shall be floated, at least twice, to a uniform sandy texture. See [03301] for concrete floor finishes and [03532] for concrete floor topping.

2. On-Grade Slabs: Generally locate joints on column lines, exact locations as directed or approved. Submit joint locations and pour sequence for review and approval.

3. On-Grade Slab Construction and Contraction Joints: Use types as indicated at column lines intermediate locations.

4. Expansion Joints: Conform to details and approved submittal. Provide expansion joint filler finished flush with slab surface except for those joints shown to be sealed with sealant. Conform to Section [07920] “Joint Sealants” where sealant sealed joints are shown or specified, including the polymer joint filler, backing, and bond breaker.
5. Control Joints: Provide for concrete slabs as indicated. At Contractor's option, "Soff-Cut" saw may be used to depth of 1-1/4" immediately providing spalling or undercutting of the concrete does not occur, and in no case shall slab reinforcement be cut or damaged. Conventional saws shall be used as soon as possible without dislodging aggregate to 1/4 slab thickness. Complete sawing of joints within 12 hours after finishing is completed. If early sawing causes undercutting or washing of the concrete, delay the sawing operation and repair the damaged areas. The saw cut shall not vary more than 1/2" from the true joint alignment. Discontinue sawing if a crack develops ahead of a saw cut. Immediately after each joint is sawed, thoroughly clean the saw cut and adjacent concrete surface. Respray surfaces treated with curing compound which are damaged during the sawing operations as soon as the water disappears. Protect joints in a manner to prevent the curing compound from entering the joints. Conform to approved submittal.

3.3 Cold Weather Provisions

A. Normal Concrete: When the temperature is below 40°F, the temperature of the concrete placed in the forms shall be at least 60°F. When the temperature is below 30 degrees F, the temperature of the concrete as mixed shall be 65°F. In all cases, when the daily average temperature is below 40°F, the concrete shall be kept at 55°F for the 72 hours and then allowed to drop uniformly to the air temperature over the next 24 hours.

1. Concrete temperature shall be measured by placing a thermometer 2” below the top of the concrete being placed.

B. Air-entrained concrete shall be kept at the above temperature for 27 hours and above freezing for an additional 72 hours.

C. No calcium chloride shall be used to accelerate hardening of concrete. Contractor to certify that any additive used does not contain calcium chloride.

D. If low temperature accelerating admixture is proposed, adjust concrete mix as required and obtain approval of Owner's Representative.

E. All concrete materials, reinforcement, forming materials and ground with which concrete is to come in contact shall be free of frost.

F. The covering or other protection used in connection with the curing shall remain in place and intact for at least 24 hours.

G. The work shall be protected from the elements, flowing water, and defacements of any nature during the construction operations.

H. Conform to the provisions of A.C.I. 306, Recommended Practice for Cold Weather Concreting, except as modified herein.

3.4 Hot Weather Provisions

A. Conform to ACI 305R and the following requirements.
B. Take extra care to reduce the temperature of the concrete being placed, and to prevent rapid drying of newly placed concrete. When the outdoor ambient temperature is more than 90°F., shade the fresh concrete as soon as possible after placing, and start curing as soon as the surface of the fresh concrete is sufficiently hard to permit it without damage.

C. Concrete placement temperatures shall be controlled by the Contractor and shall not be limited to

1. Shading and cooling the aggregate;
2. Avoiding use of hot cement;
3. Cooling mixing water by additions of ice;
4. Insulating water supply lines and tanks; and
5. Insulating mixer drums or cooling them with sprays or wet burlap.

3.5 Curing Formed Concrete

A. Keep forms containing concrete in a wet condition until removed. Keep concrete continuously moist for not less than 7 days after placement. Keep concrete moist with a fine fog water spray until protected by curing media.

B. During times of dry or excessive winds, high ambient temperature, low humidity, or other ambient conditions causing rapid drying, use specified evaporation retardant and finishing aid material according to the manufacturer's instructions and cure concrete with a fine fog spray of water, or equal, applied both during and after finishing and continued until final curing operations are started.

C. Use the water curing method, curing sheet material, or a clear liquid membrane-forming curing compound except as otherwise specified.

D. Do not use any type of finishing or curing materials or methods that interfere with the correct application or bonding of subsequent materials; verify exact requirements as they apply to all applicable materials.

3.6 Patching Formed Concrete

A. Remove fins, projections, and offsets. Cut out rock pockets, honeycomb, and all other defects to sound concrete, with edges of cuts straight and back-beveled. Dampen cut-outs and edges, and scrub with neat portland cement slurry just before patching, or apply an approved epoxy concrete adhesive.

B. Saturate form tie holes with water and fill voids and patches with flush smooth-finished mortar of same mix as concrete (less coarse aggregate), cure, and dry.

3.7 Finishing Exposed Formed Concrete

A. Sack and patch as required to remove fins and correct errors.

3.8 Grouting and Drypacking
A. Install as indicated or required. Where grouting and drypacking is part of the work of other sections, it shall conform to the following requirements, as applicable.

B. Drypacking: Mix materials thoroughly with minimum amount of water. Install drypack by forcing and rodding to fill voids and provide complete bearing under plates. Finish exposed surfaces smooth and cure with damp burlap or liquid curing compound.

C. Non-Shrink Grouting:
   1. Mixing: Mix the approved non-shrink grout material with sufficient water per manufacturers recommendations.
   2. Application: Surfaces to receive the non-shrink grout shall be clean, and shall be moistened thoroughly immediately before placing the mortar. Before grouting, surfaces to be in contact shall be roughened and cleaned thoroughly, all loose particles shall be removed and the surface flushed thoroughly with neat cement grout immediately before the grouting mortar is placed. Place fluid grout from one side only and puddle, chain, or pump for complete filling of voids; do not remove the dams or forms until grout attains initial set. Finish exposed surfaces smooth, and cure as recommended by grout manufacturer.

3.9 Site Concrete Work

A. Use bituminous type joint filler. Cure all concrete for at least 10 days with liquid curing compound or sheet material except as otherwise specified. Construct all site concrete of 2,000 psi concrete unless otherwise indicated or specified. Provide reinforcing bars or mesh only where indicated. Conform to requirements specified here in before for slab finishing and curing as applicable.

B. Concrete Curbs: Provide 1/2" thick expansion joints, at beginning and at end of curves, intersections, and 20' intervals between, set plumb, square, and to same profile as the curbs. Edge curb tops to 1/2" radius and vertical joints to 1/4" radius. Apply smooth finish followed by fine hair brush finish.

C. Concrete Gutters: Provide 1/2" thick expansion joints as above for curbs and apply a light broom finish with a 3" wide steel trowel finish at flow line.

D. Combination Curb and Gutter: As above for curbs and gutters, including expansion joints, 3" troweled flow line at base of curb.

E. Concrete Walks: Provide 1/2" expansion joints as specified for curbs and where walks abut rigid structures, aligned with joints in curbs where adjoining, and apply light broom finish perpendicular to traffic direction. Score walks as shown or directed.

F. Control Joints: Provide sawed joints for concrete walks and exterior concrete pavement as indicated. Use "Zip Strip" as distributed by S.C.A. Construction Supply, Santa Fe Springs, Calif., or equal only where specifically indicated. Install tops of the joints flush with the concrete surface and depth of joint a minimum of 1/4 the thickness of slab.

3.10 Off-Site Concrete Work
A. Provide new concrete items where indicated, and replace existing items damaged by Contractor's operations. Secure and pay for required permits, inspections, engineering, and surveying.

3.11 Slurry Concrete

A. Slurry concrete shall be used as fill or backfill where indicated, and wherever excavations are carried below design depths without approval. Slurry concrete shall be placed within 1 hour after mixing, and shall be placed in manner that will prevent voids in, or segregation of, the concrete.

B. Backfilling over slurry concrete shall not be done less than 4 hours after placing.

3.12 Field Quality Control

A. Flatness and Levelness of Floors: Floors shall be measured for levelness and flatness as indicated below. Measurements shall be made within 24 hrs after placement of the slab and shall be reported to the ENGINEER as soon as possible and not later than 72 hrs after installation. All tests are to be performed prior to removing shoring. Proposed sectional boundaries for taking measurements shall be submitted to the ENGINEER for review and approval prior to pouring the slabs. In general, use one-half bay spacings, control and cold joint locations for sectional boundaries.

1. Concrete Slab Over Metal Deck: Use a minimum $F_I$ value of 20.

2. Poured in Place and Shored Slabs: Use a minimum $F_I/F_L$ value of 20/17.

$F_I$ and $F_L$ values shall be defined per ACI 302.1R-26. Where these tolerances are not met it shall be immediately be brought to the ENGINEER’s attention. Remedial measures can be conducted with approval of the ENGINEER but should remedial measures not be possible, the contractor shall remove and replace the portions of the slab that are not in conformance at the contractor’s expense.

B. Continuous Inspection: Construct structural concrete exceeding 2,000 psi compressive strength under continuous inspection of Deputy Inspector. Obtain inspection and approval of forms and reinforcing by Contractor’s Independent Testing/Inspection Laboratory three (3) working days before placing structural concrete in order to be verified by ENGINEER.

C. Testing of Concrete: Contractor’s Independent Testing/Inspection Laboratory shall perform following tests. Samples for testing shall be obtained in accordance with ASTM C172, and shall be taken from as close to point of placement as possible.

1. Compressive Strength Tests: Cast 1 set of 3 or more cylinders from each day's placing and each 50 cubic yards, or fraction thereof, or not less than once for each 2,000 square feet of surface area for slabs and walls, of each strength of structural concrete. Date cylinders, assign record number, and tag showing the location from which sample was taken. Also record slump test result of sample. Do not make more than 2 series of tests from any 1 location or batch of concrete.
2. **Test Cylinders:** Samples will be made in accordance with ASTM C172. Cast cylinders according to ASTM C31; 24 hours later, store cylinders under moist curing conditions at about 70°F. Test according to ASTM C39 at 7 and 28 day ages. The remaining cylinder shall be kept in reserve in case tests are unsatisfactory.

3. **Control Test Cylinders:** Cast a set of two or more cylinders for each day's placing of concrete for slabs supported on shoring. Place test cylinders on slabs represented by cylinders and cure the same as slabs. Test cylinders to determine proper times for removal of shores and reshoring. A strength test shall be the average of the compressive strengths of 2 cylinders made from the same sample of concrete and tested at 28 days.

**D. Tests for Lightweight Structural Concrete:** Perform following test for each 50 cubic yards of lightweight structural concrete.

1. Along with slump test, ASTM C143, and from same sample, determine air content, unit weight and yield per ASTM C138.

2. **Shrinkage Test:** Cast 4" by 4" by 11" long bars with 10" effective gauge length, cured for 7 days in moist room and as specified in ASTM C157. Make measurements at 7-day intervals to 35 day age. Allowable shrinkage shall not exceed 0.05% after period of 35 days.

3. **Previous Shrinkage Tests:** Ready-mix concrete manufacturer may furnish certified test reports from an approved Testing Laboratory as proof of meeting shrinkage requirements provided aggregates used and concrete covered by such test reports conform to the mix design approved for use on the Work.

**E. Core Tests:** If tests show the compressive strength of any concrete falls below the required minimum, additional testing of concrete which unsatisfactory tests represent may be required. Make core tests at approved locations according to ASTM C42. Fill core holes with drypack concrete of strength required for concrete. Contractor shall bear cost of tests for below-strength concrete even if such tests indicate concrete has attained required minimum compressive strength, and all costs for required corrections.

*END OF SECTION*
SECTION 03302
UNDER SLAB VAPOR BARRIER/RETARDER

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY
A. This Section includes under slab vapor barrier/retarder for installation under concrete slabs on grade within enclosed spaces, whether indicated on Drawings or not.
B. Related Sections include the following:
   1. Division 2 Section "Earthwork" for drainage fill under slabs-on-grade.
   2. Division 3 Section "Cast-in-Place Concrete" for general building applications of finished formed concrete.

1.03 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Samples: For vapor retarder.
C. Qualification Data: For Installer and manufacturer.
D. Material Certificates: For vapor retarders, signed by manufacturers:
E. Field quality-control test and inspection reports.
F. Minutes of preinstallation conference.

1.04 QUALITY ASSURANCE
A. Installer Qualifications: A qualified installer who employs on Project personnel qualified to install vapor barrier/retarder.
B. Source Limitations: Obtain vapor barrier/retarder materials of the same brand from the same manufacturer's plant.
C. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents: ACI 301, "Specification for Structural Concrete," Sections 1 through 5.

PART 2 - PRODUCTS
2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection: Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.

2.02 VAPOR RETARDERS

A. Plastic Vapor Retarder: ASTM E 1745, Class A. Include manufacturer's recommended adhesive or pressure-sensitive tape. Available Products:

1. [Fortifiber Corporation; Moistop Ultra A].
2. [Meadows, W.R., Inc.; Vapor Mat 15].
3. [Stego Industries, LLC.; Stego Wrap 15-mil Class A].
4. [Raven Industries Inc.; Vapor Block 15].

B. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

C. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a 3/8-inch sieve, 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; complying with deleterious substance limits of ASTM C 33 for fine aggregates.

PART 3 - EXECUTION

3.01 VAPOR RETARDERS

A. Plastic Vapor Retarders: Place, protect, and repair vapor retarders according to ASTM E 1643 and manufacturer's written instructions. Lap joints 6 inches and seal with manufacturer's recommended tape.

B. Granular Course: Cover vapor retarder with granular fill, moisten, and compact with mechanical equipment to elevation tolerances of plus 0 inch or minus 3/4 inch. Place and compact a 1/2-inch-thick layer of fine-graded granular material over granular fill.

3.02 FIELD QUALITY CONTROL

A. Testing and Inspecting: Contractor will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Inspections: Installation of vapor barrier/retarder including sealing of joints and penetrations.

END OF SECTION
SECTION 03331
CAST-IN-PLACE ARCHITECTURAL CONCRETE

PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

A. This Section specifies cast-in-place architectural concrete including form facings, reinforcement accessories, placement procedures, and finishes.

B. Related Sections include the following:

1. Division 3 Section "Cast-in-Place Concrete" for formwork; material, fabrication, and installation requirements for steel reinforcement; and field quality control.

2. Division 7 Section "Joint Sealants" for elastomeric joint sealants in contraction and other joints in cast-in-place architectural concrete.

1.3 Definitions

A. Cast-in-Place Architectural Concrete: Formed concrete that is exposed to view on surfaces of completed structure or building and that requires special concrete materials, formwork, placement, or finishes to obtain specified architectural appearance.


1.4 Submittals

A. Product Data: For each type of product indicated.

B. Formwork Shop Drawings: Show formwork construction including form-facing joints, rustications, construction and contraction joints, form joint-sealant details, form tie locations and patterns, inserts and embedments, cutouts, cleanout panels, and other items that visually affect cast-in-place architectural concrete.

1.5 Quality Assurance

A. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:

1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5 and Section 6, "Architectural Concrete."

2. ACI 303.1, "Specification for Cast-in-Place Architectural Concrete."
PART 2 - PRODUCTS

2.1 Form-Facing Materials
   A. General: Comply with Division 3 Section "Cast-in-Place Concrete" for formwork and other form-facing material requirements.
   B. Form-Facing Panels for As-Cast Finishes: Glass-fiber-reinforced plastic, or other approved nonabsorptive panel materials that will provide continuous, true, and smooth architectural concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   C. Form Ties: Comply with Division 3 Section "Cast-in-Place Concrete" for removable ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal. Furnish ties with tapered tie cone spreaders that, when removed, will leave holes 1-1/2 inches in diameter on concrete surface.

2.2 Steel Reinforcement And Accessories
   A. General: Comply with Division 3 Section "Cast-in-Place Concrete" for steel reinforcement and other requirements for reinforcement accessories.
   B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire fabric in place; manufacture according to CRSI's "Manual of Standard Practice."

2.3 Concrete Materials
   A. Cementitious Material: Comply with Division 3 Section "Cast-in-Place Concrete" for cementitious materials.

2.4 Admixtures
   A. Color Pigment: ASTM C 979, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, nonfading, and resistant to lime and other alkalis. Color: As selected by Architect from manufacturer's full range.

2.5 Curing Materials
   A. Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.6 Concrete Mixtures, General
   A. Admixtures: Use admixtures according to manufacturer's written instructions.
   B. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

PART 3 - EXECUTION

3.1 Formwork
A. General: Comply with Division 3 Section "Cast-in-Place Concrete" for formwork, embedded items, and shoring and reshoring.

B. In addition to ACI 303.1 limits on form-facing panel deflection, limit cast-in-place architectural concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows: Class A, 1/8 inch.

C. Fabricate forms to result in cast-in-place architectural concrete that complies with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

3.2 Reinforcement And Inserts

A. General: Comply with Division 3 Section "Cast-in-Place Concrete" for fabricating and installing steel reinforcement. Securely fasten steel reinforcement and wire ties against shifting during concrete placement.

B. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

3.3 Removing And Reusing Forms

A. Leave formwork for beam soffits, joists, slabs, and other structural elements that support weight of concrete in place until concrete has achieved at least 70 percent of 28-day design compressive strength. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Do not use split, frayed, delaminated, or otherwise damaged form-facing material. Apply new form-release agent.

3.4 Joints

A. Construction Joints: Install construction joints true to line with faces perpendicular to surface plane of cast-in-place architectural concrete so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

3.5 Concrete Placement

A. Before placing concrete, verify that installation of formwork, form-release agent, reinforcement, and embedded items is complete and that required inspections have been performed.

B. Deposit concrete continuously between construction joints. Deposit concrete to avoid segregation.

C. Hot-Weather Placement: Comply with ACI 30.
3.6 Finishes, General

A. Acid-Etched Finish: Use acid and hot-water solution, equipment, application techniques, and cleaning procedures to expose aggregate and surrounding matrix surfaces. Protect hardware, connections, and insulation from acid attach. Expose fine aggregate with occasional exposure of coarse aggregate and uniform color; with maximum reveal of 1/16 inch.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

C. Maintain uniformity of special finishes over construction joints, unless otherwise indicated.

3.7 Concrete Protecting And Curing

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.

B. Begin curing cast-in-place architectural concrete immediately after applying as-cast formed finishes to concrete. Cure according to ACI 308.1, by methods that will not mottle, discolor, or stain concrete:

3.8 Field Quality Control

A. General: Comply with Division 3 Section "Cast-in-Place Concrete" for field quality-control requirements.

3.9 Repairs, Protection, And Cleaning

A. Repair and cure damaged finished surfaces of cast-in-place architectural concrete when approved by Architect. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved mockups.

B. Clean cast-in-place architectural concrete surfaces after finish treatment to remove stains, markings, dust, and debris.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes shotcrete applied by the wet-mix process.
B. Related Sections
   1. Section [02300—Earthwork]
   2. Section [02315—Excavation and Fill]
   3. Section [02630—Storm Drainage]
   4. Section [07162—Cementitious Waterproofing]

1.3 DEFINITIONS

A. Shotcrete: Concrete pneumatically projected onto a surface at high velocity.
B. Wet-Mix Shotcrete: Shotcrete with ingredients, including mixing water, mixed before introduction into delivery hose.

1.4 SUBMITTALS

A. Product Data: For manufactured materials and products including reinforcement and forming accessories, shotcrete materials, admixtures, and curing compounds.
B. Shop Drawings: For details of fabricating, bending, and placing reinforcement. Include support and anchor details, number and location of splices, and special reinforcement required for openings through shotcrete structures.
C. Samples: Approximately 4’ by 8’ to illustrate quality of finishes, colors, and each texture of exposed surfaces of shotcrete.
D. Sample Panels should represent finished surfaces, texturing and coloring.
E. Design Mixes: For each shotcrete mix.
F. Material Test Reports: For shotcrete materials.
G. Material Certificates: For each material item, signed by manufacturers.

1.5 QUALITY ASSURANCE

A. Qualification of Shotcrete Contractor: The successful bidder will be required to use an approved and pre-qualified shotcrete subcontractor for this project.

1. In order to qualify as a specially-skilled craftsman for the shotcrete work on this project, submit the following with bid:

   a. A signed statement of experience certifying a minimum of 10 years in business and describing in detail experience in the construction of [textured artificial rockwork and earthwork].
   
   b. Photographic evidence and references of experience and ability to [construct artificial weathered granite rock faces and boulders, as well as natural soil].
   
   c. Upon request of the engineer, the Shotcrete Contractor MAY be required to submit three sample panels of shotcrete illustrating the texture, color, etc., required under this project, as directed by the engineer. Panels shall be 4’ x 4’.
   
   d. Submit with bid, full documentation of the construction crews, resumes of lead personnel, lists of specific personnel to be used and details of the experience of each person listed and their ability to perform the work to the ENGINEER's satisfaction.
   
   e. ENGINEER reserves the right to reject non-qualified shotcrete subcontractors based on qualification submittals.

B. Pre-Qualified Contractors:

1. The following is a list of pre-qualified Shotcrete Contractors:

   a. [The Larson Company, 6701 South Midvale Park Road, Tucson, Arizona 85746, tel: 520-294-3900].
   
   b. [CemRock Landscapes, 4798 South Julian Avenue, Tucson, Arizona, 85714, tel: 520-571-1999].
   
   
   d. [Rock & Waterscape Systems, #11 Whatney, Irvine, California, 92618, tel: 949-77091936].
   

C. Installer Qualifications: A qualified installer employing nozzle operators who attain mean core grades not exceeding 2.5, according to ACI 506.2, on preconstruction tests.

D. Testing Agency Qualifications: Independent and qualified according to ASTM C 1077 and ASTM E 329 for testing indicated, as documented according to ASTM E 548, and acceptable to authorities having jurisdiction.

E. Comply with provisions of the following, unless more stringent requirements are indicated:

   1. ACI 301, "Specification for Structural Concrete."
   3. CRSI's "Manual of Standard Practice."
F. Preconstruction Testing Service: Contractor will engage a qualified independent testing agency to perform preconstruction testing and inspections indicated below:

1. Produce test panels before shotcrete placement according to requirements in ACI 506.2 and ASTM C 1140 for each design mix, shooting orientation, and nozzle operator. Produce test panels with dimensions of 24 by 24 inches (600 by 600 mm) minimum and of average thickness of shotcrete, but not less than 3-1/2 inches (90 mm). From each test panel, testing agency will obtain six test specimens: one set of three specimens unreinforced and one set of three specimens reinforced. Agency will perform the following:

   a. Test each set of unreinforced specimens for compressive strength according to ASTM C 42.
   b. Visually inspect each set of reinforced shotcrete cores taken from test panels and determine mean core grades according to ACI 506.2.

G. Mockups: Before installing shotcrete, construct mockups for each finish required and for each design mix, shooting orientation, and nozzle operator to demonstrate aesthetic effects and set quality standard for installation.

H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 PROJECT CONDITIONS

A. Cold-Weather Shotcreting: Protect shotcrete work from physical damage or reduced strength caused by frost, freezing, or low temperatures according to ACI 306.1 and as follows:

   1. Discontinue shotcreting when ambient temperature is 40 deg F (4.4 deg C) and falling. Uniformly heat water and aggregates before mixing to obtain a shotcrete shooting temperature of not less than 50 deg F (10 deg C) and not more than 90 deg F (32 deg C).
   2. Do not use frozen materials or materials containing ice or snow.
   3. Do not place shotcrete on frozen surfaces or surfaces containing frozen materials.
   4. Do not use calcium chloride, salt, and other materials containing antifreeze agents.

B. Hot-Weather Shotcreting: Mix, place, and protect shotcrete according to ACI 305R when hot-weather conditions and high temperatures would seriously impair quality and strength of shotcrete, and as follows:

   1. Cool ingredients before mixing to maintain shotcrete temperature at time of placement below [100 deg F (38 deg C) for dry mix] [or] [90 deg F (32 deg C) for wet mix].
   2. Decrease temperature of reinforcing steel and receiving surfaces below 100 deg F (38 deg C) before shotcreting.

1.7 PHOTOGRAPHS

A. Photographs of natural formations displaying intended shapes, colors, forms and textures of the completed shotcrete work are available for the Contractor's reference. Photographs, drawings and the sample panels will form the comparative standard for the work executed.

1.8 SPECIAL INSPECTIONS
A. Special Inspections required for Shotcrete, City of Los Angeles, Department of Building and Safety.

1.9 ENGINEER’S DIRECTION

A. It is intended that the configuration, texturing and coloring of exposed shotcrete surfaces be executed under the detailed direction of the Architect, at least until such times as satisfactory examples of the desired character have been developed. Notify the ENGINEER at least seven (7) days before beginning placement of first example of each type of shotcrete to be exposed and schedule time when ENGINEER can observe and direct the finishing work as it is executed. Cooperate with the ENGINEER in developing finishing techniques which will produce the required profiles, textures, colors and embedments. Correct work not approved by ENGINEER.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Forms: Form-facing panels that will provide continuous, straight, smooth, concrete surfaces. Furnish panels in largest practicable sizes to minimize number of joints.

2.2 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706/A 706M, deformed.
C. Supports: Bolsters, chairs, spacers, ties, and other devices for spacing, supporting, and fastening reinforcing steel in place according to CRSI's "Manual of Standard Practice" and as follows:
   1. For uncoated reinforcement, use [CRSI Class 2, stainless-steel] bar supports.
D. Reinforcing Anchors: ASTM A 36/A 36M, unheaded rods or ASTM A 307, Grade A (ASTM F 568, Property Class 4.6), hex-head bolts; carbon steel; and carbon-steel nuts.

2.3 SHOTCRETE MATERIALS

A. Portland Cement: ASTM C 150, Type I or II. Use only one brand and type of cement for Project.
B. Normal-Weight Aggregates: ASTM C 33, from a single source, and as follows:
   1. Aggregate Gradation: ACI 506R, Gradation No. 1 with 100 percent passing 3/8-inch (10-mm) sieve.
   2. Coarse-Aggregate Class: 3S.
C. Water: Potable, complying with ASTM C 94, free from deleterious materials that may affect color stability, setting, or strength of shotcrete.
D. Carbon-Steel Fiber: ASTM C 1116, Type 1, carbon-steel fiber and ASTM A 820, Type 1, cold-drawn wire, not less than 1 inch (25 mm) long.

E. Synthetic Fiber: Fibrillated polypropylene fibers engineered and designed for use in shotcrete, complying with ASTM C 1116, Type III, not less than 3/4 inch (19 mm) long.

F. Ground Wire: High-strength steel wire, 0.8 to 1 mm in diameter.

G. Coloring Agent: ASTM C 979, natural or synthetic mineral-oxide pigments or colored, water-reducing admixtures, free of carbon black; color stable, nonfading, and resistant to lime and other alkalis.

1. Color: [As selected by ENGINEER from manufacturer’s full range].

H. Coloring Agent Manufacturer:

1. [SGS Concrete Colors, Solomon Colors, Springfield IL., 800-624-0261].

2.4 CHEMICAL ADMIXTURES

A. General: ASTM C 1141, Class A or B, but limited to the following admixture materials. Provide admixtures for dry-mix or wet-mix shotcrete that contains not more than 0.1 percent chloride ions. Certify compatibility of admixtures with each other and with other cementitious materials.

2. Water-Reducing Admixture: ASTM C 494, Type A.
3. Water-Reducing and Retarding Admixture: ASTM C 494, Type D.
4. Water-Reducing and Accelerating Admixture: ASTM C 494, Type E.
5. High-Range, Water-Reducing Admixture: ASTM C 494, Type F.
6. Accelerating Admixture: ASTM C 494, Type C.

2.5 CURING MATERIALS

A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) dry.

B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

C. Water: Potable.

D. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.6 SHOTCRETE MIXES, GENERAL

A. Prepare design mixes for each type and strength of shotcrete.

1. Limit use of fly ash ground granulated blast-furnace slag and silica fume to not exceed, in combination, 25 percent of portland cement by weight.

B. Limit water-soluble chloride ions to maximum percentage by weight of cement or cementitious materials permitted by ACI 301.
C. Admixtures: When included in shotcrete design mixes, use admixtures and retarding admixtures according to manufacturer's written instructions.

D. Carbon-Steel Fiber: Uniformly disperse in shotcrete mix, according to manufacturer's written instructions, at a rate of 50 lb/cu. yd. (30 kg/cu. m).

E. Synthetic Fiber: Uniformly disperse in shotcrete mix, according to manufacturer's written instructions, at a rate of 1.5 lb/cu. yd. (0.90 kg/cu. m).

F. Design-Mix Adjustments: Subject to compliance with requirements, shotcrete design-mix adjustments may be proposed when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant.

2.7 NORMAL-WEIGHT SHOTCRETE MIXES

A. Proportion dry mixes by field test data methods and wet mixes according to ACI 211.1 and ACI 301, using materials to be used on Project, to provide normal-weight shotcrete with the following properties:

2. Add air-entraining admixture at manufacturer's prescribed rate to result in normal-weight, wet-mix shotcrete having an air content before pumping of 7 percent with a tolerance of plus or minus 1-1/2 percent.

2.8 COLOR

A. Shotcrete Earth Texture. Use “Trail Dust” and “Desert Tan” integral color, one 25-lb. bag per 4 yards.

B. Shotcrete Rock Texture: Use “Onyx” integral color, one 25-lb. bag per 1 yard.

2.9 SHOTCRETE EQUIPMENT

A. Mixing Equipment: Capable of thoroughly mixing shotcrete materials in sufficient quantities to maintain continuous placement.

B. Wet-Mix Delivery Equipment: Capable of discharging aggregate-cement-water mixture accurately, uniformly, and continuously.

2.10 BATCHING AND MIXING

A. Wet-Mix Process: Measure, batch, mix, and deliver shotcrete according to ASTM C 94 [and ASTM C 1116] and furnish batch ticket information.

1. Comply with ASTM C 685 when shotcrete ingredients are delivered dry and proportioned and mixed on-site.

PART 3 - EXECUTION
3.1 PREPARATION

A. Concrete or Masonry: Before applying shotcrete, remove unsound or loose materials and contaminants that may inhibit shotcrete bonding. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1/2 inch (13 mm) deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders. Dampen surfaces before shotcreting.

1. Abrasive blast or hydroblast existing surfaces that do not require chipping to remove paint, oil, grease, or other contaminants and to provide roughened surface for proper shotcrete bonding.

B. Earth: Compact and trim to line and grade before placing shotcrete. Do not place shotcrete on frozen surfaces. Dampen surfaces before shotcreting.

C. Rock: Clean rock surfaces of loose materials, mud, and other foreign matter that might weaken shotcrete bonding.

D. Steel: Clean steel surfaces by abrasive blasting according to SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

3.2 FORMS

A. General: Design, erect, support, brace, and maintain forms, according to ACI 301, to support shotcrete and construction loads and to facilitate shotcreting. Construct forms so shotcrete members and structures are secured to prevent excessive vibration or deflection during shotcreting.

1. Fabricate forms to be readily removable without impact, shock, or damage to shotcrete surfaces and adjacent materials.

2. Construct forms to required sizes, shapes, lines, and dimensions using ground wires and depth gages to obtain accurate alignment, location, and grades in finished structures. Construct forms to prevent mortar leakage but permit escape of air and rebound during shotcreting. Provide for openings, offsets, blocking, screeds, anchorages, inserts, and other features required in the Work.

B. Form openings, chases, recesses, bulkheads, keyways, and screeds in formwork. Determine sizes and locations from trades providing such items. Accurately place and securely support items built into forms.

3.3 STEEL REINFORCEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials that weaken shotcrete bonding.

C. Securely embed reinforcing anchors into existing substrates, located as required.

D. Accurately position, support, and rigidly secure reinforcement against displacement by formwork, construction, or shotcreting. Locate and support reinforcement by metal chairs, runners, bolsters, spacers, and hangers, as required.
E. Place reinforcement to obtain minimum coverages for shotcrete protection. Arrange, space, and securely tie bars and bar supports to hold reinforcement in position during shotcreting. Set wire ties with ends directed into shotcrete, not toward exposed shotcrete surfaces.

F. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.4 JOINTS

A. Construction Joints: Locate and install construction joints tapered to a 1:1 slope where joint is not subject to compression loads and square where joint is perpendicular to main reinforcement. Continue reinforcement through construction joints, unless otherwise indicated.

B. Contraction Joints: Construct contraction joints in shotcrete using saw cuts 1/8-inch- (3-mm-) wide-by-1/3 slab depth or premolded plastic, hardboard, or fiberboard strip inserts 1/4-inch- (6-mm-) wide-by-1/3 shotcrete depth, unless otherwise indicated.

1. After shotcrete has cured, remove strip inserts and clean groove of loose debris.
2. Space joints at [15 feet (4.5 m) o.c.] horizontally and vertically.
3. Tool edges round on each side of strip inserts if floated or troweled finishes are required.

3.5 ALIGNMENT CONTROL

A. Ground Wires: Install ground wires to establish thickness and planes of shotcrete surfaces. Install ground wires at corners and offsets not established by forms. Pull ground wires taut and position adjustment devices to permit additional tightening.

3.6 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by shotcrete. Use Setting Drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.7 APPLICATION

A. Apply temporary protective coverings and protect adjacent surfaces against deposit of rebound and overspray or impact from nozzle stream.

B. Moisten wood forms immediately before placing shotcrete where form coatings are not used.

C. Apply shotcrete according to ACI 506.2.

D. Apply dry-mix shotcrete materials within 45 minutes after predampening or wet-mix shotcrete materials within 90 minutes after batching.

E. Deposit shotcrete continuously in multiple passes, to required thickness, without cold joints and laminations developing. Place shotcrete with nozzle held perpendicular to receiving surface. Begin shotcreting in corners and recesses.
1. Remove and dispose of rebound and overspray materials during shotcreting to maintain clean surfaces and to prevent rebound entrapment.

F. Maintain reinforcement in position during shotcreting. Place shotcrete to completely encase reinforcement and other embedded items. Maintain steel reinforcement free of overspray and prevent build-up against front face during shotcreting.

G. Do not place subsequent lifts until previous lift of shotcrete is capable of supporting new shotcrete.

H. Do not permit shotcrete to sag, slough, or dislodge.

I. Remove hardened overspray, rebound, and laitance from shotcrete surfaces to receive additional layers of shotcrete; dampen surfaces before shotcreting.

J. Do not disturb shotcrete surfaces before beginning finishing operations.

K. Remove ground wires or other alignment control devices after shotcrete placement.

L. Shotcrete Core Grade: Apply shotcrete to achieve mean core grades not exceeding 2.5 according to ACI 506.2, with no single core grade exceeding 3.0.

M. Installation Tolerances: Place shotcrete without exceeding installation tolerances permitted by ACI 117R, increased by a factor of 2.

3.8 SURFACE FINISHES

A. Grades of Shotcrete Finish: Notes and keys on the Drawings indicate for most surfaces the finish detailing required.

B. Determination of Shotcrete Types: When Drawings and Notes do not specifically identify the type of surface to be produced, obtain direction from the Architect. Finished product should appear as a cohesive geologic formation. The following types of finishes will be produced:

1. Earth Bank: Simulate dirt bank. Texture to simulate erosion process. Work to include integral color, carving surface texture, surface staining and painting and embedment of small rocks and natural roots.

2. Sand/Mud Bottom: Simulate appearance of a sandy river bottom. Medium texture to include integral color, surface staining and painting and an occasional embedment of rock.

3. Rock: Texture to simulate granite cliffs and boulders as shown in photographs. Simulate appearance, patterns, and ridges. Work to include integral color, texture coat and surface painting.

4. Gun Finish: Textured, uneven, natural finish to exposed surfaces, where indicated (moat walls out of public view).

3.9 CURING

A. Protect freshly placed shotcrete from premature drying and excessive cold or hot temperatures.
B. Start initial curing as soon as free water has disappeared from shotcrete surface after placing and finishing.

C. Curing Exposed Surfaces: Cure shotcrete by the following methods:

1. Moisture Curing: Keep surfaces continuously moist for at least seven days with water, continuous water-fog spray, water-saturated absorptive covers, or moisture-retaining covers. Lap and seal sides and ends of covers.

2. Curing Compound: Apply curing compound uniformly in continuous operation by power spray according to manufacturer’s written instructions. Reccoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
   a. Apply curing compound to natural- or gun-finished shotcrete at rate of 1 gal./100 sq. ft. (1 L/2.5 sq. m).

D. Curing Formed Surfaces: Cure formed shotcrete surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

3.10 FORM REMOVAL

A. Forms not supporting weight of shotcrete may be removed after curing at not less than 50 deg F (10 deg C) for 24 consecutive hours after gunning, provided shotcrete is hard enough not to be damaged by form-removal operations and provided curing and protecting operations are maintained.

   1. Leave forms supporting weight of shotcrete in place until shotcrete has attained design compressive strength. Determine compressive strength of in-place shotcrete by testing representative field-cured specimens of shotcrete.

   2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing materials are unacceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.

3.11 FIELD QUALITY CONTROL

A. Contractor will engage a qualified independent testing agency to sample materials, visually grade cores, perform tests, and submit reports during shotcreting.

B. Air Content: ASTM C 173, volumetric method or ASTM C 231, pressure method; 1 test for each compressive-strength test for each mix of air-entrained, wet-mix shotcrete measured before pumping.

C. Shotcrete Temperature: ASTM C 1064; 1 test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and 1 test for each set of compressive-strength specimens.
D. Test Panels: Make a test panel, reinforced as in structure, for each shotcrete mix and for each workday or for every 50 cu. yd. (38 cu. m) of shotcrete placed, whichever is less. Produce test panels with dimensions of 24 by 24 inches (600 by 600 mm) minimum and of average thickness of shotcrete, but not less than 4-1/2 inches (115 mm). From each test panel, testing agency will obtain six test specimens: one set of three specimens unreinforced and one set of three specimens reinforced.

1. Test each set of unreinforced specimens for compressive strength according to ASTM C 1140 and construction testing requirements in ACI 506.2.

2. Visually inspect each set of reinforced shotcrete cores taken from test panels and determine mean core grades according to ACI 506.2.

E. In-Place Shotcrete: Take a set of 3 unreinforced cores for each mix and for each workday or for every 50 cu. yd. (38 cu. m) of shotcrete placed, whichever is less. Test cores for compressive strength according to ACI 506.2 and ASTM C 42. Do not cut steel reinforcement.

F. Strength of shotcrete will be considered satisfactory when mean compressive strength of each set of 3 unreinforced cores equals or exceeds 85 percent of specified compressive strength, with no individual core less than 75 percent of specified compressive strength.

1. Mean compressive strength of each set of 3 unreinforced cubes shall equal or exceed design compressive strength with no individual cube less than 88 percent of specified compressive strength.

3.12 REPAIRS

A. Remove and replace shotcrete that is delaminated or exhibits laminations, voids, or sand/rock pockets exceeding limits for specified core grade of shotcrete.

1. Remove unsound or loose materials and contaminants that may inhibit bond of shotcrete repairs. Chip or scarify areas to be repaired to extent necessary to provide sound substrate. Cut edges square and 1/2 inch (13 mm) deep at perimeter of work, tapering remaining shoulder at 1:1 slope into cavity to eliminate square shoulders. Dampen surfaces and apply new shotcrete.

B. Repair core holes from in-place testing according to repair provisions in ACI 301 and match adjacent finish, texture, and color.

3.13 CLEANING

A. Remove and dispose of rebound and overspray materials from final shotcrete surfaces and areas not intended for shotcrete placement.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes cast-in-place cellular-type lightweight insulating concrete for roof decks.

B. Related Sections includes the following:

1. Division 3 Section “Cast-in-Place Concrete” for structural lightweight concrete.

2. Division 7 Section “Thermoplastic Membrane Roofing” for roof system installed over lightweight insulating concrete.

1.03 DEFINITIONS

A. Lightweight Insulating Concrete: Low-density concrete, with an oven-dry unit weight not exceeding 50 lb/cu. ft., placed with or without embedded rigid insulation board.

1.04 SUBMITTALS

A. Product Data: For each type of product indicated. Include mixing and application instructions for each type of lightweight insulating concrete.

B. Shop Drawings: Include plans, sections, and details showing roof slopes, lightweight insulating concrete thicknesses, embedded insulation board, roof penetrations, roof perimeter terminations and curbs, control and expansion joints, and roof drains.

C. Design Mixtures: For each lightweight insulating concrete mix.

D. Qualification Data: For Installer.

E. Material Test Reports: For lightweight aggregates, from a qualified testing agency, indicating compliance with requirements.

F. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.

2. Foaming agents.

3. Admixtures.

G. Research/Evaluation Reports: For lightweight insulating concrete.
1.05 QUALITY ASSURANCE

A. Installer Qualifications: A firm that is approved by lightweight insulating concrete manufacturer.

B. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

C. Fire-Test-Response Characteristics: Where lightweight insulating concrete is part of a fire-resistance-rated roof-deck assembly, provide lightweight insulating concrete identical to that used in assemblies tested for fire resistance per ASTM E 119 by a testing agency acceptable to authorities having jurisdiction. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory," from ITS's "Directory of Listed Products," or from the listings of another testing and inspecting agency.

D. FMG Listing: Provide lightweight insulating concrete evaluated by FMG as part of a roof assembly and listed in FMG's "Approval Guide" for Class 1 fire and noncombustible rating.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's original undamaged packages or acceptable bulk containers.

B. Store packaged materials to protect them from elements or physical damage.

C. Do not use cement that shows indications of moisture damage, caking, or other deterioration.

1.07 PROJECT CONDITIONS

A. Do not place lightweight insulating concrete unless ambient temperature is 40 deg F and rising.

B. Do not place lightweight insulating concrete during rain or snow or on surfaces covered with standing water, snow, or ice.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Cementitious Material: Portland cement, ASTM C 150, Type I or III.

B. Mineral Aggregate: Manufacturer's standard hybrid mixture of expanded aggregate complying with ASTM C 332.

C. Foaming Agent: ASTM C 869.

D. Water: Clean, potable.

F. Galvanized Plain-Steel Welded Wire Reinforcement: ASTM A 185, 2 by 2 inches, W0.5 by W0.5, fabricated from galvanized steel wire into flat sheets.

G. Joint Filler: ASTM C 612, Class 2, glass-fiber type; compressing to one-half thickness under a load of 25 psi.

2.02 DESIGN MIXTURES

A. Prepare design mixtures for each type and strength of lightweight insulating concrete by laboratory trial batch method or by field-test data method. For trial batch method, use a qualified independent testing agency for preparing and reporting proposed mixture designs. Limit use of fly ash to not exceed 25 percent of portland cement by weight.

B. Limit water-soluble chloride ions to the maximum percentage by weight of cement or cementitious material permitted by ACI 301.

2.03 CELLULAR LIGHTWEIGHT INSULATING CONCRETE

A. Produce cellular lightweight insulating concrete with the following minimum physical properties using cementitious materials, air-producing liquid-foaming agents, and the minimum amount of water necessary to produce a workable mix. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. [Celcore Incorporated].
2. [Elastizell Corporation of America].
3. [Lite-Crete Inc.]
4. [Siplast].
5. As-Cast Unit Weight: 38 to 48 lb/cu. ft. at point of placement, when tested according to ASTM C 138/C 138M.
6. Oven-Dry Unit Weight: 30 to 36 lb/cu. ft., when tested according to ASTM C 495.
7. Compressive Strength: Minimum 200 psi, when tested according to ASTM C 495.

PART 3 - EXECUTION

3.01 PREPARATION

A. Control Joints: Install control joints at perimeter of roof deck and at junctures with vertical surfaces, including curbs, walls, and vents, for full depth of lightweight insulating concrete. Fill control joints with joint filler. Provide 1-inch- wide control joints for roof dimensions up to 100 feet in length; 1-1/2-inch- wide control joints for roof dimensions exceeding 100 feet.
B. Welded Wire Reinforcement: Place steel welded wire reinforcement with longest dimension perpendicular to steel deck ribs. Cut reinforcement to fit around roof openings and projections. Terminate reinforcement at control joints. Lap sides and ends of reinforcement at least 6 inches.

3.02 MIXING AND PLACING

A. Mix and place lightweight insulating concrete according to manufacturer's written instructions, using equipment and procedures to avoid segregation of mixture and loss of air content.

B. Deposit and screed lightweight insulating concrete in a continuous operation until an entire panel or section of roof area is completed. Do not vibrate or work mix except for screeding or floating. Place to depths and slopes indicated.

C. Finish top surface smooth, free of ridges and depressions, and maintain surface in condition to receive subsequent roofing system.

D. Begin curing operations immediately after placement, and air cure for not less than three days according to manufacturer's written instructions.

E. If ambient temperature falls below 32 deg F, protect lightweight insulating concrete from freezing and maintain temperature recommended by manufacturer for 72 hours after placement.

3.03 FIELD QUALITY CONTROL

A. Testing Agency: Contractor will engage a qualified independent testing and inspecting agency to sample materials, perform field tests and inspections, and prepare test reports.

B. Testing of samples of lightweight insulating concrete obtained according to ASTM C 172, except as modified by ASTM C 495, shall be performed according to the following requirements:

1. Determine as-cast unit weight during each hour of placement, according to ASTM C 138/C 138M.

2. Determine oven-dry unit weight and compressive strength according to ASTM C 495. Make a set of at least 6 molds for each day's placement, but not less than 1 set of molds for each 5000 sq. ft. of roof area.

3. Perform additional tests when test results indicate as-cast unit weight, oven-dry unit weight, compressive strength, or other requirements have not been met. Retest cast-in-place lightweight insulating concrete according to ASTM C 513 for oven-dry unit weight and compressive strength.

3.04 DEFECTIVE WORK

A. Refinish, or remove and replace, lightweight insulating concrete if surfaces are excessively scaled or too rough to receive roofing according to roofing membrane manufacturer's written requirements.
B. Remove and replace lightweight insulating concrete that fails to comply with requirements.

END OF SECTION
PART 1 - GENERAL

1.01 WORK INCLUDED

A. Concrete block masonry.
B. Reinforcing steel, mortar and grout for concrete block masonry. Furnish dowels to be embedded in concrete for anchoring concrete block masonry to concrete.
C. Install anchors, frames, built-in masonry anchors, and similar items furnished by other trades for installation in concrete block masonry; grout hollow metal frames solidly.
D. Remove excess mortar and grout, and clean exposed concrete block masonry surfaces.

1.02 RELATED WORK

A. Reinforcing steel for concrete.
B. Installation of dowels for anchoring concrete block masonry to concrete.
C. Division 11 Sections for built-in devices for incorporation into masonry construction.

1.03 QUALITY ASSURANCE

A. Tolerances for concrete block masonry:

1. Maximum variation from plumb:
   a. In walls and corners: 1/4" in 10'; 3/8" in any story or 20' maximum; 1/2" in 40'.
   b. For external corners and other conspicuous lines: 1/4" in any story or 20' maximum; 1/2" in 40'.

2. Maximum variation from level or indicated elevations: 1/4" in any bay or 20'; 1/2" in 40'.

3. Maximum variation from plan position indicated on the Drawings: 1/2" maximum.

1.04 SUBMITTALS

A. Make submittals in accordance with the requirements of Section 01330 - "Shop Drawings/Submittals".

B. Submit certification showing material compliance with these Specifications before delivering concrete block units to the jobsite.
1.05 HANDLING

A. Ship, handle and store concrete blocks to avoid chipping, cracking or damaging them. Concrete block with spalled corners may be used provided the damaged corners are concealed in the finished work. Do not use damaged concrete block at exposed locations.

B. Store concrete blocks in a dry, well ventilated space, under cover and off the ground, to prevent their getting wet.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Mortar and grout materials:

1. Portland cement: ASTM C150, Type I or II use same type and manufacture for all work.
2. Lime: ASTM C207, Type [S].
3. Aggregates:
   a. For mortar: [Natural sand, ASTM C144].
   b. For grout: [ASTM C404].
   c. Water: Potable and fresh, free of ingredients harmful to mortar and grout.


B. Concrete block: Fine-textured steam-cured units complete with all required special shapes, conforming to the following requirements:

1. ASTM C90, Grade [N-1], hollow, load-bearing.
2. Type: Normal Weight.
3. Size: [16" long x 8" high] x thicknesses indicated on the Drawings.
4. Color: [Uniformly grey].

C. Glazed Concrete Block: Comply with the following:

1. Basis of Design Product: Comply with the following:
2. Manufacturer:

   [Trenwyth Industries, Inc. 
    4626 N. 42nd. Avenue 
    Phoenix, AZ 85019 
    Tele: 800-331-9823]

4. Unit Profiles: One, two, and three faced units including bullnose corners, caps, and other shapes to construct profiles indicated.
5. Mortar: Manufacturer's standard matching color, pigmented mortar with water-repellant additive.
D. Reinforcing steel: ASTM A615, Grade [60].

E. Concrete block cleaner: "Sure Klean No. 600 Detergent" by Process Solvent Co., Inc., "Doex Chemical Cleaner" by National Chemsearch Corp., or equal.

2.02 MORTAR AND GROUT

A. Mix mortar and grout uniformly in the proportions required by the Building Code. Ready-mix mortar and grout may be used, at the Contractor's option, provided it conforms to Building Code requirements. Add admixtures at jobsite just prior to use. Turn mixture 30 revolutions after adding.

B. Job mix grout as fluid as possible for pouring without segregation of parts. Slump to range between 8 and 10 inches.

C. Mix mortar and grout by placing one-half of water and sand in a power operated mixer, then add cement, lime, admixture, and the remainder of sand and water.

D. Mortar may be retempered with water as required to maintain high plasticity. Retemper on mortar boards only by adding water within a basin formed within the mortar and rework the mortar into the water. Do not use mortar or grout which is unused within 1-1/2 hours of mixing.

E. Mix mortar and grout mechanically for not less than three minutes after all ingredients have been placed in the mixer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Inspect adjacent construction and make sure that all conditions detrimental to the proper and timely execution of this work have been corrected before proceeding.

B. Shear Walls and Bearing Walls: Inspection required during preparation of masonry wall prisms, sampling and placing of all masonry units, placement of reinforcement, inspection of grout space, immediately prior to closing of cleanouts, and during all grouting operations. Test specimens may consist of either one prism test for each 5000 square feet of wall area or a series of tests based on both grout and mortar for the first three consecutive days and each third day thereafter.

3.02 SHORING AND BRACING

A. Provide all shores and bracing required for this work. Construct shoring and bracing to required shapes and sizes, capable of supporting and sustaining the loads to which they will be subjected without failure or deflection. Leave shores and bracing in place until concrete block masonry can safely carry all required live and dead loads.

B. Brace concrete block masonry walls adequately to withstand all forces they will be subjected to during construction. Walls are not designed to be self supporting for lateral loads until attached to floor and roof elements.
3.03 WORKMANSHIP

A. Erect concrete block masonry plumb, level, square and straight to indicated lines and dimensions, with head joints filled solidly with mortar.

B. Do not use fractional parts of concrete block where whole block can be used. Chinking joints with fragments and bats is prohibited.

C. Concrete block masonry shall be sound, dry, clean and free from cracks when placed. Do not wet the block, except that in very dry weather the block contact surfaces shall be moistened just before laying.

D. Puddle grout and rod it thoroughly to insure its contact with cells of concrete block masonry units and reinforcing steel. Provide at least 1/2" clearance between sides of concrete block masonry cells and reinforcing steel. For high lift grouting use mechanical vibrator.

E. Saw cut concrete block neatly and accurately as necessary to provide openings for the work of other trades, with diamond or abrasive saws to produce straight, sharp edges without spalling or other defects, and of sizes required to maintain uniform joint widths.

F. If it is necessary to move a concrete block after it has been once set in place, remove the unit, clean it and set it in fresh mortar.

3.04 REINFORCING STEEL

A. Conform to the applicable requirements of Section [03300 - "Cast-In-Place Concrete]" as though repeated verbatim herein. Place reinforcing steel in the locations shown on the Drawings, with a minimum of 1/2" grout space between reinforcing steel and masonry. When a dowel does not line up with a vertical core, do not slope more than one horizontal in six vertical. Grout dowels in a core in vertical alignment, even though it is a cell adjacent to the vertical wall reinforcing.

B. Keep reinforcing steel straight, except at corners, and where bends or hooks are specifically indicated on the Drawings.

C. Lap splices in reinforcing steel in accordance with Building Code requirements, and separate them by one bar diameter or wire them together.

3.05 GROUTING

A. Grout cells of indicated concrete block masonry in lifts less than 4' high. At Contractor's option, high lift grouting may be used provided its installation conforms to Building Code requirements, and the Contractor pays all necessary extra inspection costs.

B. Keep mortar droppings out of grout spaces, or remove them from the grout spaces before grouting. Puddle or vibrate grout thoroughly to eliminate air pockets and assure bonding with reinforcing steel.

C. Keep vertical cells free of mortar droppings and in vertical alignment to maintain continuous, unobstructed cells not less than 4" x 4" when coarse grout is used, and 2" x 3" for all other conditions.
D. Grout bolts and anchors inserted in the concrete block masonry solidly in place so that there is a minimum of 1" of grout between the bolts and the side of the concrete block masonry cell wall.

E. Fill all cells solidly with grout. Stop pours 1-1/2" below the top of a course to form a mechanical key at pour joints.

F. Grout header beams over openings in one continuous operation.

3.06 JOINTS AND BONDING

A. Clean concrete bearing surfaces and remove all laitance by steel brushing or sandblasting to expose the coarse aggregates before laying the first course of concrete block masonry.

B. Lay concrete block masonry in straight and uniform courses in a running bond pattern. Lay the starting joint on concrete bearing surfaces with full mortar coverage, except that area where grout occurs shall be free from mortar so that grout will contact the bearing surface.

C. Mortar joints shall be straight, clean and of a uniform width (approximately 3/8"). Strike joints flush where concrete block masonry will have an elastomeric coating applied on it; tool all other joints with a rounded jointing tool to produce concave joints well bonded to the block.

D. Tool joints with a rounded bar when the mortar has partially set but still sufficiently plastic to bond. Rake out joints which are not tight at the time of tooling, point and then retool.

E. Horizontal joints shall have full mortar coverage on face shells.

F. Butter head joints well for the full width of the face shell and shove these joints tightly so that the mortar bonds well to both concrete block.

G. Provide vertical contraction joints at a spacing not to exceed 30 feet on center in all block masonry walls.

3.07 CLEANING AND PROTECTING

A. Remove mortar and grout stains from concrete block surfaces immediately upon their discovery. Clean exposed concrete block surfaces with one of the specified cleaners used in strict accordance with the manufacturer's printed instructions. Take all necessary precautions to avoid staining the concrete block and adjacent surfaces. Cover sills and top course of unfinished work with waterproof coverings and tie securely in place to prevent its accidental displacement.

B. Dampen (but don’t saturate) the surface of the concrete block masonry with a light fog spray when the atmosphere is excessively dry and keep it damp for approximately three days to permit the mortar to thoroughly cure.

END OF SECTION
PART 1 - GENERAL

1.1 Related Documents

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 Summary

A. This Section includes stone veneer adhered to Portland cement plaster basework.

B. Related Sections include the following:

1. Division 5 Section "Cold-formed Metal Framing" for exterior wall framing and gypsum sheathing.

2. Division 7 Section "Sheet Metal Flashing and Trim" for exposed sheet metal flashing.

3. Division 7 Section "Water Repellents" for sealer applied to stone veneer.

4. Division 9 Section "Portland Cement Plaster" for cement plaster basework to receive stone veneer.

1.3 Submittals

A. Product Data: For each type of product indicated. For stone varieties proposed for use on Project, include data on physical properties required by referenced ASTM standards.

B. Stone Samples for Verification: For each color, grade, finish, and variety of stone required.

C. Qualification Data: For Installer.

1.4 Quality Assurance

A. Installer Qualifications: An installer who employs experienced stone masons and stone fitters who are skilled in installing stone veneer assemblies similar in material, design, and extent to those indicated for this Project and whose projects have a record of successful in-service performance.

B. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from a single quarry with resources to provide materials of consistent quality in appearance and physical properties.

C. Source Limitations for Mortar Materials: Obtain ingredients of a uniform quality for each mortar component from a single manufacturer and each aggregate from one source or producer.
D. Mockups: Build mockups to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution.

1. Build mockups for each type of stone veneer assembly in sizes approximately 120 inches long by 60 inches high by full thickness, including face and backup. Include stone coping at top of mockup.

2. Protect accepted mockups from the elements with weather-resistant membrane.

3. Approval of mockups is for color, texture, and blending of stone; relationship of mortar and sealant colors to stone colors; tooling of joints; and aesthetic qualities of workmanship. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless such deviations are specifically approved by Architect in writing.

4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

5. If the mock-up panels are not permitted to be part of the finished Work, completely demolish and remove them from the job site upon completion and acceptance of the work of this Section.

1.5 Delivery, Storage, And Handling

A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

C. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 Project Conditions

A. Protection of Stone Veneer Assemblies: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed stone veneer assemblies when construction is not in progress. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.

B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining the face of stone veneer assemblies.

1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on the ground and over the wall surface.

2. Protect sills, ledges, and projections from mortar droppings.

3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
4. Turn scaffold boards near the wall on edge at end of each day to prevent rain from splashing mortar and dirt on completed stone veneer assemblies.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on setting beds. Remove and replace stone veneer assemblies damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in Section 2104.3 of the Uniform Building Code. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.


PART 2 - PRODUCTS

2.1 Stone, General

A. Products: Subject to compliance with requirements, provide the products specified.

B. Provide stone of soundness (hardness and density), texture, graining, color, tone, matching Architect's samples available at bid time. Stone shall be sound and free from defects that will impair strength, durability, or appearance. Quarry and fabrication plant facilities shall be available for the Architect's inspection at any time.

C. All stone shall be free from holes, seams, shakes, clay pockets, spalls, stains, starts, and other defects which would impair the strength, durability, and appearance of the work, as determined by the Architect.

D. The following minimum criteria for quality control of stone cracks applies:

1. Cracks greater than 0.002" in width and 0.125" in depth are not acceptable.

2. Cracks less than 0.002" in width shall be no longer than 4.0 inches.

E. All quarry cracks, seams, fissures, veins and other natural cracks are to be pre-qualified by the Architect as healed, partially healed, or open. Stone panels with partially healed and open cracks are not acceptable.

2.2 Stone Material

A. Varieties: Subject to compliance with requirements, provide stone meeting the following criteria:

1. [Material/Quartz-Based Dimension Stone Standard: ASTM C 616, Classification II Quartzitic Sandstone].

2. Source: [Domestic].

3. Color: [Match "Kokomo Gold (Padre Gold)]."
2.3 Manufacturers

A. In other Part 2 articles where subparagraph titles below introduce lists, the following requirements apply for product selection: Products: Subject to compliance with requirements, provide the products specified.

2.4 Adhering Materials For Stone Veneer

A. Proprietary Materials: Provide proprietary materials for adhering stone veneer to cement plaster basework, consisting of the following:


B. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement.

C. Water: Potable.

2.5 Masonry Cleaners

A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry-measure tetrasodium polyphosphate and 1/2-cup dry-measure laundry detergent dissolved in 1 gal. of water.

2.6 Stone Fabrication

A. General: Fabricate stone in sizes and shapes necessary to comply with requirements indicated, including details on Drawings.

B. Cut stone to produce pieces of thickness, size, and shape indicated and to comply with fabrication and construction tolerances recommended by applicable stone association or, if none, by stone source, for faces, edges, beds, and backs. Clean sawed backs of stone to remove rust stains and iron particles. Precisely locate and cut opening through stone at penetrations.

C. Gage backs of stones for adhered veneer.


E. Dress joints (bed and vertical) straight and at right angle to face, unless otherwise indicated.

F. Finish exposed faces and edges of stone to comply with requirements indicated for finish and to match approved samples and mockups. All surfaces exposed to view shall be finished.

1. Face Finish, General: Natural cleft except as indicated otherwise.

3. Finish for Stone Cap: Smooth (honed), machine finish. Finish exposed ends of copings same as edge and top faces.

4. Direction of grain drift shall run generally parallel on all finished surfaces. Erected work shall be oriented in direction as approved by the Architect.

5. Exposed surfaces and edges shall be free from cracks, broken corners, chipped edges, scratches, or other defects affecting appearance. Hiding of defects will be permitted. Units having flaws or imperfections and will be rejected. Replace with acceptable units without additional compensation. Patching of stone shall only be done in accordance with approval of the Architect.


G. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.

2.7 Adhering Materials Mixes

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

B. Latex-Modified Cementitious Adhering Mortar: Proportion and mix proprietary cementitious material blend and latex additive to comply with latex-additive manufacturer's written instructions.

PART 3 - EXECUTION

3.1 Examination

A. Examine surfaces indicated to receive stone veneer assemblies, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. Examine wall framing, sheathing, building wrap and cement plaster basework to verify that installation will result in a weatherproof covering.

2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 Preparation

A. Advise installers of other work about specific requirements for items to be built into stone veneer assemblies.

B. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.
3.3 Installation Of Adhered Stone Veneer Assemblies

A. Perform necessary field cutting as stone is set. Use power saws to cut stone. Cut lines straight and true, with edges eased slightly to prevent snipping.

B. Sort stone before it is placed in wall to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.

C. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.

D. Set stone to comply with requirements indicated on Drawings. Apply proprietary cementitious adhering mortar to thickness recommended by manufacturer. Back butter stone to provide full bedding and firm support, as necessary to secure stone veneer assemblies in place. Set stone into wet, sticky mortar and beat in with beating block and rubber mallet to imbed stone and adjust level. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances. Use sufficient setting mortar so a slight excess will be forced out the edges of stone units as they are set. Check mortar for complete coverage by periodically removing a stone piece and inspecting bedding mortar transfer onto back of stone.

E. Maintain uniform joint widths except for variations due to different stone sizes and where minor variations are required to maintain bond alignment, if any. Lay walls with joints not less than 1/4 inch at narrowest points nor more than 3/8 inch at widest points.

F. Rake out joints to depth of stone before setting mortar has hardened. Rake joints with square bottoms and clean sides.

G. Match expansion, control, and pressure-relieving joints of widths and at locations indicated. Keep expansion and pressure-relieving joints free of mortar and other rigid materials.

3.4 Construction Tolerances

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2 inch in 40 feet or more. For external corners, expansion joints, control joints, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.

B. Variation from Level: For joints and lines of exposed lintels, sills, parapets, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or 1/2 inch in 40 feet or more.

C. Variation of Linear Building Line: For position shown in plan, do not exceed 1/2 inch in 20 feet or 3/4 inch in 40 feet or more.

D. Measure variation from level, plumb, and position shown in plan as variation of the average plane of the face of each stone from level, plumb, or dimensioned plane.

E. Variation in Joint Thickness: Do not vary from joint size range indicated.
F. Variation in Plane between Adjacent Stones: Do not exceed one-half of tolerance specified for thickness of stone.

G. Variation in Plane on Face of Individual Stone: Do not exceed one-half of tolerance specified for thickness of stone.

3.5 Adjusting And Cleaning

A. Remove and replace stone veneer assemblies of the following description:

1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.

2. Defective joints.

3. Stone veneer assemblies not matching approved samples and mockups.

4. Stone veneer assemblies not complying with other requirements indicated.

B. Replace in a manner that results in stone veneer assemblies matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean stone veneer assemblies as work progresses. Remove mortar fins and smears before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean stone veneer assemblies as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone veneer assemblies.

3. Clean stone veneer assemblies by bucket and brush hand-cleaning method described in BIA Technical Note No. 20 Revised II, using job-mixed detergent solution.

3.6 Excess Materials And Waste

A. Excess Stone: Stack excess stone where directed by ENGINEER for City's use.

B. Disposal as Fill Material: Dispose of clean stone waste, including mortar and excess or soil-contaminated sand, by crushing and mixing with fill material as fill is placed.

1. Crush masonry waste to less than 4 inches in greatest dimension.

2. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Division 2 Section "Earthwork."
3. Do not dispose of stone waste as fill within 18 inches of finished grade.

C. Excess Stone Waste: Remove excess clean masonry waste that cannot be used as fill, as described above, and other waste, and legally dispose of off City's property.

END OF SECTION
PART 1 GENERAL

1.1 DESCRIPTION

A. Principal work in this Section:

1. Requirements: Provide structural steel, complete, in accordance with Contract Documents.

B. Related work in other Sections:

1. Section 03300 - Cast-In-Place Concrete: Grouting of bearing and leveling plates; placing embedments and anchor bolts.

2. Section 05300 - Metal Decking: Shear connectors, accessories.

1.2 QUALITY ASSURANCE

A. Quality Assurance: Prepare and execute full and complete program of Quality Assurance including evaluation, material reports, sampling, appropriate types and quantities of testing, and detailed fabrication and erection drawings which provide no opportunity to complete unsatisfactory steel work. Perform retesting or evaluations by Quality Control personnel due to deficient work, and similar work at no additional cost to Owner.

B. Quality Control: Steelwork is subject to evaluation and tests in shop and field by others. Evaluations and testing undertaken by others is strictly for random evaluation. Extent, duration and amount of testing and evaluation is entirely at discretion of others. Use of testing services, execution of testing or evaluation services by others shall in no way relieve sole responsibility to furnish materials and construction in full compliance with Contract Documents.

C. Testing Agency: Owner will engage, at his expense, certified Testing Agency to inspect materials, fabrication, high strength bolted connections and welds, to perform tests specified, and to submit reports to Architect and local Building Authority.

1. Testing Agency will be responsible for conducting and interpreting tests, will state in reports whether test results comply with Contract Documents, will specifically note deviations therefrom, and will indicate corrective measures required and taken. Testing Agency inspectors shall keep daily records of work inspected and its disposition in accordance with form prescribed in "Structural Welding Code."
2. Provide Testing Agency with the following:
   a. Shop and erection drawings.
   b. Cutting lists, order sheets, material bills, shipping bills and mill test reports.
   c. Information as to time and place of rollings and shipment of material to shop.
   d. Access to places where material is being fabricated or produced.
   e. Representative sample pieces requested for testing.
   f. Full and ample means and assistance for testing.
   g. Proper facilities, including scaffolding, temporary work platforms and hoisting facilities for inspection of Work in mills, shop and field.

3. Contractor shall provide and pay for corrective measures, including additional and more complete testing.

4. Architect and Testing Agency may observe structural steel at plant before shipment; however, Architect reserves right to reject material, at any time before final acceptance which does not conform to requirements of Contract Documents.

5. Unless more stringent requirements are stated elsewhere, be responsible for extra costs due to:
   a. Inspections and testing required off-site greater than 75 miles from the job site.
   b. Inspections and testing required at more than one off-site location.
   c. Overtime inspections and testing incurred without Owner's approval or for acceleration of work for Contractor's convenience.

D. Source Quality Control:

1. General: Material delivered with certificates classified as identifiable; without certificates classified as unidentifiable. High strength steels shall be suitably identified on each piece and reviewed by the Testing Agency in comparison to mill test certificates.

2. Testing of Unidentifiable Material: By testing agency; paid for by Contractor.

   a. General: Test material not identifiable by heat number and mill test or other acceptable manufacturer's identification per ASTM A370 as follows:

      1) Structural Shapes and Plates: From coupons taken from material; one tensile test and one bend test per 5 tons of each shape.
2) High Strength Bolts: Each lot of 100 bolts; tensile tests on 2 bolts in full size and one tensile test on 1/2 inch diameter machined specimen.

E. Bolted connections shall be inspected by Testing Agency in accordance with AISC Specification for "Structural Joints using ASTM A325 and A490 Bolts".

1. All bolts shall be inspected as "fully-tensioned" unless specifically identified on the drawings that the bolt may be only tightened to "snug-tight" condition.

F. Welding shall be inspected and tested by Testing Agency during fabrication and erection of structural steel in accordance with AWS as follows:

1. Certify welders and make inspections and tests as required. Record types and locations of defects found in Work, and measures required and performed to correct such defects.

2. In addition to visual inspection of welds, magnetic particle and ultrasonic inspection shall be made. Magnetic particle inspection shall be made on root pass and finished weld.

3. Method of magnetic particle inspection shall be in accordance with ASTM E109. Cracks or zones of incomplete fusion or penetration not acceptable. Equipment shall be capable of locating cracking below surface of welds.

4. Perform ultrasonic inspection in accordance with AWS D1.1.

G. Testing Agency shall inspect structural steel for laminations or other discontinuities by ultrasonic methods.

H. Each bolting crew and welder shall be assigned identifying symbol or mark. Shop and field connections shall be identified so that inspector can refer back to crew or person making connection.

I. Testing Agency shall confirm qualification of welders, AWS procedures are followed, welding equipment is used per manufacturer's recommendations, preheating is properly used, proper use of runout plates, jigs, and fit-up, and structural steel complies with specified dimensional standards.

J. Where inspection reveals defects, extent of inspection will be increased as necessary to assure that full extent of defects in joint has been found and to assure that same defects are not present in welds made on similar parts or under similar circumstances.

1.3 REFERENCES

A. Except as modified by governing codes and by Contract Documents, comply with applicable provisions and recommendations of the following:

1. AISC "Code of Standard Practice for Steel Buildings and Bridges".

   a. Paragraph 4.2.1 of above code is hereby modified by deletion of the following sentence: "This approval constitutes the owner's acceptance of all responsibility for the design adequacy of any connections designed by the fabricator as a part of his preparation for the shop drawings."
2. AISC "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings".
   a. All bolting shall be installed in the "fully-tensioned" condition unless specifically stated on the Drawings that the bolts in a specific connection may be tightened only to the "snug-tight" condition.

3. AWS "Structural Welding Code".

4. Industrial Fastener Institute "Handbook on Bolt, Nut and Rivet Standards".

5. SSPC "Steel Structures Painting Manual, Volume 2 Systems and Specifications".


7. ASTM A6 "General Requirements for delivery of Braced Steel Plates, Shapes, Steel Piling and Bars for Structural Use".

B. Comply with Federal (OSHA, etc.), State and local laws which govern safety and other requirements for structural steel work.

1.4 SUBMITTALS

A. Make submittals in accordance with the requirements of Division 1.

1. In general, a minimum of 10 working days in the Engineer of Record's office should be scheduled for a usual review period for a usual sized submittal of shop drawings.

2. Submittal shall be made after completion, checking and coordination and be received by the Engineer of Record at least 45 days prior to fabrication.

3. The review of shop drawings by the Engineer of Record is for conformance with the design intent and the stamp on the returned submittal implies fabrication may proceed only if the work is in accordance with the Contract Documents.

4. The initial submittal shall consist of "Erection drawings" with member sizes, elevations and position dimensions for coordination by various trades of slab edges, slab openings, mechanical equipment locations, etc.

B. Product Data: Include laboratory test reports and such other data required to show compliance with Contract Documents. Indicate by transmittal form that copy of each applicable instruction has been distributed to each Installer or Fabricator.

1. Structural Steel: (each type) including certified copies of mill reports covering chemical and physical properties, country and rolling mill of origin, and including statement indicating that steel is new billet steel and that testing has been performed in accordance with ASTM standards. Correlate individual heat numbers with each specified section and location. Retest steel if mill test reports are unsatisfactory.

2. High strength bolts: (each type) including nuts and washers. Provide test reports for each production lot indicating proof load, tensile strength (wedge test), and hardness. Provide certified copies of mill reports covering chemical and
physical properties, country and rolling mill of origin, and including statement indicating that steel is new billet steel and that testing has been performed in accordance with ASTM Standards. Retest bolts if test reports are unsatisfactory.

3. Welding electrodes: (each type).

4. Shop coat primer paint: Field touch-up paint; manufacturer's specifications, performance data, and application instructions.

5. Shop applied shear stud connectors.

6. Anchor bolts.

C. Shop Drawings: Submit Shop Drawings for the following items in accordance with Division 1 prepared under supervision of a Registered Professional Engineer with current registration in State of California, including complete details and schedules, all shop and erection details for fabrication and assembly, all connections, holes, bolts and welds. All welds, both shop and field, shall be indicated by the AWS Standard Welding Symbols.

1. Provide shop fabrication drawings which show details, schedules and other information necessary for fabrication of each member and for shop assembly of members of structure. Indicate type, size, location and extent of welds and bolts. Clearly distinguish between shop and field bolts and welds. Indicate member splices and plate splices on shop drawings, for both shop and field. Indicate AISC pre-qualified welds by designation which indicates root and bevel angles for partial and full penetration welds as well as the specific weld process and the fabricator's specific identification for the welding procedure specification which includes preheating and other requirements.

2. Provide field assembly and erection drawings which show field assembly prior to erection and after erection. Indicate details, schedules and diagrams showing field assembly. Procedures shall indicate intermediate surveys, cambers, member overlengths, and allowances for temperature. Include setting drawings and templates for column base plates.

3. Provide written procedure of each item and welding sequence including preheating and cool down at each joint to minimize effect of weld shrinkage residual stress, and to maintain erection tolerances.

4. Identify each type and class of welding electrodes.

5. Form and character of shop drawings shall be to Architect's satisfaction, be checked and complete. Reuse of the Contract Documents is not permitted. Non-domestic fabrication shall be in accordance with shop drawings prepared domestically by structural steel detailers commonly providing services to domestic fabricators.

D. Calculations: Submit calculations for connections proposed as substitutions for indicated connections, and for connections where design criteria and loads are indicated. Submit calculations bearing seal of Professional Engineer registered in State where Project is located.

E. Surveys: Submit certified surveys by Contractor's registered professional engineer, showing elevations and locations of base plates and anchor bolts to receive structural steel, and showing elevations and locations for major members, with particular notation
of discrepancies between actual installation and Contract Documents, signed by Contractor, Erector and Surveyor.

F. Testing and Inspection Reports.

G. Welders Certifications, Welding Procedure Specifications, etc.

H. Prior to fabrication, prepare and submit to Testing Agency and Architect written Quality Assurance Program including material identification, welder certifications/re-certifications, welding procedure specifications, etc. as well as all procedures for shop fabrication and field connections for the steel work. These procedures shall indicate Fabricator's quality control measures, monitoring and repair procedures. Weld details and procedures shall be in accordance with AISC and AWS pre-qualified details, procedures and standards, as well as, particularly prequalified welding procedures and particularly prequalified welder certifications for each complete penetration shop and field welding process and detail.

X. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:

1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials. Provide separate data for each different manufacturer used:
   a. Steel Fabrications assembled on-site.
      1. The Cost of all of these materials can be added together.
   b. Steel Fabrications assembled off-site.
      1. Materials that are fabricated into assemblies by someone other than the contractor at a fabrication shop.

2. LEED Credit MRc5.1: Provide manufacturer name and location data for the following materials. Provide separate data for each different manufacturer used:
   a. Steel assembled off-site.

1.5 STORAGE AND HANDLING

A. Comply with the requirements of Division 1.

B. Plan method and sequence to avoid delay or damage to steel work or work of other trades.

C. Be responsible for steel shipment to site and storage of fabricated steel at job site. Material stored at job site shall not exceed design loads on structures so that members will not be distorted or otherwise damaged; and shall be protected against corrosion or deterioration.

D. Stack materials out of mud and dirt and provide for proper drainage. Protect from damage or soil ing by adjacent construction operations.

E. Provide temporary shoring, bracing and guy lines to adequately protect all persons and property and to ensure proper alignment.
1.6 ALTERNATIVES

A. Substitutions for member sizes, type(s) of steel, connection details or other modifications proposed by Contractor will be considered only under following conditions:

1. That request has been made and accepted prior to first submission of any shop drawings. The initial submittal of erection plans shall record the substitution of any members or material grades.

2. That there is substantial cost advantage and time advantage and that proposed revision is necessary to obtain required materials at proper time to accomplish work in time scheduled. Substitutions proposed due to lack of timely ordering of material are not acceptable.

3. That sufficient sketches, engineering calculations, and other data have been submitted to facilitate Architect checking, including the dimensions and weight of both the original and substitute members, connections, and the relationship of the substitute member, or modification of details to adjacent work.

4. The cost reductions and savings in time to complete work shall also be submitted. The substitutions shall not affect the architectural design and be equal or greater than the original member in structural characteristics, and at no additional cost to the Owner.

B. Substitution of higher yield strength steels or Dual Certified steels is acceptable for other members if found acceptable under the provisions of Paragraph A and the member size is not changed.

C. Alternative column splice locations or alternatives to provide a single size column where a spliced column is shown, will probably not be acceptable substitutions, particularly for columns in the lateral load resisting system.

PART 2 PRODUCTS

2.1 MATERIALS

A. Structural Steel:

1. Structural steel shall comply with provisions of ASTM Specifications appropriate for grades indicated. Provide ASTM A572-Grade 50, A992 or equivalent steel, unless noted otherwise.

2. Dimensional Standards: ASTM A6; welded shapes per dimensional standards of mill rolled sections.

3. Quality: Sound, free from loose mill scale, cracks, laminations, and slag inclusions.

4. Column Sections and Plates: ASTM A572-50 thicker than 2 inches shall be fine grained killed steel.

B. Welding Electrodes: Comply with provisions of AWS "Structural Welding Code" and Specification A5.1, A5.5, A5.17, A5.18 and A5.20.
C. High strength bolts and high strength bearing bolts, nuts and washers: Comply with provisions of:
   1. ASTM A325 or A490, optionally and where noted.
   2. AISC Specification for "Assembly of Structural Joints Using High Strength Bolts".
   3. All bolts shall be hex head without break-off splines, etc.

D. Paint:
   1. Paint shall be confirmed to meet all Code requirements including latest SCAQMD.
   3. Zinc rich primer for painted steel exposed to the elements: Tnemec No. 90-97; weight not less than 21 pounds per gallon.
   4. Hot dip galvanized all steel work permanently exposed to the exterior including bolts, nuts, washers, etc.

E. Miscellaneous Materials:
   1. Provide miscellaneous materials or accessories as indicated or required for good construction practice.
   2. Provide supplemental structural steel support framing for metal deck where normal deck bearing is precluded by column flange plates or other framing members and around minor floor openings where indicated.
   3. Shop applied shear stud connectors.
   4. Anchor bolts.

2.2 FABRICATION

A. General: Fabricate per AISC Specifications. Properly mark materials where field assembly requires. Sequence material shipments to expedite erection and minimize field handling.

B. Planning and Milling:
   1. Mill bearing surfaces to true planes. Mill ends of columns perpendicular to centerline axis connected mid depth points at ends of member. Milled surfaces shall be completely assembled or welded before milling. Cut and fit column and bearing stiffeners to give full bearing over cross section.
   2. Column Base Plates:
      a. From 2 inches through 4 inches thickness: Straighten by pressing.
      b. Over 4 inches thickness: Plane top for column bearing; plane bottom when bearing on steel.
C. Holes, Cutout and Filling: Provide where indicated for other trades. No additional holes, cutouts, or fittings permitted without written permission.

D. Camber: Fabricate beams, girders and assemblies with natural camber upward, unless otherwise indicated. Provide camber on beams and girders as indicated.

E. Connections shall be as indicated. Alternate connections may be required due to erection or other conditions. Connections for shop or field connections or splicing shall be shown on shop fabrication drawings for review prior to fabrication.

F. Detail connections by fabricator based on information indicated and considerations of shipment and erection. Detailing shall be performed using rational engineering design and standard practice in accordance with AISC. Details indicated on Drawings may be subjected to minor changes during detailing.

G. Individual steel shapes indicated consist of members which are identified by designations indicated. Where alternative shapes are indicated, submit initial set of erection drawings showing members which are proposed to be used. Where indicated or where material availability is difficult, individual members may be fabricated from individual plates and such proposed substitutions shall be shown on initial erection drawings.

H. No combination of bolts and welds shall be used for stress transmission in same faying face of connections.

I. Automatic or semi-automatic welding may be used per AWS procedure.

J. Welding, filler metal, welding techniques, qualified welders, and procedures shall be in accordance with AISC specification for "Design, Fabrication and Erection of Structural Steel for Buildings", and AWS "Structural Welding Code" and "Filler Metal Specifications".

K. Clean steel in areas where painting, welding, bolting, stud welding, metal deck welding will be performed.

L. Welding processes other than shielded metal arc and submerged arc may be used provided procedure qualification tests in accordance with American Welding Society are made for intended application of such process. Testing and Submittal of test reports shall be submitted with proposed locations of use for review prior to Shop Drawings Submittal and shall have been identified during bidding and reviewed.

M. Built-up sections assembled by welding shall be free of warpage and axes shall have alignment within specified tolerances.

N. Welds not specified shall be continuous fillet weld, using not less than minimum size as specified by AWS.

O. Welding sequences shall be such to reduce residual stresses due to welding to minimum value.

P. Toughness and notch sensitivity of steel shall be considered in formation of welding procedures to prevent brittle and premature fracture and shall be in accordance with AISC/AWS FEMA 350.

1. Welding procedures for complete penetration welds shall include sequences for placing each weld bead as well as pre-heat and post-heating, electrode selection, etc.
2. Welding procedures shall be written and shall be prepared by a qualified welding engineer.

3. Welding procedures shall account for all fabrication orientations and welding conditions, material grades, mill certifications, member sizes, etc.

Q. Detail and design welded connections to minimize accumulation and concentration of through-thickness strains due to weld shrinkage.

R. Detailing of copes at complete penetration welds shall follow AISC/AWS FEMA 350, except as noted.

1. The weld access web cope details shall be compatible with the weld process. The bottom flange web cope shall permit as much welding as possible under the cope and beyond the web.

2. The weld access web cope details shall be developed with the consultation of the qualified welding engineer who develops the written welding procedure specification for the welds.

3. The weld access web cope details shall follow FEMA 350, Figure 3 – 5 for beam to column connections in moment frames, beam to column connection in braced frames, for column splices for frames, and base plate connections for frames.

S. Reduced Flange Sections: Edges of reduced flange sections in moment frame beams shall be ground smooth and corners eased. Notches, grooves, under cuts, nicks, etc. are not acceptable in the reduced flange sections.

T. Repairs: Remove defects, reweld, and grind welds flush; method of repairs shall be acceptable to Testing Laboratory. In lieu of repairs, materials with defects may be replaced with new at Contractor's option and expense.

2.3 SHOP PAINTING

A. General: Do not paint when ambient temperature is below 40 degrees Fahrenheit. Paint in dry weather or under cover. Apply paint by brush or spray over dry dust free surface per manufacturer's directions. Do not thin paint in excess of manufacturer's recommendations. Allow paint to dry before handling and shipment of structural steel.

B. Shop-coat structural steel except the following:

1. Members to be encased in concrete.

2. Contact surfaces of welded connections and areas within 2 inches of field welds.

3. Contact surfaces of high-strength bolted connections.

4. Surface receiving sprayed-on fireproofing.

C. Prime Paint:

1. Surface Preparation: Clean surfaces of loose mill scale, dirt, rust and other foreign matter by use of suitable tools; hand tool cleaner per SSPC SP-3, commercial blast cleaning per SSPC SP-6 for steel exposed to the elements. Remove oil and grease with cleaners per SSPC SP-1.
2. Application: Apply one coat to a dry film thickness not less than 2.0 mils.

3. Zinc Rich Primer Application: Apply one coat to a dry film thickness not less than 4.0 mils.

D. Machine Finished Surfaces: Carefully protect against corrosion with coat of white lead and tallow or similar protection; apply per AISC requirements prior to shipments.

E. Concealed Surfaces: Paint parts inaccessible after assembly or erection with 2 coats of primer paint, of different colors.

F. Field Painting:
   1. Field paint bolt heads and nuts, welds, abrasions, and unpainted steel work.
   2. Field paint with primer paint.
   3. Clean completed steel work of foreign materials.

G. Unpainted Surfaces: Remove oil and grease with solvent cleaners; remove dirt and other foreign material by sweeping with wire brushes.

PART 3 EXECUTION

3.1 INSPECTION

   A. Examination: Examine substrates, adjoining construction and conditions under which Work is to be installed. Do not proceed with Work until satisfactory conditions have been corrected.

3.2 PREPARATION

   A. Field Measurements: Establish permanent bench marks and verify elevations of concrete on which structural steel is to be placed and anchor bolt locations and projections using licensed Professional Engineer registered in State where Project is located. Report discrepancies to Architect before proceeding with Work. Perform remedial work in the shop prior to shipment to the field.

3.3 ERECTION

   A. Be responsible for accurate setting and leveling of bearing plates. Furnish templates for accurate setting of anchor bolts. Bearing plates shall be leveled on steel wedges or shims or as otherwise detailed. Grout bearing plates as specified in Section 03300-Cast-In-Place Concrete.

   B. Notify grout manufacturer at least 24 hours prior to grouting. Do no grouting without grout manufacturer’s representative present at site, for initial test plate and initial production work. Train workmen in preparation, placing, curing, etc. to the satisfaction of inspector.

   C. Erect building frame true and level. Erect columns in manner to allow for shrinkage of girders after welding. Check plumbness after erection of each tier. Maintain structural stability of frame during erection; provide temporary bracing where necessary to maintain frame stability and to support required loads, including equipment and its operation.
3.4 ERECTION TOLERANCES

A. Be responsible for correct fitting of structural members and for elevation and alignment of finished structure per AISC Code of Standard Practice (minimum). Be responsible for adjustments necessary in steel work because of discrepancies in elevations and alignment. Furnish shim plates or developed fills where required to obtain fit and alignment.

B. Unless otherwise noted, plumb structure to accuracy of 1 to 1000, but not to exceed 1/2 inch maximum per two story tier. Overall vertical plumbness not to exceed 1 to 500, but not to exceed 1 inch maximum. Level horizontal members to accuracy of 1 to 1000 not to exceed +/- 1/4 inch measured at columns. The actual centerlines of truss chords members shall not vary from theoretical centerlines by more than 1/2 inch at any point.

C. Measurements relating to above shall be on theoretical centerline of members.

3.5 CONNECTIONS

A. Do no welding or bolting until as much of structure as will be stiffened by welding or bolting has been properly aligned.

B. Do not use drift pins to enlarge unfair holes in main material. Ream holes that must be enlarged to admit bolts. Use of burned holes for bolted connections not permitted and main structural members with burned holes will be rejected. Burning and drifting may be used to align unfair holes in secondary bracing members only, when acceptable to Architect. Maintain minimum edge distances at enlarged holes.

C. When high strength bolts or high strength bearing bolts are used, AISC Specifications shall apply including values as noted therein, and installation shall be to full torques (not snug tight) by either "turn of the nut tightening" or with torque wrenches. In using manual torque wrenches, required torque can be read from wrench dial. Care should be taken that wrench is properly calibrated. Nuts shall be in motion when torque is measured. In using power wrenches, follow recommendations of wrench manufacturer. Calibrate manual and power torque wrenches at least once daily and for each lot of bolts.

D. Alternative bolting may be accomplished by utilizing Coronet Load Indicator washers as "direct tension indicators" in accordance with current specifications as indicated in AISC, 8th Edition, the County of Los Angeles, UBC-ICBO Report No. 2885, and manufacturer's recommendations whichever are more stringent. Proposers shall indicate their cost with and without use of indicators for bolting and for use on friction bolted connections only.

E. All field welding shall be performed by pre-qualified welders using pre-qualified welding procedures.

F. All field welding of complete penetration welds of beam flanges to columns shall be performed by particularly pre-qualified welders and particularly pre-qualified welding procedures.

1. Welding shall proceed only based on written procedure specifications prepared by a qualified welding engineer.

2. The written procedure specifications shall account for field conditions, material grades, member sizes, etc.
3. The written procedure specifications shall include specific diagrams for different job conditions showing the sequence of placements of weld beads, extension/backup/runoff material, locations of tack welds, start/stop locations, etc. as well as cleaning, grinding, etc. between passes.

4. The written procedure specification shall indicate pre-heat and post-heat requirements based on the full chemical composition of the abutting steels, field conditions, electrode and weld process, etc. The procedure shall indicate the locations of measurement of temperatures and frequency of measurements.

5. The written procedure specification shall indicate that the bottom flange welds be built up to full size by welding alternately in a uniform manner on both sides of the web. Stops and starts shall be avoided below the web and weld shall proceed under the web cope and beyond as much as possible.

6. The written procedure specification shall indicate removal of extension/backup/runoff materials attendant with the bottom flange connections as well as gouging the weld to remove any incomplete penetration, slag, etc. of the root passes and reinforcing the bottom of the weld.

7. The written procedure shall indicate the field fit up requirements and tolerances of the root opening.

3.6 SURVEY

A. Make accurate survey of actual locations and cambers of steel members immediately upon completion of erection of steel of entire structure and promptly submit same to Architect. Should locations vary beyond allowable tolerances, take necessary corrective measures and modify details and/or procedures as required.

B. Survey information shall have sufficient actual elevations of steel and cambers to allow other trades to correlate with expected deflections in setting screeds and verifying metal deck gauge.

END OF SECTION
SECTION 05121
ARCHITECTURALLY – EXPOSED STRUCTURAL STEEL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary
   Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes structural steel and architecturally exposed structural steel.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 1 Section "Quality Control" for independent testing agency procedures and
      administrative requirements.
   2. Division 5 Section "Steel Deck" for field installation of shear connectors.
   3. Division 5 Section "Metal Fabrications" for loose steel bearing plates and miscellaneous
      steel framing.
   4. Division 9 Section "Special Coatings" for surface preparation and priming requirements.
   5. Division 9 Section "Painting" for surface preparation and priming requirements.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Engineer structural steel connections required by the Contract
   Documents to be selected or completed by the fabricator to withstand design loadings indicated.

B. Engineering Responsibility: Engage a fabricator who utilizes a qualified professional engineer
   to prepare calculations, Shop Drawings, and other structural data for structural steel
   connections.

C. Fabrication required for Structural Steel. City of Los Angeles, Department of Building Safety.

D. Fabrication required for Shop Welds. City of Los Angeles, Department of Building Safety.

E. Special Inspection required for Structural Observation. City of Los Angeles, Department of
   Building Safety.

1.4 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and
   Division 1 Specification Sections.

B. Product Data for each type of product specified.

C. Shop Drawings detailing fabrication of structural steel components.
1. Include details of cuts, connections, splices, camber, holes, and other pertinent data.

2. Indicate welds by standard AWS symbols, distinguishing between shop and field welds, and show size, length, and type of each weld.

3. Indicate type, size, and length of bolts, distinguishing between shop and field bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.

4. Include Shop Drawings signed and sealed by a qualified professional engineer responsible for their preparation.

D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Mill test reports signed by manufacturers certifying that their products, including the following, comply with requirements.
   1. Structural steel, including chemical and physical properties.
   2. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
   3. Direct-tension indicators.
   4. Shear stud connectors.
   5. Shop primers.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced Installer who has completed structural steel work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

1. Fabricator must participate in the AISC Quality Certification Program and be designated an AISC-Certified Plant as follows:
   a. Category: Category I, conventional steel structures.
   b. Category: Category II, complex steel building structures.
   c. Fabricator shall be registered with and approved by authorities having jurisdiction.

C. Comply with applicable provisions of the following specifications and documents:
   2. AISC's "Load and Resistance Factor Design (LFRD) Specification for Structural Steel Buildings."
5. AISC's "Seismic Provisions for Structural Steel Buildings."
6. ASTM A 6 (ASTM A 6M) "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."

D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.

E. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code–Steel."
   1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.

F. Mockups: Prior to installing architecturally exposed structural steel, construct mockups for each form of construction and finish required to demonstrate aesthetic effects as well as qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for final unit of Work.
   1. Locate mockups on-site in the location and of the size indicated or, if not indicated, as directed by Architect.
   2. Notify Architect one week in advance of the dates and times when mockups will be constructed.
   3. Demonstrate the proposed range of aesthetic effects and workmanship of steel surfaces and welded and bolted connections.
      a. Coordinate finish painting requirements of mockups with Division 9 Section "Painting."
   4. Obtain Architect's approval of mockups before start of final unit of Work.
   5. Retain and maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
      a. When directed, demolish and remove mockups from Project site.
      b. Approved mockups in an undisturbed condition at the time of Substantial Completion may become part of the completed Work.

G. Preinstallation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.
B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.7 SEQUENCING

A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel Shapes, Plates, and Bars: As follows:

B. Cold-Formed Structural Steel Tubing: ASTM A 500, Grade B.

C. Hot-Formed Structural Steel Tubing: ASTM A 501.

D. Steel Pipe: ASTM A 53, Type E or S, Grade B.
   1. Weight Class: Standard.
   2. Finish: Galvanized.

E. Anchor Rods, Bolts, Nuts, and Washers: As follows:
   2. Headed Bolts: ASTM A 307, Grade A; carbon-steel, hex-head bolts; and carbon-steel nuts.
   3. Headed Bolts: ASTM A 325 (ASTM A 325M), Type 1, heavy hex steel structural bolts and heavy hex carbon-steel nuts.

F. Nonhigh-Strength Bolts, Nuts, and Washers: ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); carbon-steel, hex-head bolts; carbon-steel nuts; and flat, unhardened steel washers.
   1. Finish: Hot-dip zinc-coating, ASTM A 153, Class C.

G. Welding Electrodes: Comply with AWS requirements.

2.2 PRIMER
A. Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer with good resistance to normal atmospheric corrosion, complying with performance requirements of FS TT-P-664.

B. Primer: SSPC-Paint 25; red iron oxide, zinc oxide, raw linseed oil and alkyd primer.

C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds and repair painting galvanized steel, with dry film containing not less than 93 percent zinc dust by weight, and complying with DOD-P-21035A or SSPC-Paint 20.

2.3 GROUT

A. Cement Grout: Portland cement, ASTM C 150, Type I; and clean, natural sand, ASTM C 404, Size No. 2. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

B. Metallic, Shrinkage-Resistant Grout: Premixed, factory-packaged, ferrous aggregate grout, complying with ASTM C 1107, of consistency suitable for application, and a 30-minute working time.

C. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C 1107, of consistency suitable for application, and a 30-minute working time.

2.4 FABRICATION

A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to AISC specifications referenced in this Section and in Shop Drawings.

1. Camber structural steel members where indicated.
2. Identify high-strength structural steel according to ASTM A 6 (ASTM A 6M) and maintain markings until steel has been erected.
3. Mark and match-mark materials for field assembly.
4. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
5. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.

B. Fabricate architecturally exposed structural steel with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.

1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating, and shop priming.
2. Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for architecturally exposed structural steel.
C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
   1. Plane thermally cut edges to be welded.

D. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.

E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's printed instructions.

F. Steel Wall Framing: Select true and straight members for fabricating steel wall framing to be attached to structural steel framing. Straighten as required to provide uniform, square, and true members in completed wall framing.

G. Welded Door Frames: Build up welded door frames attached to structural steel framing. Weld exposed joints continuously and grind smooth. Plug-weld fixed steel bar stops to frames. Secure removable stops to frames with countersunk, cross-recessed head machine screws, uniformly spaced not more than 10 inches (250 mm) o.c., unless otherwise indicated.

H. Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.
   1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
   2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.

2.5 SHOP CONNECTIONS

A. Shop install and tighten nonhigh-strength bolts.

B. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
   1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
   2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.

2.6 SHOP PRIMING

A. Shop prime steel surfaces, except the following:
   1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches (50 mm).
   2. Surfaces to be field welded.

B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:
1. SSPC-SP 5 "White Metal Blast Cleaning."

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils (0.038 mm). Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply 2 coats of shop paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

D. Painting: Apply a 1-coat, nonasphaltic primer complying with SSPC's "Painting System Guide No. 7.00" to provide a dry film thickness of not less than 1.5 mils (0.038 mm).

2.7 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel indicated for galvanizing according to ASTM A 123.

2.8 SOURCE QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform shop inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
2. Provide testing agency with access to places where structural steel Work is being fabricated or produced so required inspection and testing can be accomplished.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.

1. Liquid Penetrant Inspection: ASTM E 165.
2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
3. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."

D. In addition to visual inspection, shop-welded shear connectors will be inspected and tested according to requirements of AWS D1.1 for stud welding and as follows:

1. Bend tests will be performed when visual inspections reveal either less than a continuous 360-degree flash or welding repairs to any shear connector.
2. Tests will be conducted on additional shear connectors when weld fracture occurs on shear connectors already tested, according to requirements of AWS D1.1.

PART 3 - EXECUTION
3.1 EXAMINATION
A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.
B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION
A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.
1. Do not remove temporary shoring supporting composite deck construction until cast-in-place concrete has attained its design compressive strength.

3.3 ERECTION
A. Set structural steel accurately in locations and to elevations indicated and according to AISC specifications referenced in this Section.
B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
   a. Comply with manufacturer's instructions for proprietary grout materials.
C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
   1. Level and plumb individual members of structure.
   2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
E. Splice members only where indicated.
F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds; and grind smooth at exposed surfaces.

G. Do not use thermal cutting during erection.

H. Finish sections thermally cut during erection equal to a sheared appearance.

I. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

3.4 FIELD CONNECTIONS

A. Install and tighten nonhigh-strength bolts.

B. Weld Connections: Comply with AWS D1.1 for procedures, appearance and quality of welds, and methods used in correcting welding work.
   1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
   2. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp.
   3. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of back-side welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch (13 mm) and larger. Grind flush butt welds. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

A. Owner will engage an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports.

   1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.

B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.

C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.

D. In addition to visual inspection, field-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.

   1. Liquid Penetrant Inspection: ASTM E 165.
   2. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
   3. Radiographic Inspection: ASTM E 94 and ASTM E 142; minimum quality level "2-2T."

E. In addition to visual inspection, field-welded shear connectors will be inspected and tested according to requirements of AWS D1.1 for stud welding and as follows:
1. Bend tests will be performed when visual inspections reveal either less than a continuous 360-degree flash or welding repairs to any shear connector.

2. Tests will be conducted on additional shear connectors when weld fracture occurs on shear connectors already tested, according to requirements of AWS D1.1.

3.6 CLEANING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint. Apply paint to exposed areas using same material as used for shop painting.

   1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils (0.038 mm).

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on structural steel are included in Division 9 Section "Painting."

C. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A 780.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Open web steel joists, with extended ends, and extended bottom chords.
   2. Bridging and bridging anchors.
   3. Headers and loose bearing plates.

B. Related Documents: The Contract Documents, as defined in Section 01110 - Summary of Work, apply to the Work of this Section. Additional requirements and information necessary to complete the Work of this Section may be found in other Documents.

C. Related Sections:
   1. Section 05120 - Structural Steel: Building structural frame.
   2. Section 09900 - Painting: Field painting of exposed joists and roof deck.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM):
   1. ASTM A 36 - Specification for Carbon Structural Steel.
   2. ASTM A 307 - Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

B. American Welding Society (AWS):
   1. AWS D1.1 - Structural Welding Code.

C. Steel Joist Institute (SJI):
   1. SJI - Standard Specifications Load Tables and Weight Tables for Steel Joists and Joist Girders.

D. Steel Structures Painting Council (SSPC):
   1. SSPC SP 2 - Hand Tool Cleaning.
   2. SSPC Paint 15 - Steel Joist Shop Paint.

1.3 FABRICATION REQUIREMENTS

A. Fabricator required; City of Los Angeles, Department of Building and Safety.

1.4 SUBMITTALS

A. Section 01300 - Submittals: Procedures for submittals.
   1. Shop Drawings:
a. Indicate joist types using standard SJI designations, spacing, location, bridging, anchorages, and special conditions.
b. Indicate welded field connections using standard AWS welding symbols.
c. Indicate paint primer type, accessories, and installation details.
d. Joist setting plans.

2. Assurance/Control Submittals:
   a. Test Reports: Submit the following reports directly to Los Angeles Bureau of Engineering from testing laboratory, with copy to Contractor. Prepare reports in conformance with Section 01450 - Quality Control:
      1) Welding inspection.
      2) Bolted connection inspection.
   b. Certificate: Manufacturer certificate, signed and sealed by a registered structural engineer, certifying that joists are designed in accordance to and comply with SJI specifications and are certified by SJI.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with SJI, Load Tables and Weight Tables.

B. Qualifications:
   1. Fabricator: Company specializing in performing Work of this Section with minimum 5 years documented experience.
   2. Erector: Company specializing in performing Work of this Section with minimum 5 years documented experience, certified by AISC Quality Certification Program.
   3. Qualifications for Welding Work: Qualify welding operators in accordance with AWS Standard Qualification Procedures. Provide certification that welders employed in work have satisfactorily passed AWS qualification tests within previous 12 months. If recertification of welders is required, provide without additional cost to Los Angeles Bureau of Engineering.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 - Product Requirements: Transport, handle, store, and protect products.

B. Comply with recommendations of SJI Specifications.

C. Protect from corrosion, deformation, and other damage.

PART 2 PRODUCTS

2.1 MATERIALS

A. Open Web Joist Members: SJI Type K Open Web.

B. Bridging: ASTM A 36.

C. Welding Materials: AWS D1.1; type required for materials being welded.
   1. Open Web Steel Joists: Conform to SJI Specifications for Open Web Steel Joists and to SJI Technical Digest No. 8, Welding of Open Web Steel Joists.
2. Longspan and Deep Longspan Steel Joists and Joist Girders: Conform to applicable Welding Electrodes section in SJI Specifications.


E. Primer: SSPC 15, Type 1, red oxide.

F. Accessories: Provide anchors and fasteners required for installation and attachment of joists and bridging.

G. Structural Steel Building Framing: Specified in Section 05120.

2.2 FABRICATION

A. Design and fabricate joists, including headers and other supporting framing, in accordance with SJI Standard Specifications.

1. Verify Drawing dimensions and field conditions before beginning fabrication.
2. Provide for concentrated loads indicated on Drawings.

B. Bottom Chord Extensions: Provide joist bottom chord extensions at columns, not framed in minimum two directions, with structural steel members. Connect to columns as indicated on Drawings.

C. Extended Ends: Provide extended joist ends at locations indicated on Drawings. Comply with load tables and design loads indicated on Drawings.

D. Bridging: Provide horizontal or diagonal type bridging for open web joists, including bridging anchors for ends of bridging lines ending at walls or beams.

E. End Anchorage: Provide anchorages to connect joists to adjacent construction.

F. Header Units: Provide header units to support tail joists at openings in roof system not framed with steel shapes.

2.3 FINISH

A. Prepare joist component surfaces in accordance with SSPC SP 2.

B. Shop prime joists. Do not prime surfaces that will be field welded and in contact with concrete.

1. Apply one shop coat of primer to joists and joist accessories to provide a continuous dry film thickness of 0.50 mils.

C. Field Painting: Field paint joists, indicated on Drawings to receive paint finish, as specified in Section 09900.

2.4 SOURCE QUALITY CONTROL

A. Inspection: Los Angeles Bureau of Engineering reserves the right to have Los Angeles Bureau of Engineering’s Representative make a visual inspection of joists at fabricators’ shop before shipment.

PART 3 EXECUTION
3.1 EXAMINATION

A. Section 01700 - Execution Requirements: Verification of existing conditions before starting work.

B. Verification of Conditions: Verify that field measurements, surfaces, substrates and conditions are as required, and ready to receive Work.

C. Report in writing to Los Angeles Bureau of Engineering prevailing conditions that will adversely affect satisfactory execution of the Work of this Section. Do not proceed with Work until unsatisfactory conditions have been corrected.

D. By beginning Work, Contractor accepts conditions and assumes responsibility for correcting unsuitable conditions encountered at no additional cost to the Los Angeles Bureau of Engineering.

3.2 ERECTION

A. Erect steel joists, joist girders, and bridging in accordance with SJI Standard Specifications and SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Girders.

B. Do not start erection of joists until supporting Work is in place and connections made.

C. Erect and bear joists on supports.

D. Allow for erection loads. Provide temporary bracing to maintain joists safe, plumb, and in true alignment.

E. Install bridging simultaneously with joist erection, before construction loads are applied. Connect ends of bridging lines at top and bottom chords terminating at walls or beams.

F. After joist alignment and installation of framing, field weld joist seat to bearing member.

G. Position and field weld joist chord extensions and wall attachments.

H. Do not permit installation of roof decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.

I. Do not field cut or alter joists.

J. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

3.3 CONSTRUCTION

A. Interface with Other Work:

1. Coordinate placement of anchorages in concrete and masonry construction for making connections to joists and joist girders, and for securing bearing plates.

2. Furnish anchor bolts and other devices built into concrete and masonry construction to appropriate installer for installation.

B. Site Tolerances:

1. Minimum Variation From Plumb: 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. Section 01450 - Quality Control: Field testing and inspection.

B. Testing laboratory will inspect bolted connections and field welds.
   2. Welded: Visually inspected.

END OF SECTION
PART 1 GENERAL

1.1 DESCRIPTION

A. Principal work in this Section:
   1. Provide all metal deck and accessories, complete, in accordance with the Contract Documents.

B. Related Work in other Sections:
   1. Section 03300 - Cast-In-Place Concrete.
   2. Section 05120 - Structural Steel.
   3. Section 05510 - Steel Stairs.

1.2 QUALITY ASSURANCE

A. Quality Assurance: Prepare and execute Quality Assurance program including materials report, sampling, and detailed shop drawings which provide no opportunity to complete unsatisfactory metal decking. Perform retesting or evaluation by Quality Control personnel due to deficient work, and similar work at no additional cost to Owner.

B. Quality Control: Metal decking may be subject to evaluation and tests in shop and field by others. Evaluations and testing undertaken by others is strictly for random evaluation. Extent, duration and amount of testing or evaluation is entirely at discretion of others. Use of testing services, or execution of testing or evaluation service by others shall in no way relieve Contractor's sole responsibility to furnish materials and construction in full compliance with Contract Documents.

C. Use adequate numbers of skilled craft persons who are thoroughly trained and experienced in the necessary crafts and who are complete familiar with specified requirements and the methods needed for proper performance of the Work of this Section.

D. Testing Agency: Owner will engage, at his expense, Testing Agency to inspect metal decking and shear connector installation, to perform tests specified, and to submit reports to Architect.

   1. Testing Agency will be responsible for conducting and interpreting tests, will state in reports whether test results comply with Contract Documents, will specifically note deviations therefrom, and will indicate corrective measures required and taken.

   2. Provide Testing Agency with the following:
      a. Shop and erection drawings.
      b. Cutting lists, order sheets, material bills, shipping bills and test reports.
      c. Representative sample pieces requested for testing.
d. Full and ample means and assistance for testing.

e. Proper facilities, including scaffolding, temporary work platforms and hoisting facilities for inspection of Work in mills, shop and field.

3. Contractor shall provide and pay for corrective measures, including additional and more complete testing.

1.3 STANDARDS

A. Except as modified by governing codes and by the Contract Documents, comply with applicable provisions and recommendations of the following:

1. "Specifications for the Design of Light Gauge Cold-Formed Steel Structural Members" by AISI.


3. "Design Manual for Floor Decks and Roof Decks" by SDI.

1.4 SUBMITTALS

A. Product data: Within 40 calendar days after the Contractor has received the City's "Notice to Proceed" submit the following:

1. Materials list of items proposed to be provided under this Section.

2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.

B. Make submittals in accordance with the requirements of Division 1.

1. In general, a minimum of 10 working days in the Engineer of Record's office should be scheduled for a usual review period for a usual sized submittal of shop drawings.

2. Submittal shall be made after completion, checking and coordination and be received by the Engineer of Record at least 45 days prior to fabrication.

3. The review of shop drawings by the Engineer of Record is for conformance with the design intent and the stamp on the returned submittal implies fabrication may proceed only if the work is in accordance with the Contract Documents.

C. Shop Drawings: Submit detailed drawings showing layout of deck panels and all special conditions requiring closure panels, supplementary framing and special jointing or other accessories. Shop drawings shall clearly show locations, sizes and details for decking; precut and field cut openings for floor openings, shear studs, and other details. Show all welding at ends, edges, sidelap fastening, etc. Form and character of shop drawings shall be to Architect's satisfaction, be checked and complete. Reuse of Contract Documents is not permitted.
D. Manufacturer's Literature: Submit copies of manufacturer's specifications and installation instructions for each work item specified. Include manufacturer's certification as may be required to show compliance with these Specifications. Indicate by transmittal form that a copy of each instruction has been distributed to the installer.

E. Manufacturer's Certification: Submit steel physical and chemical tests and certification that galvanizing and steel comply with Contract Documents.

F. Test Data: Submit manufacturer's test data for composite deck sections to be used to verify a minimum factor of safety of 2 for total load on a single span condition. Provide full layout and description of embossments and indentations of metal decking including size and spacing.

G. Calculations: Submit calculations for all composite and non-composite metal deck span and load conditions for the project bearing seal and signature of Professional Engineer registered in State where project is located. Include manufacturer's published load-span tables and deck section properties. Submit published load span data and diaphragm characteristics for all deck slabs. Submit ICBO/Building Department Report of approvals for fire rating, load capacity and diaphragm characteristics for decking and also approval report for shear connector.

H. Submit shop drawings showing complete layout of shear connectors for each member and data indicating any adjustments to shear capacities due to deck configuration or grouping. Show all deck configurations at shear stud locations, particularly for beams parallel to deck spans.

X. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:

1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials. Provide separate data for each different manufacturer used:
   a. Steel Decking

2. LEED Credit MRc5.1: Provide manufacturer name and location data for the following materials. Provide separate data for each different manufacturer used:
   a. Steel Decking

1.5 STORAGE AND HANDLING

A. Comply with the Requirements of Division 1.

B. Store materials to permit easy access for inspection and identification. Keep steel members off ground using pallets, platform or other supports. Protect steel members and package materials from corrosion and deterioration.

C. Do not store materials on structure in a manner that might cause distortion, damage or overloading members or supporting structure. Repair or replace damaged materials or structure as directed at Contractor's sole expenses.

D. Storage of Materials: Store off ground, and under cover, protected from damage. Store packaged materials in unopened containers. Provide for proper drainage.
E. Handling Materials: Handle materials in way to protect surfaces. Prevent distortion of and other damage to fabricated deck.

PART 2 PRODUCTS

2.1 MATERIALS

A. Composite Floor and Roof Deck Unit:
   1. Verco: 3 inch; Type W-3, 20 gauge minimum, or equal.
   2. Verco: 2 inch; Type W-2, 20 gauge minimum, or equal.
   3. Verco: 1-1/2 inch; Type B-Formlok, 20 gauge minimum or equal.

B. Roof Deck without Concrete:
   1. Verco: 3 inch; Type N, 18 gauge minimum with shear transfer.
   2. Verco: 1-1/2 inch; Type B, 18 gauge minimum with shear transfer.

C. Roof Deck without Concrete over Sloped Roofs in general area of Meeting Room, Entry and Lobby:
   1. Epic Metals: 2 inch; Type ER2RA (Acoustical), 16 gauge minimum. Perforations and acoustic material to provide noise reduction coefficient 0.95 minimum.

D. Steel for Galvanized Deck: ASTM 653, SS, Grade 33, Fy = 38,000 minimum. For Epic acoustic deck ASTM A653, Grade 40, Fy = 40,000 psi minimum.
   1. Galvanizing: ASTM 924, as follows:
      a. For All Decking with Concrete Fill: G60, 0.60 oz./sq. ft.
      b. For All Decking without Concrete Fill: G90, 0.90 oz./sq. ft.

E. Paint for Galvanized Deck: Zinc dust, zinc oxide, alkyd resin, complying with FS TT-P-641f, Type II. Pretreat galvanized surfaces to be painted in accordance with SSPC-PT 2-64. For Epic acoustic deck, prepare galvanized surface for priming and for painting in accordance with painting specification.

F. Shear Connectors: Through-deck stud welded shear connectors.
   1. KSM Division, Omark Industries.

G. Accessories: Provide accessories of every kind required to complete the installation of metal decking in the system shown. Finish sheet metal items to match deck. Accessories shall be 18 gauge minimum thickness and galvanized. Include the following items:
1. Metal cover plates to close gaps at changes in deck direction, columns, walls and openings.

2. Continuous sheet metal edging at openings and concrete slab edges (16 gauge minimum at interior openings and 12 gauge minimum at the perimeter slab edge). Increase minimum thickness, provide 18 gauge (min.) strap anchors at 36" maximum spacing or alternative support for concrete and construction loads and maintain edge of slab within 1/4" of required location.

3. Sealed closures for ends of cells on single-unit decking.

4. Provisions for venting through decking for slab which are to receive elastomeric coating, roofing or waterproofing coatings/waterproofing membranes. Venting shall be equal to or greater than 1.5% of deck area and shall be evenly distributed.

5. Supplementary framing including miscellaneous angles as necessary for support of slab edges at columns, at perimeter edges of floors and openings as well as angles for deck support at pipe sleeves adjacent to columns.

6. For metal deck without concrete fill provide bent plate at all edges 3/8 inch minimum.

2.2 FABRICATION

A. Deck Section Requirements: Comply with the depth and minimum metal thickness requirements as shown and comply with basic design criteria as hereinafter specified.

1. The slab shall be designed for service conditions as a composite section for the superimposed dead and live loads, as shown on Drawings, on a simple span condition with a limiting deflection of L/360, steel stress of 0.75 Fy, f'c per ACI 318.

2. As a temporary loading condition, metal decking shall be designed typically for non-shored condition for the wet weight of concrete including minimum allowance for construction loads of 20 psf. Under the temporary loading conditions the maximum deflection shall be limited to 1/2" or L/240 whichever is smaller or maximum stress of 0.60 Fy, based on either a single span loading or single span loading of multiple span conditions whichever governs.
   
   a. Provide deck shores for any span or loading condition which does not meet the stress/deflection criteria set forth above.

3. The deck configuration shall be such as to properly accommodate shear studs to develop their required capacity.

B. Decking shall have interlocking seam along sides of panels.

C. The minimum gauge of decking shall be increased as required to satisfy requirements of load and deflection corresponding to span lengths and number of spans for each piece of decking as actually installed with expected concrete fill thickness accounting for tolerances and deflections.

PART 3 EXECUTION

3.1 INSPECTION OF CONDITIONS
A. Examine the areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until detrimental conditions are corrected. Start of installation operations shall imply Contractor's acceptance of job conditions.

3.2 PLUG WELD QUALIFICATION PROCEDURE

A. The erector shall use only experienced welders qualified for welding light gauge metal and establish the welding procedure for the plug weld of the steel decking for the particular gauge used, which is to be witnessed by the Owner's Testing Agency.

B. The welder should start by clamping a piece of the deck on the top flange of a scrap beam or plate of at least 1/2" in thickness with the edge of the sheet steel protruding over the edge of the beam by 3".

C. Welding cables of length and size similar to that which will be used on the actual construction, should be used for this test.

D. The welder should make what he believes is a good 3/4" puddle weld through 20 gauge sheet steel to the beam with the crater filled and reasonable reinforcement above the sheet metal. The following are suggested settings for this equipment.

1. Electrode: E-60.
2. Three welds per electrode.
3. 19 second duration per weld.
4. Burn-off rate of 4.7 seconds per inch.

E. When weld has cooled, strike the edge of the sheet steel with a sledge hammer so as to rotate the sheet around the puddle weld until the sheet or the weld breaks.

F. Measure the diameter of the weld nugget remaining on the structural steel. If the weld is not satisfactory, adjust the amperage and repeat by making test welds and breaking them until the proper 3/4" nugget is obtained, once the proper welds are consistently obtained (a minimum of three welds), have the welder make another test weld by first welding on a scrap plate to consume at least 6" of a new electrode and then immediately, while the electrode is still hot, make another puddle weld. Test this weld and compare the results with the welds made previously and considered satisfactory.

G. Using the same electrode, power supply unit, setting, and cable lengths established above, determine an average burn-off rate for 3 electrodes. Then make another puddle weld as a final check on the procedure.

H. Each welder on the steel deck shall be qualified using the above procedure, prior to welding any steel roof or floor deck to the structure.

3.3 SHEAR CONNECTOR WELDING REQUIREMENTS

A. All shear studs as indicated on Drawings are based on the allowable shear capacities for shear studs in normal weight stone concrete per AISC or as indicated. Actual stud shear capacities must be determined by tests on the type of deck supplied and the number of studs required in each rib. If additional shear studs are required due to decreases in the allowable shear values, such studs shall be provided at Contractor's expense.
B. Shear connectors shall be applied in accordance with the manufacturer's printed instructions. Use only personnel and equipment authorized by the manufacturer.

C. Through-deck stud welding may be used where metal thickness permits proper stud welding to develop the strength as required. Stud and/or deck manufacturer shall provide adequate test results to verify the feasibility of through-deck stud welding for the particular stud size and metal thickness involved. The stud and/or deck manufacturer shall satisfy the requirements of the stud installer for expeditious and proper installation. All the manufacturer's requirements regarding cleanliness of steel and other items shall be met by the installer.

D. If through-deck stud welding is unfeasible, the studs shall be installed in prepunched holes in the deck. Prepunched holes shall be provided only for the shear studs involved and hole oversize shall be held to a minimum.

3.4 ERECTION

A. General: Provide units of types shown: install in single lengths for at least 3 spans where practicable. Provide auxiliary steel angle supports where required to support decking; preheat as required; weld per AWS.

B. Layout: Place and adjust units into final position prior to permanent fastening. Bring each unit to proper bearing on supporting steel. Place units in straight alignment for entire length of cell runs, close alignment of adjoining units, and with minimum space between ends of abutting units.

C. Welding: Attach panels to all structural supports with 3/4" fusion weld spaced not more than 12" o.c. At joints weld both panels to support.

1. Button-punch or weld side joints 2'-6" o.c., maximum. For structural concrete deck slabs, and side seam welded at 12 inches maximum for metal deck roofs without concrete or with insulating concrete.

2. Secure accessories by tack welding.

3. Touch-up welds and field cuts with touch-up paint as specified, promptly after installation.

D. Hanging Loads for Metal Decks without Concrete: Do not hang loads from decking exceeding 50 lbs. at widely spaced locations. Provide Unistrut or other miscellaneous members as necessary to span between steel beams. Hangers shall have anchorage spanning across the tops of two adjacent deck highpoints. Do not hang anything from metal decking itself or metal tabs punched from the decking.

E. Hanging Loads for Metal Deck Structural Concrete Slabs: Hangers shall have anchors embedded in concrete. Do not hang anything from the metal decking itself or metal tabs punched from the decking.

F. Patching, Drilling, Cutting or Reinforcing: When required on site by other trades, control measures/methods to assure deck can support loads, etc.

G. Closures & Angle Closures:

1. Secure into position by welding at not over 18" centers, unless otherwise indicated.
2. Provide angle closures at openings and provide concrete retainer flashings and transition flashing as required to make decking complete and ready to receive concrete or roofing.

3. Sheet metal closure shall not be utilized for support of cladding, stud framing, etc., but sheet metal closure may be utilized as temporary support for holding embeds for other trades in position during concrete work. Coordinate all work relating to metal deck work.

H. Defective or Damaged Units: Not permitted.

3.4 FIELD QUALITY CONTROL

A. Field welding of metal decking and shear studs subject to continuous inspection by Owner's testing agency. Give at least 3 days notice prior to welding.

1. Metal Deck: Visually inspect metal deck plug welds for quality of weld; direct requalification of welders as needed. Inspect welding of attachments, accessories, and heavy gauge bent plates at slab edges.

2. Shear Studs: Visually inspect shear stud installation; direct qualification of welders as needed. Perform bend test on five percent of all studs and a minimum of two studs per beams.

3.5 CLEAN-UP

A. After erection, remove metal cuttings and construction debris. Remove grease, oil, and other foreign material from top side of metal decking which would prevent proper bonding of concrete fill or roofing materials. Leave decking in a condition acceptable to other trades. Remove all foreign materials from underside of metal decking which would prevent proper bonding of spray-on fireproofing materials where fireproofing is required. Touch-up with zinc-rich paint all welding and top and bottom of decking without where deck is permanently exposed to view or the elements. Zinc-rich touch-up deck soffits of deck-slabs where deck is permanently exposed to view or the elements.

END OF SECTION
SECTION 05310
ACOUSTICAL METAL DECKING

PART 1   GENERAL

1.1 SUMMARY

The requirements of this Specification Section include all materials, equipment and labor necessary to furnish and install an ER2RA Acoustical Roof Deck System or equal.

A. ER2RA shall serve as an acoustical ceiling and a structural roof deck as indicated on the contract drawings.

B. ER2RA Acoustical Roof Deck shall provide an exposed bottom surface that is substantially flat. The narrow rib openings of the ER2RA Acoustical Roof Deck units shall provide the appearance of a linear ceiling. Fasteners for sidelaps and overlying roofing materials shall be concealed within the depth of the dovetail-shaped ribs.

C. EPICORE "Wedge Nut" hanging devices that are specially configured to fit into the dovetail shaped ribs of the ER2RA Acoustical Roof Deck units shall be available. These hanging devices shall be utilized whenever any related work is suspended from ER2RA, Acoustical Roof Deck. EPICORE "Wedge Nut" hanging devices shall be furnished by the installer of the related work unless otherwise indicated.

1.2 RELATED WORK

The following related work is not part of this Specification Section:

A. Structural Steel: Supplementary framing.

B. Roofing: Other than structural roof deck and accessories.

C. Painting: Preparation for and application of field painting.

D. Mechanical: Attachments to ER2RA Acoustical Roof Deck.

E. Electrical: Attachments to ER2RA Acoustical Roof Deck.

1.3 SUBMITTALS

Submit the following items in accordance with the conditions of the contract and appropriate Specification Sections.

A. Product data for ER2RA Acoustical Roof Deck and EPICORE hanging devices including material types, dimensions, finishes, load capacities and noise reduction coefficients.

B. Erection drawings for ER2RA Acoustical Roof Deck and related accessory items showing profiles and material thicknesses, layout, anchorage and openings.

1.4 REFERENCE STANDARDS

A. Section Properties: Shall be computed in accordance with the AISI specification for THE DESIGN OF COLD-FORMED STEEL STRUCTURAL MEMBERS, latest edition.
B. Welding: Shall comply with applicable provisions of ANSI/AWS D1.3-89 STRUCTURAL WELDING CODE-SHEET STEEL.

C. Noise Reduction Coefficient: Shall be verified by the results of sound absorption tests conducted at Riverbank Acoustical Laboratories. A minimum NRC of 0.95 shall be provided. Copies of the sound absorption test shall be submitted upon request.

1.5 QUALITY ASSURANCE

A. Manufacturer shall have been regularly engaged in the production of a deck section with dovetail-shaped ribs for a period of at least 5 years.

B. Manufacturer's product shall be approved by Factory Mutual Research Corporation for use in Class 1 Insulated Steel Deck Roof Construction.

PART 2 PRODUCTS

2.1 MANUFACTURER

In accordance with the requirements of this Specification Section, provide products manufactured by EPIC METALS CORPORATION, or equal, 2" thick, NR 0.95.

2.2 MATERIALS

A. ER2RA Acoustical Roof Deck units shall be cold-formed from steel sheets conforming to ASTM-A-653, Grade 40, or equal, having a minimum yield strength of 40,000 psi.

B. Before forming, the steel sheets shall have received a hot-dip protective coating of zinc conforming to ASTM-A-924, Class G90.

C. The minimum uncoated thickness of material supplied shall be within 5% of the design thickness.

2.3 FABRICATION

A. ER2RA Acoustical Roof Deck units shall have continuous dovetail-shaped ribs spaced 6 1/16" on center and formed to the following nominal dimensions: 2" depth, 9/16" rib opening at bottom, 1 1/2" rib width at top.

B. The design thickness and minimum section properties shall be indicated on ICBO and L.A. City Research Reports.

C. ER2RA Acoustical Roof Deck units shall have full depth positive registering sidelaps that can be fastened by welds or screws.

D. Whenever possible, ER2RA Acoustical Roof Deck units shall be fabricated to provide a minimum three span condition.

F. ER2RA Acoustical Roof Deck units shall be fabricated with 5/32" perforated holes staggered 3/8" o.c. Perforated areas shall be located in the bottom flat areas between the dovetail-shaped ribs.

2.4 ACCESSORIES
A. EPICORE "Wedge Nut" hanging devices shall be installable and relocatable along the length of the interior ribs of the ER2RA Acoustical Roof Deck units. Manufacturer's product data shall be consulted for minimum spacings, load capacities and proper installation procedure of the EPICORE "Wedge Nut" hanging devices.

B. Sump pans, ridge plates, valley plates, transition plates and eave plates shall be provided per manufacturer's standards.

C. Manufacturer's standard flexible or metal type profile closures shall be provided as indicated on the contract drawings.

D. 2" thick by 4 1/2" wide sound absorbing elements of 3 lb. density fiberglass shall be provided for installation above the perforated holes in the bottom flat area between the dovetail-shaped ribs.
   1. To facilitate field painting of the perforated surfaces, the sound absorbing elements shall be supported on corrosion resistant mesh spacers.
   2. The Contractor shall furnish sound absorbing elements and mesh spacers under this section of the specifications.

PART 3 EXECUTION

3.1 GENERAL

ER2RA Acoustical Roof Deck units and accessories shall be installed in strict accordance with the manufacturer's approved erection drawings, installation instructions, the Steel Deck Institute (SDI) Manual for Construction with Steel Deck, and all applicable safety regulations.

3.2 BEFORE INSTALLATION

A. The supporting frame and other work relating to the ER2RA Acoustical Roof Deck shall be examined to determine if this work has been properly completed.

B. All components of the ER2RA Acoustical Roof Deck System shall be protected from damage during shipment and handling. If storage at the jobsite is required, bundles or packages of these materials shall be elevated above the ground, sloped to provide drainage and protected from the elements with a ventilated waterproof covering.

3.3 INSTALLATION

A. Bundles or packages of ER2RA, Acoustical Roof Deck System components shall be located on supporting members in such a manner that overloading of any individual members does not occur.

B. Before being permanently fastened, ER2RA Acoustical Roof Deck units shall be placed with ends accurately aligned and adequately bearing on supporting members. Proper coverage of the ER2RA Acoustical Roof Deck units shall be maintained. Care shall be taken by the erector to maintain uniform spacing of the bottom rib opening (equal to the openings in the profiled sheet) at the sidelaps.

C. Field cutting of the ER2RA Acoustical Roof Deck units shall be performed in a neat and precise manner. Only those openings shown on the drawings shall be cut. Other openings shall be reviewed in advance and cut by those requiring the opening.
D. ER2RA Acoustical Roof Deck units shall be fastened to all supporting members with 3/4" diameter puddle welds at a nominal spacing of 12" o.c.

E. Sidelaps of ER2RA Acoustical Roof Deck units shall be fastened by welds or screws at a spacing of 36" o.c. or less as indicated on the manufacturer's erection drawings. Sides of ER2RA Acoustical Roof Deck units that are located at perimeter edges of the building shall be fastened to supporting members at a spacing of 36" o.c. or less as indicated on the manufacturer's erection drawings.

F. Sump pans, ridge plates, valley plates, transition plates, eave plates and supplied reinforcement for small openings shall be fastened as indicated on the manufacturer's erection drawings.

3.4 AFTER INSTALLATION

A. Construction loads that could damage the ER2RA Acoustical Roof Deck such as heavy concentrated loads and impact loads shall be avoided. Planking shall be used in all high traffic areas.

B. Prior to the placement of the sound absorption elements, the top surface of the ER2RA Acoustical Roof Deck shall be cleaned of all debris, grease, oil and other foreign substances.

1. Cleaning the bottom surface of the ER2RA Acoustical Roof Deck for field painting shall be the responsibility of the painting contractor.

C. Galvanized coatings that are significantly damaged shall be repaired. An appropriate galvanized repair paint shall be used and the paint manufacturer's application instructions shall be followed.

D. Sound absorbing elements shall be dry before installation of the elements or overlying roof materials.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Roof deck.

B. Related Sections include the following:

1. Division 3 Section "Lightweight Concrete Roof Fill."
2. Division 5 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.3 SUBMITTALS

A. Product Data: For each type of deck, accessory, and product indicated.

B. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.

C. Product Certificates: Signed by steel deck manufacturers certifying that products furnished comply with requirements.

D. Welding Certificates: Copies of certificates for welding procedures and personnel.

E. Research/Evaluation Reports: Evidence of steel deck's compliance with building code in effect for Project, from a model code organization acceptable to authorities having jurisdiction.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who has completed steel deck similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

D. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those steel deck units tested for fire resistance per ASTM E 119 by a testing and inspection agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another testing and inspecting agency.
2. Steel deck units shall be identified with appropriate markings of applicable testing and inspecting agency.

E. AISI Specifications: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Deck:
   a. BHP Steel Building Products or approved alternate.
   b. ASC Pacific, Inc. Metal Floor, Roof and Wall System.
   c. Verco Manufacturing Co.
   d. Epic Metals Corp.
   e. Marlyn Steel Products, Inc.
   g. Roof Deck, Inc.
   h. United Steel Deck, Inc.

2.2 ROOF DECK

A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 29, and the following:
1. Select steel grade required. Revise primer type if required; primer below offers minimum temporary corrosion protection. Coordinate primer selection with Division 7 Section "Sprayed Fire-Resistive Materials" or paint and coating systems specified in Division 9.

2. Galvanized Steel Sheet: ASTM A446-85, Structural Steel Grade E with galvanized coating per ASTM A525-86, G90.

3. Profile Depth: 1-1/2 inches.

4. Design Uncoated-Steel Thickness: .0474 inch (1.2 mm)

5. Span Condition: Triple span or more.

6. Select side-lap configuration. Interlocking seams may be fastened by welding or button punching.

2.3 ACCESSORIES

A. General: Provide manufacturer’s standard accessory materials for deck that comply with requirements indicated.

B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.

C. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), not less than 0.0359-inch (0.91-mm) design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

D. Steel Sheet Accessories: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

E. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi (230 MPa), of same material and finish as deck, and of thickness and profile.

F. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.

G. Galvanizing Repair Paint: ASTM A 780.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

3.2 INSTALLATION, GENERAL

A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 29, manufacturer’s written instructions, and requirements in this Section.

B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
C. Locate decking bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

3.3 ROOF DECK INSTALLATION

A. Fasten roof deck panels to steel supporting members by arc spot (puddle) welds of the surface diameter indicated or arc seam welds with an equal perimeter, but not less than 1-1/2 inches (38 mm) long, and as follows:
   1. Weld Diameter: 5/8 inch (16mm), nominal.
   2. Weld Spacing: Weld edge and interior ribs of deck units with a minimum of four welds per deck unit at each support. Space welds 12 inches apart parallel to flutes at supports.

B. Mechanically clinch or button punch sidelaps at 24 inches on center.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm), with end joints as follows:
   1. End Joints: lapped 2 inches (51mm) minimum.

D. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld to substrate to provide a complete deck installation.

3.4 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing agency to perform field quality-control testing.

B. Field welds will be subject to inspection.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work that does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.
3.5 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION
SECTION 05410
EXTERIOR LIGHT GAUGE METAL FRAMING

PART 1  GENERAL

1.1  SUMMARY
A. Furnish and install exterior light gauge metal framing as indicated on the drawings and specified.

1.2  SUBMITTALS
A. Shop Drawings: Submit dimensioned fabrication and erection drawings.
B. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:
   1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials. Provide separate data for each different manufacturer used:
      a. Light Gage Metal Framing
   2. LEED Credit MRC5.1: Provide manufacturer name and location data for the following materials. Provide separate data for each different manufacturer used:
      a. Light Gage Metal Framing
B. The Owner will engage and pay the testing agency for services rendered in the same manner as specified for “Structural Steel” in Section 05120.

1.3  QUALITY ASSURANCE
A. Comply with the following as a minimum requirement:
   1. AISI - Specifications for the Design of Cold Formed Steel Structural Members.
   2. Welds shall be performed by AWS certified welders. Welding shall be performed in accordance with requirements of the American Welding Society (AWS) Structural Welding Code.
   3. Welding shall be inspected by a special inspector, approved by the Engineer to inspect the Work of this section. The Engineer shall be responsible for monitoring the work of the special inspector to ensure that the inspection program is satisfactorily completed.

1.4  DELIVERY, STORAGE AND HANDLING
A. Store metal studs above grade and protect from corrosion.
B. Store welding electrodes in accordance with AWS D12.1.

PART 2  PRODUCTS
2.1 MANUFACTURERS
   A. Provide products manufactured by one of the following (or equal):
      1. Chicago Metallic Corporation.
      2. Inryco/Milcor.
      3. United States Gypsum.
      4. Dale Industries, Inc.

2.2 MATERIALS
   A. Light Gage Metal Framing: Conform to ASTM A 568 for uncoated steel thickness, hot dip galvanized conforming to ASTM A 123, Coating Class G60. Strengths shall be as specified in ASTM A 653, Grade D, yield strength 50 Ksi. Framing shall be manufactured by USG, Western Metal, or equal.
   B. Gages and properties of studs shall be as indicated on Drawings.
   C. Mechanical anchors to concrete and masonry shall be metal cinch at least 3/8 inch in diameter threaded bolt head type. Anchor bolts to be installed in concrete shall be hook type 1/2 inch diameter or more.
   D. Mechanical anchors to metal framing shall be No. 10 self-tapping and self-drilling wafer-head screws.
   E. Accessories: Provide special top tracks, angles, fasteners, and strips of gypsum wallboard, as required for fire rating assembly required at each condition.
   F. Mineral Wool: Provide Thermafiber Safing Insulation, or equal.

2.3 DETAILED REQUIREMENTS
   A. Conform to the following detailed requirements
      1. Minimum 6” to 8”
      2. Minimum 16 gage
      3. Galvanized
      4. Maximum 16” oc
      5. Weld studs to runners
      6. Use only welders certified by LA City for light gauge welding.
      7. Conform to AWS Standards and Industry Best Practices

PART 3 EXECUTION

3.1 INSTALLATION
   A. Install plumb and true. Install necessary accessories for proper installation.
B. Anchor top and bottom runner track to ceiling or roof structure overhead and to floor structure below.

C. Studs shall be installed squarely in top and bottom runner track with firm abutment against track webs.

D. Align and plumb studs, and fasten to flanges of both top and bottom runner tracks.

E. Provide 3 studs minimum at corners of stud walls. Locate so as to provide surfaces for attachment of interior and exterior facing materials.

F. Members not indicated to be welded together shall be attached with manufacturer recommended screws with one screw at each flange of stud to top and bottom track. Wire tying of framing members is not permitted.

G. Provide lateral bracing and bridging in accordance with manufacturer's written recommendations.

H. Intersecting walls and partitions, whether load-bearing or not, shall be connected.

I. Splices in axially loaded studs are not permitted.

J. Splice or butt weld butt joints in runner tracks. No splices are permitted in tracks over lintels, diaphragm sheathing, or diagonal bracing.

K. Weld connections by fillet welds or plug welds in accordance with AWS recommended procedures and practices.

L. Touch-up field abrasions and welds with galvanizing touch-up material.

M. Studs that frame door openings shall be clipped to floor with 14 gage angle clips, with two fasteners into studs and two fasteners into floor.

N. Provide additional joists or blocking adjacent to exterior and interior walls, openings and elsewhere as required to provide support for indicated ceiling construction.

O. Provide an additional joist under parallel partitions where partition length exceeds 1/2 joist span and around floor and roof openings which interrupt one or more spanning members.

3.2 CONNECTIONS TO METAL DECKING

A. Provide premolded neoprene filler strips matching the flute profile for non-fire-rated walls and partitions covered on one or both sides up to metal decking.

B. The top runner track of fire-rated partitions shall be a minimum of 20 gage and attached to the metal deck with required fasteners at spacing required for fire rating, but in no case over 16 inches on center. Areas above the runner shall be friction fit with a minimum depth of 2-1/2 inches of 4 pounds per cubic foot density mineral wool insulation. A minimum of 1/2 inch of firestopping compound shall be installed to each side of the mineral wool insulation for a one-hour system, and one inch of firestopping for a 2-hour system. Install required special tracks, angles, fasteners and strips of gypsum wallboard to provide required fire resistance rating.

3.3 QUALITY CONTROL
A. Welding Inspection:

1. Inspection of field welding operations shall be performed by the special inspector.

2. The special inspector shall inspect material, equipment, procedures, welds, and welder qualifications.

3.4 CLEAN UP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.5 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION
PART 1   GENERAL

1.1 SUMMARY
A. Furnish and install load-bearing metal stud systems as indicated on the drawings and specified.

1.2 SUBMITTALS
A. Shop Drawings: Submit dimensioned fabrication and erection drawings.
B. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:
   1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials. Provide separate data for each different manufacturer used:
      a. Light Gage Metal Framing
   2. LEED Credit MRc5.1: Provide manufacturer name and location data for the following materials. Provide separate data for each different manufacturer used:
      a. Light Gage Metal Framing

1.3 QUALITY ASSURANCE
A. Comply with the following as a minimum requirement:
   1. AISI - Specifications for the Design of Cold Formed Steel Structural Members.
   2. Welds shall be performed by AWS certified welders. Welding shall be performed in accordance with requirements of the American Welding Society (AWS) Structural Welding Code.
   3. Welding shall be inspected by a special inspector, approved by the Engineer to inspect the Work of this section. The Engineer shall be responsible for monitoring the work of the special inspector to ensure that the inspection program is satisfactorily completed.

1.4 DELIVERY, STORAGE AND HANDLING
A. Store metal studs above grade and protect from corrosion.
B. Store welding electrodes in accordance with AWS D12.1.

PART 2   PRODUCTS

2.1 MANUFACTURERS
A. Provide products manufactured by one of the following (or equal):
2.2 MATERIALS

A. Light Gage Metal Framing: Conform to ASTM A 568 for uncoated steel thickness, hot dip galvanized conforming to ASTM A 123, Coating Class G60. Strengths shall be as specified in ASTM A 653, Grade D, yield strength 50 Ksi. Framing shall be manufactured by USG, Western Metal, or equal.

B. Gages and properties of studs shall be as indicated on Drawings.

C. Mechanical anchors to concrete and masonry shall be metal cinch at least 3/8 inch in diameter threaded bolt head type. Anchor bolts to be installed in concrete shall be hook type 1/2 inch diameter or more.

D. Mechanical anchors to metal framing shall be No. 10 self-tapping and self-drilling wafer-head screws.

E. Accessories: Provide special top tracks, angles, fasteners, and strips of gypsum wallboard, as required for fire rating assembly required at each condition.

F. Mineral Wool: Provide Thermafiber Safing Insulation, or equal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install plumb and true. Install necessary accessories for proper installation.

B. Anchor top and bottom runner track to ceiling or roof structure overhead and to floor structure below.

C. Studs shall installed squarely in top and bottom runner track with firm abutment against track webs.

D. Align and plumb studs, and fasten to flanges of both top and bottom runner tracks.

E. Provide 3 studs minimum at corners of stud walls. Locate so as to provide surfaces for attachment of interior and exterior facing materials.

F. Members not indicated to be welded together shall be attached with manufacturer recommended screws with one screw at each flange of stud to top and bottom track. Wire tying of framing members is not permitted.

G. Provide lateral bracing and bridging in accordance with manufacturer's written recommendations.

H. Intersecting walls and partitions, whether load-bearing or not, shall be connected.
I. Splices in axially loaded studs are not permitted.

J. Splice or butt weld butt joints in runner tracks. No splices are permitted in tracks over lintels, diaphragm sheathing, or diagonal bracing.

K. Weld connections by fillet welds or plug welds in accordance with AWS recommended procedures and practices.

L. Touch-up field abrasions and welds with galvanizing touch-up material.

M. Studs that frame door openings shall be clipped to floor with 14 gage angle clips, with two fasteners into studs and two fasteners into floor.

N. Provide additional joists or blocking adjacent to exterior and interior walls, openings and elsewhere as required to provide support for indicated ceiling construction.

O. Provide an additional joist under parallel partitions where partition length exceeds 1/2 joist span and around floor and roof openings which interrupt one or more spanning members.

3.2 CONNECTIONS TO METAL DECKING

A. Provide premolded neoprene filler strips matching the flute profile for non-fire-rated walls and partitions covered on one or both sides up to metal decking.

B. The top runner track of fire-rated partitions shall be a minimum of 20 gage and attached to the metal deck with required fasteners at spacing required for fire rating, but in no case over 16 inches on center. Areas above the runner shall be friction fit with a minimum depth of 2-1/2 inches of 4 pounds per cubic foot density mineral wool insulation. A minimum of 1/2 inch of firestopping compound shall be installed to each side of the mineral wool insulation for a one-hour system, and one inch of firestopping for a 2-hour system. Install required special tracks, angles, fasteners and strips of gypsum wallboard to provide required fire resistance rating.

3.3 QUALITY CONTROL

A. Welding Inspection:
   1. Inspection of field welding operations shall be performed by the special inspector.
   2. The special inspector shall inspect material, equipment, procedures, welds, and welder qualifications.

3.4 CLEAN UP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.5 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION
SECTION 05500
METAL FABRICATIONS

PART 1 GENERAL

1.1 DESCRIPTION

A. Work Included: Provide miscellaneous metal and metal fabrications in place, as indicated on the Contract Drawings and hereafter specified or needed for complete and proper installation.

B. Material selection:
   1. Select materials that have the highest possible recycled content while still meeting performance criteria.
   2. Select materials from local manufacturers wherever possible.

C. Related Work Sections:
   1. Documents affecting work of this Section include, but are not necessarily limited to the GENERAL CONDITIONS, and Sections in GENERAL REQUIREMENTS of DIVISION 1 of these Specifications.
   2. Carpentry work in Section 06100.
   3. Metal Doors Frames in Section 08110.
   4. Painting in Section 09900.
   5. Devices for support of mechanical and electrical materials in Divisions 15 and 16.

1.2 QUALITY ASSURANCE

A. Inspection of shop fabrication shall be as required by the L.A. Building Code and the California Building Code.

B. Qualifications of Personnel: Use only adequate number of skilled workers who are thoroughly trained and experienced in the necessary crafts and are completely familiar with the necessary crafts and with the specified requirements and methods needed for proper performance of the work of this Section.

C. Welder's Qualifications: Currently qualified according to AWS D1-1, and the L.A. Department of Building and Safety.

D. Design: Fabricate and erect work in accordance with A.I.S.C.

E. Welding Operations: Perform shop and field welding required in connection with work of this Section in strict accordance with pertinent recommendations of the American Welding Society (AWS).

F. Project Conditions: Do not fabricate components which require fitting to structural elements or into finished spaces until dimensions are verified at the job-site.

G. Provide shop inspection.
1.3 SUBMITTALS

A. General: Comply with pertinent provisions in the SUBMITTALS SECTION 01330 in DIVISION 1 - GENERAL REQUIREMENTS of these Specifications.

B. Materials List: Submit list of proposed items to be provided under this Section.

C. Shop Drawings: Submit for all items proposed to be fabricated and installed under this Section. Identify each proposed item with corresponding Contract Drawing detail and Specification references.

D. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:

1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials. Provide separate data for each different manufacturer used:
   a. Steel Fabrications assembled on-site
      1) The cost of all of these materials can be added together.
   b. Steel Fabrication assembled off-site.
      1) Materials that are fabricated into assemblies by someone other than the Contractor at a fabrication shop.
   c. Aluminum Fabrications

2. LEED Credit MRc4: Provide recycled content data for each different product type, size and manufacturer used for the following materials:
   a. Aluminum Fabrications
   b. Recycled content materials claims shall meet the following requirements:
      2) The recycled content of each material shall be provided for the percentage by weight of post-consumer and post-industrial content, as defined in the document referenced above, used in each product type used.

3. LEED Credit MRc5.1: Provide manufacturer name and location data for the following materials. Provide separate data for each different manufacturer used:
   a. Steel Fabrication assembled on-site
   b. Steel Fabrication assembled off-site
   c. Aluminum Fabrication
1.4 PRODUCT HANDLING

A. General:
   1. Fabricated metal items shall not be fabricated or delivered to the job-site before required review of the Shop Drawings by the City Engineer or the City Project Manager and returned to the Contractor.
   2. Store fabricated metal items above ground on platforms, skids or other approved supports in a weathertight and dry location until ready for installation.

B. Protection: Use all means necessary to protect the materials and manufactured items of this Section before, during and after installation and to protect the work and materials of all other trades.

C. Replacements: In the event of damage to work of this Section, immediately make all repairs and replacements necessary to the approval of the City Engineer or the City Project Manager and at no added cost to the City.

D. Materials to be Installed by Others:
   1. Deliver anchor bolts and other anchorage devices to be embedded in concrete to the job-site in time before start of concrete work operations.
   2. Provide setting drawings, templates and other directions necessary for installation of anchor bolts and devices.

PART 2 PRODUCTS

2.1 MATERIALS AND COMPONENTS

A. General:
   1. All material shall conform with the following requirements and shall be of new stock of the highest grade available, free from defects and imperfections, of recent manufacture and unused. Where two or more identical articles or pieces of equipment are required, they shall be of the same manufacture.
   2. All metals shall be free from any defects which would impair the strength, durability, appearance, and shall be of the best commercial quality, for the purposes intended and adequate to withstand the strains and stresses to which they will be subject. Metals shall be protected from injury at the job, in transit, and until erected in place, inspected, and approved.

B. Miscellaneous Related Materials:
   2. Aluminum channel Sills: Provide extruded aluminum conforming to ASTM B261. Accurately fabricate the material, free from blemishes and irregularities. Finish shall be mill finish and painted.
3. Aluminum channels, tees and other shapes to be installed in the Patio and back of the building shall conform to ASTM B221. Fabricate units to form smooth, sharp, well-defined lines and arrises. Finish shall be mill finished and painted.


5. Fasteners: Same material and finish of work to be fastened together; screws to be countersunk oval head type, unless otherwise indicated on the Drawings.

6. Mechanical Anchors: For securing miscellaneous metal items to concrete to be self-drilling concrete anchors, not less than 3/8-inch size, Phillips Redhead, or as otherwise indicated on the Drawings.

7. Bolts and Nuts: Low-carbon hexagon-head type, ASTM A-307, Grade "A" or "B".

8. Miscellaneous: All items of miscellaneous metal indicated on drawings, including clip angles, ties, straps, anchors, bolts, angles, rods, and other appurtenances required by details or necessary for proper installations.

9. Dry Pack: A cement-sand mix of 1 part Portland cement to 2-1/2 parts sand by volume with necessary water added to provide for solid compaction.

2.2 SHOP PAINT
A. Primer: Use "10-99 Tnemec Primer" or "Rustoleum Number 5769 Primer.
B. For Repair of Galvanizing: Use a high zinc-dust content paint complying with MIL-P-21035.

2.3 FABRICATION
A. Field Measurements: Secure all field measurements required for proper and adequate fabrication and installation of all work of this Section.
B. Workmanship:
   1. Except as otherwise shown on the Contract Drawings or the approved Shop Drawings, use materials of size, thickness, and type required to produce reasonable strength and durability in the work of this Section.
   2. Fabricate with accurate angles and surfaces which are true to the required lines and levels, grinding exposed welds smooth and flush, forming exposed connections with hairline joints, and using concealed fasteners wherever possible.
   3. Prior to shop painting or priming, properly clean metal surfaces as required for the applied finish and for the proposed use of the item.
   4. On surfaces inaccessible after assembly or erection, apply two coats of the specified primer. Change color of second coat to distinguish it from the first.
   5. Work to dimensions shown or accepted on the Shop Drawings, using proven details of fabrication and support.
   6. Conform to applicable provisions of Los Angeles City Building Code, Division 27.
7. Form exposed work true to line and level, with accurate angles and surfaces and with straight sharp edges.

8. Ease the exposed edges to a radius of approximately 1/32-inch unless otherwise shown.

9. Form bent-metal corners to smallest radius possible without impairing the work.

10. Welding: Electric arc welding, Los Angeles City Building Code, Division 27.

11. Bolting: Bolts to be drawn tight and threads set to secure nuts.

12. Assembly: Assemble all items with parts in true alignment and accurately fitted, joints well made, adequately fastened with butts and sharp edges ground smooth.

13. Conceal all fastenings where practicable and make exposed joints hairline.

14. Nonferrous metal items shall comply with best practice of the trade. Form all sections true to detail and free from defects impairing appearance, strength, and durability.

15. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.

16. On surfaces inaccessible after assembly or erection, apply two (2) coats of the specified primer. Change color of second coat to distinguish it from the first coat.

C. Galvanizing: Provide a zinc coating for those items shown or specified to be galvanized as follows and as applicable:

1. ASTM A153 for galvanized iron or steel hardware.

2. ASTM A123 for galvanized rolled, pressed or forged steel shapes, plates, bars and strip 1/8-inch thick and heavier.

3. ASTM A386 for galvanized assembled steel products.

D. Shop Painting: Use primer complying to FS TT-P-862, Type I, rust inhibitive product, compatible with finish coat specified in Section 09900. Field paint shall be in colors selected by the Architect.

1. Required: On all uncoated ferrous metals; galvanized ferrous metal not to be shop coated.

2. Painting: Full prime coating, completely covering the metal surfaces; at least 1 coat on all surfaces which will be accessible after fabrication and erection; at least 2 coats on all surfaces which will be inaccessible after erection.

3. Remove scale, rust and other deleterious materials before application of Shop Coating.

4. Clean off heavy rust and loose mill scale in accordance with SSPC-SP-2 or SSPC-SP-3 before coating.

5. Remove oil, grease and similar contaminants in accordance with SSPC-SP-1.
E. Carpenter's Iron Work: Furnish all bent or otherwise fabricated bolts, plates, anchors, hangers and other miscellaneous steel items not readily obtainable "OFF-THE-SHELF" and required for anchoring work to concrete, masonry and interior partitions. Fasteners shall be of the same material as the item being fastened. Items to be built into masonry or cast into concrete shall be delivered to the job-site in time to avoid any delay of other trade operations. Anchor, for mechanical anchoring of items to concrete shall be self-drilling type and minimum 3/8-inch size.

F. Cleaning Ledge: Provide ledges capable of withstanding a uniform load of 250 lbf per sq. ft. or a concentrated load of 8000 lbf, whichever produces the greater stress.

PART 3 EXECUTION

3.1 INSTALLATION

A. General:
   1. Set work accurately into position, plumb, level, true, and free from rack.
   2. Anchor firmly into position.
   3. Where field welding is required, comply with AWS recommended procedures of manual-shielded metal-arc welding for appearance and quality of weld and for methods to be used in correcting welding work. Grind exposed welds smooth, and touchup shop prime coats.
   4. Do not cut, weld, or abrade surfaces which have been hot-dip galvanized after fabrication and which are intended for bolted or screwed field connections.
   5. Dissimilar Materials: Where metals are in contact with plaster, or dissimilar metals, paint contact faces of the metal before installation with a heavy bituminous coating.

B. Immediately After Erection: Clean the field welds, bolted connections, and abraded areas of shop priming. Paint the exposed areas with same material used for shop priming.

3.2 CLEAN-UP AND ADJUSTMENT

A. During the progress of the work, keep the premises free from debris and waste resulting from work of this Section. Upon completion of this Section remove all surplus materials and debris from the job-site. Immediately after erection, clean the field welds, bolted connections and abraded areas of shop priming. Paint the surfaces with the same material used for the shop priming.

B. Adjustments: Adjust all operating parts and/or assemblies as may be required to provide the necessary function and smooth operation.

END OF SECTION
PART 1 – GENERAL

1.1 Work Included:
   A. Welded or Crimped Wire Mesh Panels and Doors.
   B. Shop Fabricated Galvanized and Welded Ferrous Metal Framing for Animal Enclosures.
   C. Door Hardware.
   D. Miscellaneous Shop Fabricated Galvanized Ferrous Metal Items Required for a Complete and Proper Installation.
   E. Animal Management Requirements of Construction.

1.2 Work Installed Under This Section But Furnished Under Other Sections:
   A. Section 07900—Sealants: Specified epoxy sealants used in conjunction with work of this Section.
   B. Section 08110—Steel Door and Frames: Heavy gage hollow metal steel door required for installation.
   C. Section 08710—Finish Hardware: Hardware scheduled for heavy gage hollow metal doors and keeper doors, not specified under the requirements of "Section.

1.3 Related Sections
   A. Section 01732 - Selective Demolition – for re-use of existing Dayroom Mesh Panels
   B. Section 01740 - Mock-Up Panels: Specific requirements for mock-ups of items required of this Section.
   C. Section 04810 - Unit Masonry Assemblies
   D. Section 05050 - Anchoring and Fasteners: Anchoring and fastening methodology requirements.
   E. Section 05500 - Metal Fabrications: Miscellaneous Metal required for installation.
   F. Section 05506 - Animal Transfer Door Assemblies: Steel Animal Transfer Door construction installed.
   G. Section 05508 - Animal Transfer Corridor: Steel Animal Transfer Corridor construction installed.
   H. Section 08800 - Glazing.
I. Section 09900—Painting and Finishing Scheduled finishes for work of this section.

1.4 Pre-Qualified Metal Fabricators and Installers

A. Only Subcontractors whose experience and workmanship that have been previously reviewed and pre-qualified by the Architect/Exhibit Designer for the Work of this Section. Qualifications for companies not listed herein include a minimum of ten (10) years experience in metal work of this type, plus a minimum of three (3) similar projects involving containment of animals. Companies requesting consideration shall submit written and photographic proof of previously performed projects.

B. Subject to the compliance with the requirements of these Specifications, pre-qualified fabricators and installers for all caging include, but are not limited to the following:

1. A thru Z Consulting and Distributing: Contact Sean Stoddard, P.O. Box 30820, Tucson, AZ, 520-749-0544.

2. LGL Animal Care Products, Inc., Contact John M. Eppes, 1520 Cavitt Street, Bryan, Texas. 77801. (Tel.) (409) 775-1776 (Fax) (409) 775-8449.

1.5 References

A. AM A36 - Structural Steel.

B. ASTM A53 - Hot-Dipped Zinc-coated Welded and Seamless Steel Pipe.

C. ASTM A325 - High Strength Bolts for Structural Steel Joints.

D. ASTM A386 - Zinc-Coating (Hot-Dip) on Assembled Steel Products.

E. ASTM A500 - Cold-formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.

F. ASTM ASO I - Hot-formed Welded and Seamless Carbon Steel Structural Tubing.

G. AWS D1.1 - Structural Welding Code.

H. FS TIT-P-31 - Paint, Oil: Iron Oxide, Ready Mix, Red and Brown.

I. FS TT-P-641 - Primer Coating, Zinc Dust-Zinc Oxide (for Galvanized Surfaces).

J. FS TT-P-645 - Primer, Paint, Zinc Chromate, Alkyd Type.


1.6 Field Measurements
A. Prior to submission of shop drawings, the Caging Contractor shall verify that all field measurements are as indicated on Caging Drawings and Schedules, and notify the Architect in writing of any major discrepancies. No fabrication shall proceed until all inconsistencies are corrected.

1.7 Submittals

A. Submit Shop Drawings, Field Mock-up and Samples to the requirements relevant to Sections 01740 - Mockup Panels and 01340 - Submittals.

B. Shop Drawings:
   1. Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   2. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS welding Symbols. Indicate net weld lengths.

C. Samples: Submit one 24" x 24" sample of each woven wire mesh type specified, showing typical termination conditions, typical welded connections, and other pertinent construction components.

D. Prototype: Submit a working prototype of Keeper Door Assembly to the requirements of Section 01740 using specified materials for review by the Owner and Architect. Components shall be installed at a location selected by the Owner. Prototypes may be installed as part of the Work if all safety and design standards have been met (as determined by the Owner and Architect).

E. Production runs of all components shall be contingent on the results of the review process and acceptance of the working mock-up.

PART 2 – PRODUCTS

2.1 Mesh Panels Assemblies as manufactured by A thru Z.

A. Wire Mesh Panel Assemblies: Galvanized steel components fabricated as follows:
   1. 1/4" diameter 2" x 2" maximum (measured center line to center line) steel flat top wire mesh set in steel frame, as detailed on drawings.

B. Steel Sections: ASTM A36, galvanized.

C. Steel Tubing: ASTM A501, galvanized.

D. Cords and Wires: Galvanized Steel.

E. Fasteners, Bolts, Nuts, and Washers: ASTM A325; all bolts, machine screws and fasteners shall be either torx or hex socket round head and flat head as indicated on the drawings except where specifically noted otherwise.

F. Welding Materials: AWS D1.1; type required for materials being welded.
G. Touch-up Primer for Galvanized Surfaces: ZRC or approved equal to match color of galvanized panels for all field welded surfaces. Cold galvanizing is intended for limited touch-up only and will be acceptable only for those areas necessary for field welds.

H. Exposed Mechanical Fastenings: Flush countersunk torx or hex socket machine screws and bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

I. Anchor Bolts: Hilti countersunk flathead hex socket "Kwik--Bolts" for installation in monolithic concrete in sizes indicated on the Drawings, unless specifically noted otherwise.

2.2 Door Hardware and Keying

A. Hinges:
   1. Where hinges are specified for keeper doors, they shall be Hager Co. AB850 stainless steel heavy weight hinges.

B. Locks and Locksets:
   1. Keeper Doors: Locks shall be mortise lockset type Best 37H high security series with lever - 15, contour type with return, and "anti-friction" latch bolts. Functions shall be as called for in hardware sets. Furnish proper length strikes to suit door and frame conditions. Trim design shall be escutcheon type J. Where flush handles are specified furnish Builders Brass Works type 166SM with spindles to fit the mortise locksets.

   2. All locksets shall be furnished with Best Lock Co. High Security removable core cylinders.

C. Padlocks:
   1. Padlocks shall be Best Lock Co. series 21B, 5/16" shackle diameter, shackle length as required (minimum 1-1/2" shackle length). Provide a padlock for every padlock tab lock location indicated on the Drawings and/or as scheduled.
      a. Zoo provides all padlocks, contractor provides core and cylinders.

D. Slide Bolts: Richards Wilcox 128-P11 where scheduled or indicated.

E. Cremone Bolt:
   1. Furnish Richards Wilcox Type 1017. Mount bolt on keeper side of door. Drill and tap all cremone bolt handles scheduled or detailed to receive padlocks.

F. Substitutions: All substitutions for the hardware of this Section must be reviewed and approved by the Architect/Exhibit Designer and Owner prior to Bid acceptance.
G. Keying: Coordinate all keying with the Project General Contractor and the requirements of Section 08710 - Finish Hardware, in the specifications for the overall Project.

H. Hardware Finishes: All hardware shall be finished to the requirements of Section 08710 – Finish Hardware.

2.3 Finishes

A. All exposed metal surfaces work of this Section shall be galvanized.

2.4 Animal Transfer Restraint Unit

A. Furnish one Animal Transfer Restraint Unit made from high strength stainless steel with mechanical squeeze back. Animal Transfer Restraint Unit shall be equipped with lock and latch mechanism to secure unit in place once inside holding building. Outside dimensions of Animal Transfer Restraint Unit shall not exceed 72”L x 60”W x 50”H. Animal transfer restraint unit shall provide the following features:

1. Stainless steel drop rods on fixed sides.
2. Two guillotine doors on either end.
3. Fold down hand crank.
4. Stainless steel excreta pan
5. Stainless steel plate swivel casters

B. Subject to the compliance with the requirements of these Specifications, pre-qualified fabricators and installers for all caging include, but are not limited to the following:

1. A thru Z Consulting and Distributing: Contact Sean Stoddard, P.O. Box 30820, Tucson, AZ, 520-749-0544.
2. LGL Animal Care Products, Inc. Contact John M. Eppes, 1520 Cavitt Street, Bryan, Texas. 77801. (Tel.) (409) 775-1776 (Fax) (409) 775-8449

PART 3 - EXECUTION

3.1 Preparation

A. Verify that field conditions are acceptable and are ready to receive work. Do not install until any unsatisfactory conditions are corrected. Beginning Work constitutes contractor's acceptance of conditions as satisfactory.

B. Obtain Architect/Engineer approval prior to site cutting or making adjustments not scheduled.

C. Clean and strip site primed steel items to bare metal where site welding is scheduled.
D. Make provision for erection loads with temporary bracing. Keep work in alignment.

E. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate trades.

3.2 Coordination
A. Coordinate all material requirements with other pertinent specification Sections relevant to the Work of this Section.

B. Coordinate re-use of existing Dayroom mesh panels as shown on drawings.

3.3 Preparation of Steel Assemblies
A. Verify dimensions at site prior to shop fabrication.

B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

C. Fabricate items with joints tightly fitted and secured. Make exposed joints butt tight, flush, and hairline. All oversized holes required for fabrication shall be welded and plugged. No holes, cavities or other voids, will be acceptable, unless specifically designed into the caging system.

D. Continuously seal joined members by continuous welds.

E. Fit and shop assemble in largest practical sections, for delivery to site.

F. Grind exposed welds flush and smooth with adjacent finished surface. Ease exposed edges to small uniform radius of 1/8". Radius all comers to 1/4".

G. Galvanized items to minimum 2.0 oz/sq ft. zinc coating in accordance with ASTM A386.

H. Do not prime surfaces in direct contact bond with concrete or where field welding is required. Prime paint items scheduled with one coat.

3.4 Installation
A. Install items plumb and level, accurately fitted, free from distortion or defects. Installation of the wall eyebolts is in the field as directed by the Zoo. Installation of the ceiling eye bolts are as indicated on the drawings. Damage to plank to be repaired.

B. Perform field welding in accordance with ASW D1.1.

C. After installation, touch-up field welds, scratched or damaged surfaces with specified touch-up primer.

D. Remove all sharp edges, burrs, corners and slivers which, in the opinion of the Architect, could injure animals or caregivers.
3.5 Welding Requirements

A. All exposed welds shall be ground smooth and galvanized.

B. Remove all sharp edges, burrs, corners and slivers, which in the opinion of the Architect and/or Owner, could injure animals or keepers.

3.6 Schedule for Welded or Crimped Wire Mesh Panels and Doors:

A. Gorilla bedroom wire mesh partition assemblies.

B. Gorilla bedroom doors type “F” and “G.”

C. Gorilla transfer cage doors type “K.”

D. Animal transfer corridor.

E. Dayroom panels—new and existing panel assemblies to be re-used.

F. Overhead mesh at gorilla bedrooms.

G. Steel mesh over doors, windows and skylights.

END OF SECTION
PART 1 – GENERAL

1.1 Work Included
A. Pull-bar manually operated animal transfer door assemblies.
B. Cable-operated Door Assemblies.
C. Chain drive door assemblies.
D. Cover panels and plates.
E. Pullbar operators.
F. Locking mechanisms.
G. Miscellaneous shop fabricated operating hardware and steel shapes.
H. Animal Management requirements of Construction.

1.2 Pre-Qualified Fabricators and Installers
A. Fabricator/Installer shall be the same as identified in Section 05504 - Welded or Crimped Wire Mesh Panels and Doors

1.3 Related Sections
A. Section 0174 0 - Mock-up Panels: Specified working mock-up involving work of this Section.
B. Section 04810 – Unit Masonry Assemblies
C. Section 05504 - Welded or Crimped Wire Mesh Panels and Doors: Requirements for caging and keeper Doors.
D. Section 05508 – Animal Transfer Corridor:
E. Section 07900 - Sealants: Specified epoxy sealants used in conjunction with work of this Section.

1.4 References
A. ASTM A36 - Structural Steel.
B. ASTM A53 - Hot-Dipped, Zinc-coated Welded and Stainless Steel Pipe.
C. ASTM A325 - High Strength Bolts for Structural Steel Joints.
D. ASTM A386 - Zinc-Coating (Hot-Dip) on Assembled Steel Products.
E. ASTM A446 - Sheet Steel, Zinc-Coated by the Hot-Dipped Process, Structural Quality.

F. ASTM A500 - Cold-formed Welded and Seamless Carbon Steel Structural Tubing.

G. ASTM A501 - Hot-formed Welded and Seamless Carbon Steel Structural Tubing.


I. AWS D1.1 - Structural Welding Code.

J. FS TT-P-31 - Paint, Oil: Iron Oxide, Ready Mix, Red and Brown.

K. FS TT-P-641 - Primer Coating, Zinc Dust-Zinc Oxide (for Galvanized Surfaces.)

L. FS TT-P-645 - Primer, Paint, Zinc Chromate, Alkyd Type.

1.5 Field Measurements

A. Prior to submission of shop drawings, the Transfer Door Contractor shall verify that all field measurements are as indicated on Caging Drawings and Schedules, and notify the Architect in writing of any major discrepancies. No fabrication shall proceed until all inconsistencies are corrected.

1.6 Submittals

A. Submit Shop Drawings, Field Mock-Up, and Samples to the requirements relevant to Sections 01340 - Submittals and 01740 - Mockup Panels.

B. Shop Drawings: Indicate profiles, sizes, all hardware components, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable. Indicate welded connections using standard AWS welding symbols. Indicate net weld lengths.

C. Samples:

1. Submit two (2) samples each of sheaves, PVC coated cables, galvanized cover plates (8 inches long), and polypropylene door material (8 inch x 8 inch).

D. Prototype: Submit a prototype of Transfer Door Assembly to the requirements of Section 01740 using specified materials for review by the Owner and Architect. Components shall be installed at a location selected by the Owner. Prototypes may be installed as part of the Work if all safety and design standards have been met (as determined by the Owner and Architect).

E. Production runs of all components shall be contingent on the results of the submittal and review process.

PART 2 – PRODUCTS
2.1 Materials for Fabricated Assemblies as Manufactured by A thru Z.

2.2 Special Fabricated Steel Doors.

2.3 Special Fabricated Polypropylene Doors.

   A. Steel Sections: Galvanized steel as indicated on the Drawings conforming with ASTM A36.

   B. Steel Cover Plate: 10 gauge steel sheet, galvanized to the requirements of ASTM A446, G165 coating designation. All sheet steel shall be pre-drilled for fasteners prior to galvanizing process. Maximum lengths shall be 15 feet.

   C. Steel Tubing: Galvanized steel in shapes and sizes indicated on the Drawings conforming with ASTM A501.

   D. Door Reinforcement: Resin impregnated Honycomb core w/ 5" of linear inches of surface contact per square inch.

   E. Locks: 16 gauge reinforced steel

   F. Hinges: 7 gauge heavy duty hinge reinforcement.

   G. Cable: 7 x 19 stainless 1/8" diameter cable in lengths as indicated on the Drawings for proper operation, as manufactured by MacWhyte Wire Rope Go., Kenosha, WI 53141.

   H. Polypropylene Doors: Molded sheet with machined edges of sizes indicated on the Drawings, in translucent white. (Door type H & J)


   J. Sheaves: Fabricated as detailed on the Drawings.

   K. Bolts, Nuts, and Washers: ASTM A325; all bolts, machine screws and fasteners shall, be stainless steel and either torx or hex socket round head and flat head, as indicated on the drawings except where specifically noted otherwise.

   L. Welding Materials: AWS DI.I; type required for materials being welded.

   M. Touch-up Primer for Galvanized Surfaces: ZRC or approved equal to match color of galvanized panels for all field welded surfaces. Cold galvanizing is intended for limited touch-up only and will be acceptable only for those areas necessary for field welds.

   N. Galvanized steel assemblies shall be free from burrs. Grind smooth all assemblies prior to galvanization.

   O. Counter Weight Material: Any material suitable in providing the required minimum weight. Material may include steel plates, lead plates, stories, etc.
2.3 Fabrication
   A. Verify dimensions on site prior to shop fabrication.
   B. Fabricate item with joints tightly fitted and secured. Make exposed joints butt tight, flush, and hairline.
   C. Continuously seal joined members by continuous welds.
   D. Fit and shop assemble in largest practical sections, for delivery to site.
   E. Grind exposed welds flush and smooth with adjacent finished surface. Ease exposed edges to small uniform radius.
   F. Exposed Mechanical Fastenings: Flush countersunk torx or hex socket machine screws and bolts; stainless steel finish; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
   G. Anchor Bolts: Hilti countersunk flathead hex socket "Kwik-Bolts," stainless steel finish, for installation in monolithic concrete in sizes indicated on the Drawings, unless specifically noted otherwise.

2.5 Shop-Applied Protective Coating:
   A. Shop-apply a thin layer of surface oil as a protective coating of all galvanized products prior to shipment to Project site.

2.6 Finishes
   A. Clean surfaces of rust scale, grease, and foreign matter prior to finishing.
   B. Radius all corners 1/4" and ease all edges 1/8".
   C. Do not prime surfaces in direct contact bond with concrete or where field welding is required.
   D. Unless specified otherwise, all exposed metal surfaces of this section shall be galvanized to minimum 2.0 oz/sq ft. zinc coating in accordance with ASTM A386.

2.7 Hardware
   A. Padlocks: Provide padlocks for all padlock tabs for work of this Section. See Section 08710 - Finish Hardware for Padlock Specification that are to be Owner provided.

PART 3 – EXECUTION

3.1 Preparation
A. Verify that field conditions are acceptable and are ready to receive work. Do not install until any unsatisfactory conditions are corrected. Beginning Work constitutes contractor's acceptance of conditions as satisfactory.

B. Obtain Architect/Engineer approval prior to site cutting or making adjustments not scheduled.

C. Clean and strip site primed steel items to bare metal where site welding is scheduled.

D. Make provision for erection loads with temporary bracing. Keep work in alignment.

E. Supply items required to be cast into concrete or embedded in masonry with setting templates, to appropriate trades.

3.2 Fabrication of Steel Assemblies

A. Verify dimensions on site prior to shop fabrication.

B. Fabricate items with joints tightly fitted and secured. Make exposed joints butt tight, flush, and hairline.

C. Continuously seal joined members by continuous welds.

D. Fit and shop assemble in largest practical sections to minimize field welding to size.

E. Grind exposed welds flush and smooth with adjacent finished surface. Ease exposed edges to small uniform radius.

3.3 Installation

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Perform field welding in accordance with AWS D1.1.

C. After installation, touch-up field welds, scratched or damaged surfaces with specified touch-up primer.

D. Remove all sharp edges, burrs, corners and slivers which, in the opinion of the Architect, could injure animals or caregivers.

3.4 Counterweight Assemblies

A. Counterweight assemblies shall be filled with enough weight material to within 5 pounds less than the total weight of the transfer door.

3.5 Schedule for Special Fabrication & Transfer Door Assemblies:

A. Door type "A" – Special Fabrication Steel Door Assemblies.

B. Doors type "D"- Special Fabrication Steel Door Assemblies.
C. Doors type “H & J” - Polypropylene Fabrication Door Assemblies
D. Doors type “K” - Polypropylene Fabrication Door Assemblies
E. Exhibit Doors - Special Fabrication Steel Door Assemblies.

END OF SECTION
SECTI0N 05510
STEEL STAIR5

PART 1 GENERAL

1.1 SUMMARY

A. Design, furnish and install steel stairs as indicated on the drawings and specified. Stairs shall be the product of an Owner approved fabricator.

1.2 SUBMITTALS

The following shall be submitted:

A. Shop Drawings shall include the following information:

1. Plans and elevations, and details of sections and connections. Include calculations, drawings, and the approval stamp of the registered designer.

2. Setting drawings, diagrams, templates for installation of anchor bolts, and miscellaneous metal items.

3. Certificates of Compliance for the approved fabricator and Welder Qualification shall be submitted. Welders shall be certified to have been qualified in accordance with AWS D1.1.

4. Submit information that attests to the qualifications of the steel stairs fabricator.

B. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:

1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials. Provide separate data for each different manufacturer used:

   a. Steel Stairs fabricated on-site
   b. Steel Stairs fabricated off-site

2. LEED Credit MRc5.1: Provide manufacturer name and location data for the following materials. Provide separate data for each different manufacturer used:

   a. Steel Stairs fabricated on-site
   b. Steel Stairs fabricated off-site

1.3 QUALITY ASSURANCE

A. Structural steel shall conform to U.B.C. standard No. 27-1 material specifications for structural steel and Title 24, Part 2 Chapter 27, and Title 24, part I of CCR.

B. Sheet and strip steels and steels other than those listed in U.B.C. Standard No. 27-1, if used for structural purpose, shall be approved by the Architect.

C. Structural steel shall conform to "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings".
PART 2  PRODUCTS

2.1  STAIR ASSEMBLY

A. Stairs shall be designed by a registered Structural Engineer in the State of California. Drawings and calculations shall be submitted to the Engineer of record for approval prior to fabrication.

B. Stairs shall be preassembled in the shop to the greatest extent possible. Components shall be disassembled only to the extent necessary for shipping and handling. Units shall be clearly marked for reassembly and coordinated installation.

C. Structural shapes and plates, except plates to be cold-formed, shall conform to ASTM A36, unless otherwise noted.

D. Steel plates to be bent or cold-formed shall conform to ASTM A283, Grade C.

E. Steel bars and bar-size shapes shall conform to ASTM A36, or ASTM A575.

F. Structural steel tubing, hot-formed, welded or seamless, shall conform to ASTM A 500, Grade B, unless otherwise noted.

G. Sheets and strips shall conform to ASTM A568 and ASTM A569.

H. Decking shall be galvanized sheet steel, minimum yield strength of 33,000 PSI, ASTM A446, Grade A, minimum 20 gage, galvanized finish per ASTM A525, G60.

I. Welding materials shall conform to UBC Standard 27-6. Arc welding electrodes shall be in accordance with AWS A5.1 or AWS A5.5. Use E70XX electrodes.

2.2  WELDING

A. Welds shall conform to the requirements of the California State Building Code, and be approved by the Owner.

B. Type of steel used in welded structures shall have chemical properties suitable for welding as determined by chemical analysis.

C. Materials and workmanship shall conform to the requirements specified herein and to U.B.C. standard No. 27.6 modified as follows:

1. No welded splices shall be made except those shown on the Drawings unless approved in writing by Structural Engineer.

2. The drawings will designate joints in which it is important that the welding sequence and technique be controlled to minimize shrinkage stresses and distortion.

2.3  FASTENERS

A. Zinc-coated fasteners shall be galvanized in accordance with ASTM A153. Fasteners shall be selected for the type, grade, and class required for the installation of steel stair items.

B. Standard bolts and nuts shall be regular hexagon-head conforming to ASTM A307, Grade A.
C. Lag bolts shall be square-head conforming to ASME B18.2.1.
D. Machine screws cadmium-plated steel conforming to ASME B18.6.3.
E. Washers shall be round, carbon steel per ANSI B18.22.1.

2.4 SHOP PRIMING
A. Steelwork shall be shop primed with the fabricator's standard rust inhibitive primer.

2.5 STEEL PANS
A. Welding shall be used for joining pieces together, unless otherwise indicated or specified. Units shall be fabricated so that bolts and other fastenings do not appear on finish surfaces. Joints shall be made true and tight. Continuous welds shall be ground smooth where exposed.
B. Closures for exposed ends of stringers shall be provided. Headers shall be bolted to stringers and newels. Framing members shall be bolted to stringers and headers.

2.6 LIGHTWEIGHT CONCRETE FILL
A. Provide lightweight concrete fill. Mix shall be proportioned so as to produce concrete with a minimum compressive strength of 3000 psi at 28 days, and a unit weight of 90 to 100 lbs. per cubic foot in the oven dry condition, at 28 days.
B. Aggregates: Lightweight aggregate shall conform to ASTM C330, and shall be sealed, expanded shale such as "Rocklite", as produced by Lightweight Processing Company, or equal.
C. Reinforcing Mesh shall conform to ASTM A185. Welded wire fabric shall be self-furring 4" x 4/14" - No. 14 gage welded mesh, furnished in flat sheets.

PART 3 EXECUTION
3.1 INSTALLATION
A. Installation shall be in accordance with the approved shop drawings and installation instructions. Erect members in proper alignment, securely anchored in place.
B. The procedures of manual shielded metal arc welding, quality of welds made, and methods used in correcting welding work shall comply with AWS D1.1, and be approved by the Owner.
C. Inspection of all shop and field welding operations shall be made by a qualified Welding Inspector approved by the Owner. The inspector shall make a record of welds including:
   1. Identification marks of welders.
   2. List of defective welds.
   3. Manner of correction of defects.
B. The Welding Inspector shall check the material, equipment and procedures, as well as the welds and competence of the welder.
1. The inspector shall furnish a report that the welding which is required to be inspected is proper and has been done in conformity with the approved Drawings and Specifications.

C. The Welding Inspector shall use all means necessary to determine the quality of the weld and may use gamma ray, magnaflux, trepanning sonics or any other aid to visual inspection deemed necessary to assure the adequacy of the welding.

D. Inspection of Shop Fabrication: Shall be in accordance with Title 24, CBC.

3.2 TOUCHUP

A. Field welds, bolted connections, and abraded areas of the shop paint shall be cleaned, and exposed areas shall be painted with the paint used for shop painting.

B. Paint shall be applied by brush or spray to provide a minimum dry-film thickness of 2 mils.

END OF SECTION
PART 1   GENERAL

1.1  SUMMARY
A. Furnish and install the fixed aluminum ladders as indicated on the drawings and specified.

1.2  SUBMITTALS
A. Submit the following in accordance with Section 01340.
   1. Submit the manufacturer’s descriptive data, including installation instructions.
   2. Submit shop drawings showing dimensions, profiles, and details of installations, including fastenings and anchorage.

PART 2   PRODUCTS

2.1  FIXED ALUMINUM LADDERS
A. Ladders shall be the product of Dur-Red Products, or Precision Ladders, LLC, or equal.
B. Ladders shall comply with safety requirements of ANSI 14.3 and CCR, Title 8, General Safety Orders, Sec. 3277.
C. Ladders shall have the following attributes:
   1. Stringers (Siderail): Aluminum I-beam or channel (6005-t5).
   2. Treads: Extruded aluminum (6005-t5) with serrated top.
D. Roof hatch ladders shall be provided with ladder extensions where required by CBC, “LadderUP Safety Post”. The extension device shall be manufactured of high strength metal with a telescoping tubular section that locks automatically when fully extended. Upward and downward movement shall be controlled by a stainless steel spring balancing mechanism. Unit shall be completely assembled with fasteners for securing to the ladder rungs in accordance with the manufacturer’s instructions.

PART 3   EXECUTION

3.1  INSTALLATION
A. Install ladders as recommended by the product manufacturer at locations indicated, fabricated as detailed, and in accordance with the approved shop drawings.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes: steel pipe and tube handrails and railings.

B. Related Sections include the following:

1. Division 5 Section "Ornamental Metal" for ornamental metal handrails and railings fabricated from custom components.
2. Division 5 Section "Ornamental Handrails and Railings" for ornamental metal handrails and railings fabricated from stock components.

1.3 PERFORMANCE REQUIREMENTS

A. General: In engineering handrails and railings to withstand structural loads indicated, determine allowable design working stresses of handrail and railing materials based on the following:

1. Cold-Formed Structural Steel: AISI SG-673, Part I, "Specification for the Design of Cold-Formed Steel Structural Members."

B. Structural Performance of Handrails and Railings: Provide handrails and railings capable of withstanding the following structural loads without exceeding allowable design working stresses of materials for handrails, railings, anchors, and connections:

1. Top Rail of Guards: Capable of withstanding the following loads applied as indicated:
   a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
   b. Uniform load of 50 lb/ft. (730 N/m) applied horizontally and concurrently with uniform load of 100 lb/ft. (1460 N/m) applied vertically downward.
   c. Concentrated and uniform loads above need not be assumed to act concurrently.

2. Handrails Not Serving As Top Rails: Capable of withstanding the following loads applied as indicated:
   a. Concentrated load of 200 lbf (890 N) applied at any point and in any direction.
   b. Uniform load of 50 lb/ft. (730 N/m) applied in any direction.
   c. Concentrated and uniform loads above need not be assumed to act concurrently.
3. **Infill Area of Guards:** Capable of withstanding a horizontal concentrated load of 200 lbf (890 N) applied to 1 sq. ft. (0.09 sq. m) at any point in system, including panels, intermediate rails, balusters, or other elements composing infill area.

   a. Load above need not be assumed to act concurrently with loads on top rails in determining stress on guard.

**E. Thermal Movements:** Provide handrails and railings that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

   1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

**F. Control of Corrosion:** Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

### 1.4 SUBMITTALS

**A. Product Data:** Submit product data for grout, anchoring cement, and paint products.

**B. Shop Drawings:** Show fabrication and installation of handrails and railings. Include plans, elevations, sections, component details, and attachments to other Work.

   1. For installed handrails and railings indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

**C. Samples for Initial Selection:** Manufacturer's color charts showing the full range of colors available for products with factory-applied color finishes.

**D. Samples for Verification:** For each type of exposed finish required, prepared on components indicated below and of same thickness and metal indicated for the Work. If finishes involve normal color and texture variations, include sample sets showing the full range of variations expected.

   1. 6-inch- (150-mm-) long sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters.
   2. Fittings and brackets.

**F. Qualification Data:** For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

**G. Product Test Reports:** From a qualified testing agency indicating products comply with requirements, based on comprehensive testing of current products.

**H. Product Test Reports:** From a qualified testing agency indicating handrails and railings comply with ASTM E 985, based on comprehensive testing of current products.

### 1.5 QUALITY ASSURANCE
A. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of handrails and railings that are similar to those indicated for this Project in material, design, and extent.

B. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated, as documented according to ASTM E 548.

C. Source Limitations: Obtain each type of handrail and railing through one source from a single manufacturer.

1.6 STORAGE
A. Store handrails and railings in a dry, well-ventilated, weathertight place.

1.7 PROJECT CONDITIONS
A. Field Measurements: Verify handrail and railing dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Established Dimensions: Where field measurements cannot be made without delaying the Work, establish dimensions and proceed with fabricating handrails and railings without field measurements. Coordinate construction to ensure that actual dimensions correspond to established dimensions.

1.8 COORDINATION
A. Coordinate installation of anchorages for handrails and railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.9 SCHEDULING
A. Schedule installation so handrails and railings are mounted only on completed walls. Do not support temporarily by any means that does not satisfy structural performance requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Steel Pipe and Tube Railings:
   a. Humane Equipment Co.
   b. Wagner: R & B Wagner, Inc.
2.2 METALS

A. General: Provide metal free from pitting, seam marks, roller marks, stains, discolorations, and other imperfections where exposed to view on finished units.

B. Steel and Iron: Provide steel and iron in the form indicated, complying with the following requirements:
   1. Steel Pipe: ASTM A 53; galvanized finish for exterior installations and where indicated.
   2. Steel Tubing: Cold-formed steel tubing, ASTM A 500, Grade A, unless another grade is required by structural loads.
   3. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

C. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails, unless otherwise indicated.

2.3 WELDING MATERIALS, FASTENERS, AND ANCHORS

A. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

B. Fasteners for Anchoring Handrails and Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring handrails and railings to other types of construction indicated and capable of withstanding design loads.
   1. For steel handrails, railings, and fittings, use plated fasteners complying with ASTM B 633, Class Fe/Zn 25 for electrodeposited zinc coating.

C. Fasteners for Interconnecting Handrail and Railing Components: Use fasteners fabricated from same basic metal as fastened metal, unless otherwise indicated. Do not use metals that are corrosive or incompatible with materials joined.
   1. Provide concealed fasteners for interconnecting handrail and railing components and for attaching them to other work, unless otherwise indicated.
   2. Provide concealed fasteners for interconnecting handrail and railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for handrails and railings indicated.
   3. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

D. Cast-in-Place and Postinstalled Anchors: Anchors of type indicated below, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and equal to four times the load imposed when installed in concrete, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.
   2. Chemical anchors.
   3. Expansion anchors.

2.4 PAINT
A. Shop Primers: Provide primers to comply with applicable requirements in Division 9 Section "Painting."

B. Shop Primer for Ferrous Metal: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with performance requirements in FS TT-P-664; selected for good resistance to normal atmospheric corrosion, compatibility with finish paint systems indicated, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

C. Shop Primer for Galvanized Steel: Zinc-dust, zinc-oxide primer formulated for priming zinc-coated steel and for compatibility with finish paint systems indicated, and complying with SSPC-Paint 5.

2.5 GROUT AND ANCHORING CEMENT

A. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.

B. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound. Provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

A. General: Fabricate handrails and railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.

B. Assemble handrails and railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

C. Form changes in direction of railing members as follows:

1. By inserting prefabricated flush-elbow fittings at return.
2. By any method indicated above, applicable to change in direction involved.

D. Welded Connections: Fabricate handrails and railings for connecting members by welding. Cope and weld or use weld in fittings. Weld connections continuously to comply with the following:

1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove flux immediately.
4. At exposed connections, finish exposed surfaces smooth and blended so no roughness shows after finishing and welded surface matches contours of adjoining surfaces.
E. Nonwelded Connections: Fabricate handrails and railings by connecting members with concealed mechanical fasteners and fittings, unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

1. Fabricate splice joints for field connection using an epoxy structural adhesive where this is manufacturer’s standard splicing method.

F. For railing posts set in concrete, provide preset sleeves of steel not less than 6 inches (150 mm) long with inside dimensions not less than 1/2 inch (12 mm) greater than outside dimensions of post, and steel plate forming bottom closure.

G. For removable railing posts, fabricate slip-fit sockets from steel tube whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height. Provide socket covers designed and fabricated to resist being dislodged.

1. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.

H. Shear and punch metals cleanly and accurately. Remove burrs from exposed cut edges.

I. Ease exposed edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing the Work.

J. Cut, reinforce, drill, and tap components, as indicated, to receive finish hardware, screws, and similar items.

K. Provide weep holes or another means to drain entrapped water in hollow sections of handrail and railing members that are exposed to exterior or to moisture from condensation or other sources.

L. Fabricate joints that will be exposed to weather in a watertight manner.

M. Close exposed ends of handrail and railing members with prefabricated end fittings.

N. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns, unless clearance between end of railing and wall is 1/4 inch (6 mm) or less.

2.7 FINISHES, GENERAL

A. Provide exposed fasteners with finish matching appearance, including color and texture, of handrails and railings.

2.8 STEEL FINISHES

A. Galvanized Handrails and Railings: Hot-dip galvanize exterior steel and iron handrails and railings to comply with ASTM A 123. Hot-dip galvanize hardware for exterior steel and iron handrails and railings to comply with ASTM A 153/A 153M.

B. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:

1. ASTM A 123, for galvanizing steel and iron products.
2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
C. Fill vent and drain holes that will be exposed in finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

D. For galvanized handrails and railings, provide galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.

E. Preparation for Shop Priming: After galvanizing, thoroughly clean handrails and railings of grease, dirt, oil, flux, and other foreign matter, and treat with metallic-phosphate process.

F. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with minimum requirements indicated below for SSPC surface-preparation specifications and environmental exposure conditions of installed handrails and railings:

1. Exteriors (SSPC Zone 1B): SSPC-SP 6, "Commercial Blast Cleaning."
2. Interiors (SSPC Zone 1A): SSPC-SP 7, "Brush-off Blast Cleaning."

G. Apply shop primer to prepared surfaces of handrail and railing components, unless otherwise indicated. Comply with requirements in SSPC-PA 1, "Paint Application Specification No. 1," for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fit exposed connections together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required to install handrails and railings. Set handrails and railings accurately in location, alignment, and elevation; measured from established lines and levels and free from rack.

1. Do not weld, cut, or abrade surfaces of handrail and railing components that have been coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
2. Set posts plumb within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails so variations from level for horizontal members and from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet (5 mm in 3 m).

C. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing handrails and railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

A. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic cement filler colored to match finish of handrails and railings.

B. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article whether welding is performed in the shop or in the field.
C. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches (50 mm) beyond joint on either side, fasten internal sleeve securely to one side, and locate joint within 6 inches (150 mm) of post.

3.4 ANCHORING POSTS

A. Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with the following anchoring material, mixed and placed to comply with anchoring material manufacturer’s written instructions:

B. Form or core-drill holes not less than 5 inches (125 mm) deep and 3/4 inch (20 mm) larger than OD of post for installing posts in concrete. Clean holes of loose material, insert posts, and fill annular space between post and concrete with the following anchoring material, mixed and placed to comply with anchoring material manufacturer’s written instructions:

1. Nonshrink, nonmetallic grout.
2. Nonshrink, nonmetallic grout or anchoring cement.

C. Cover anchorage joint with flange of same metal as post, attached to post as follows:

1. Welded to post after placing anchoring material.
2. By set screws.

D. Leave anchorage joint exposed; wipe off surplus anchoring material; and leave 1/8-inch (3-mm) build-up, sloped away from post.

1. For steel pipe railings, weld flanges to post and bolt to metal supporting surfaces.

E. Install removable railing sections, where indicated, in slip-fit metal sockets cast in concrete.

3.5 ANCHORING RAILING ENDS

A. Anchor railing ends into concrete and masonry with round flanges connected to railing ends and anchored into wall construction with postinstalled anchors and bolts.

1. Connect flanges to railing ends using nonwelded connections.

3.6 ATTACHING HANDRAILS TO WALLS

A. Attach handrails to wall with wall brackets. Provide bracket with 1-1/2-inch (38-mm) clearance from inside face of handrail and finished wall surface.

B. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.

3.7 CLEANING

A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.
3.8 PROTECTION

A. Protect finishes of handrails and railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at the time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units.

END OF SECTION
PART 1   GENERAL

1.1 SUMMARY

A. Furnish and install the decorative glass railings as indicated on the drawings and specified.

B. Provide Blumcraft Railglass Style RG-200 Railing System (or equal) having the following aluminum components:

1. Mounting Bracket: RG-200W
2. Rail Top: No. 324
3. Handrail: No. 583, 1-1/2" diameter
4. Handrail Bracket: WBNC-G

1.2 SYSTEM PERFORMANCE REQUIREMENTS

A. General: Engineer, fabricate, and install the decorative railing systems to withstand structural loads indicated in the California Building Code, and the Building Code of the City of Los Angeles.

1. Testing shall be performed in accordance with ASTM E935.

2. Structural computations shall be prepared and signed by a professional engineer who is registered in the state of California.

3. Infill area of guardrail systems shall be capable of withstanding a horizontal concentrated load of 200 lbf applied to one sq. ft. at any point in the system including panels, intermediate rails, balusters, or other elements composing the infill area.

1.3 SUBMITTALS

A. Submit Product Data that fully describes each of product to be provided.

B. Shop drawings showing fabrication and installation of the decorative railings including plans, elevations, sections, details of components, and attachments to other units of Work.

1. Include structural computations, material properties, and other information needed for structural analysis that has been signed and sealed by a registered professional engineer responsible for their preparation.

C. Samples for verification purposes of each type of exposed finish required, prepared on components indicated below that are of the same thickness and metal indicated for final unit of Work. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected.

1. 6-inch-long sections of each distinctly different linear railing member including handrails, top rails, posts, and balusters.
2. Fittings and brackets.

3. Mesh and their connections.

D. Test reports from independent testing laboratory evidencing compliance of handrails and railing systems with ASTM
   1. City of Los Angeles Research Reports or ICBO evaluation reports, if any, will be acceptable in lieu of test reports.

PART 2 PRODUCTS

2.1 DECORATIVE GLASS RAILINGS

A. Manufacturer: Subject to compliance with specified requirements, provide railing products indicated on the drawings, or "or equal" products of one of the following:
   1. Blum: Julius Blum & Co., Inc.
   3. Newman Bros., Inc.

B. Materials shall be of recent manufacturer, of the best workmanship, and in the forms and of the types that comply with requirements of railing industry standards, and that are free from surface blemishes where exposed to view in the finished unit. Exposed to view surfaces exhibiting pitting, seam marks, roller marks, stains, discolorations, or other irregularities on finished units are not acceptable.

C. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

D. Fasteners for anchoring decorative railings to in-place construction shall be selected fasteners of the type, grade, and class required to produce connections that are suitable for anchoring railing in place and capable of withstanding design loadings.

E. Fasteners for interconnecting railing components shall be fasteners of same basic metal as the fastened metal, and finished to match the decorative railings. Do not use metals that are corrosive or incompatible with materials joined.

G. Glass shall be in sizes and thicknesses indicated.

H. Decorative glass railings to comply with the aesthetic and engineering requirements indicated on the approved shop drawings.

I. Preassemble the decorative railings in the shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.

J. Provide toe boards at railings around openings and at the edge of open-sided floors and platforms.
K. Finishes shall be as indicated on the drawings and shall comply with NAAMM "Metal Finishes Manual."

L. Finished work shall be uniform, and free from blemishes or stains. Variations in appearance of abutting or adjacent pieces are not acceptable. Noticeable variations in the same piece are not acceptable.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install decorative railings as recommended by the manufacturer of the product. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as sleeves, anchor bolts, and miscellaneous items having integral anchors, that are to be embedded in concrete as masonry construction. Coordinate delivery of such items to project site.

B. Fit exposed connections accurately together to form tight, hairline joints.

C. Avoid cutting of railing at the point of installation when practicable. When job site cutting, drilling, and fitting required use precision methods that will not damage the railings. Set decorative railings accurately in location, alignment, and elevation, measured from established lines and levels and to the proper radius of curvature.

1. Do not weld, cut, or abrade surfaces of decorative railings that have been coated or finished after fabrication and are intended for field connection by mechanical or other means without further cutting or fitting.

2. Set posts plumb within a tolerance of 1/4 inch in 12 feet.

3. Align rails so that variations from level for horizontal members and from parallel do not exceed 1/4 inch in 12 feet.

D. Adjust decorative railings prior to anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated but not less than that required by design loadings.

E. Use the manufacturer's standard mechanical joints for permanently connecting railing components. Seal recessed holes of exposed locking screws with plastic filler cement colored to match finish of handrails and railing systems.

F. Install expansion joints at locations indicated but not further apart than required to accommodate thermal movement. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; locate joint within 6 inches of post.

G. Protect finishes of railing systems and handrails from damage during construction period by use of temporary protective coverings approved by railing manufacturer. Remove protective covering at time of Substantial Completion.

H. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.
PART 1 GENERAL

1.1 SUMMARY
A. Furnish and install pipe railings as indicated on the drawings and specified.

1.2 SUBMITTALS
A. Submit shop drawings showing fabrication and installation of handrails and railings including plans, elevations, sections, details of components, and attachments to other units of Work.

B. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:

   1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials. Provide separate data for each different manufacturer used:

      a. Steel Pipe

   2. LEED Credit MRc5.1: Provide manufacturer name and location data for the following materials. Provide separate data for each different manufacturer used:

      a. Steel Pipe

1.3 PROJECT CONDITIONS
A. Field Measurements: Where handrails and railings are indicated to fit to other construction, check actual dimensions of other construction by accurate field measurements before fabrication; show recorded measurements on final shop drawings. Coordinate fabrication with construction progress to avoid delay of Work.

PART 2 PRODUCTS

2.1 MATERIALS
A. Steel Pipe: ASTM A120, or A53, finish, type and weight class as follows:

   1. Black finish, shop primed for interior locations.

   2. Galvanized finish for exterior installations.

   3. Type F, standard weight (schedule 40).

B. Brackets, Flanges, and Anchors: Formed steel of the same finish as supported rails, unless otherwise indicated.

C. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD-C 621. Provide grout shall be by one of the following manufacturers:
1. "Masterflow 713"; Master Builders.

D. Paint: Shop prime ferrous metal with the fabricator's standard rust inhibitive paint.

E. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility in fabricated items.

F. Fasteners for Anchoring Railings to Other Construction: Select fasteners of the grade, and class required to produce connections that are suitable for anchoring railing to other types of construction indicated and capable of withstanding design loadings.

2.2 STATIONARY RAILINGS

A. Stationary pipe railings, consisting of top rail, intermediate rails, posts and handrails, shall be provided as indicated on the drawings. Railings shall conform to requirements of CFR 29 Part 1910, Section 23.

B. Posts, rails, and corners shall be joined by mitered and welded joints made by fitting post to top rail and intermediate rails to post, mitering corners, groove welding joints, and grinding smooth, butt railing splices, reinforced by an interior sleeve not less than 6 inches long.

2.3 REMOVABLE RAILINGS

A. For removable railing posts, fabricate slip-fit sockets from steel pipe whose inside diameter is sized for a close fit with posts and to limit deflection of post without lateral load, measured at top, to not more than 1/12 of post height. Provide socket covers designed and fabricated to resist accidental dislodgement.

PART 3 EXECUTION

3.1 PREPARATION

A. Coordinate setting drawings, templates, instructions, and directions for installation of anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items.

3.2 INSTALLATION - STATIONARY RAILINGS

A. Install railings in accordance with approved shop drawings and installation instructions. Fit exposed connections accurately together to form tight, hairline joints. Set handrails and railings accurately in location, alignment, and elevation, measured from established lines and levels and free from rack.

B. Provide anchorage devices and fasteners where necessary for securing handrails and railings to in-place construction.

C. Anchor posts in concrete by means of pipe sleeves preset and anchored into concrete. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with the specified non-shrink grout, mixed and placed to comply with anchoring material manufacturer's directions.
D. Attach handrails to wall with wall brackets and end fittings. Provide bracket with not less than 1-1/2-inch clearance from inside face of handrail and finished wall surface.

3.3 REMOVABLE RAILINGS
A. Install removable railing sections where indicated in slip-fit metal sockets cast into concrete. Accurately locate sockets to match post spacing.

3.4 ADJUSTING AND CLEANING
A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material.

3.5 PROTECTION
A. Protect finishes of railing systems and handrails from damage during construction period by use of temporary protective coverings approved by railing manufacturer. Remove protective covering only at time approval by the Owner.
B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.
C. Notify the Owner and the Architect in a timely manner to review and approve the work.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes the following:
   1. Catch basin grates.
   2. Trench drain grates.
B. Related Sections include the following:
   1. Section 02300—Earthwork.
   2. Section 02530—Sanitary Sewage.
   3. Section 02630—Storm Drainage.
   4. Section 02741—Hot-Mix Asphalt Paving.
   5. Section 02751—Cement Concrete Paving.
   6. Section 02768—Stamped Cement Concrete Paving.
   7. Section 03300—Cast-in-Place Concrete.

1.3 SUBMITTALS
A. Product Data: For the following: Drain grates.

1.4 PROJECT CONDITIONS
A. Field Measurements: Where gratings are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.5 COORDINATION
A. Coordinate installation of anchorages for gratings, grating frames, and supports. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves,
concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:


2. Trench Drain Grate at Wet wall: Angle, 6", cast iron, powder coat matte black finish; Type-S framing. Urban Accessories, 949-552-1130, or approved alternate.

3. Trench Drain Grates at Service Gates: Wave, 8", cast iron, standard finish; 8" Type-S framing. Urban Accessories, 949-552-1130, or approved alternate.


5. Trench Drains in Holding Building of Dayroom and in Exhibit: 854 ductile iron grate, locking device 851-C (stainless steel), ABT, Inc., 800-438-6057, or approved alternate.


PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing gratings to in-place construction. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.

B. Placement: Set units accurately in location, alignment, and elevation; measured from established lines and levels and free from rack.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete or masonry.

END OF SECTION
SECTION 05533
PAINTED STEEL CANOPIES

PART 1   GENERAL

1.1 SUMMARY

A. Furnish and install painted steel canopies as indicated on the drawings and specified.

B. Submit shop drawings for canopy structural framing system, and roofing panels, and other canopy system components.

1.2 SUBMITTALS

A. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:

1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials. Provide separate data for each different manufacturer used:
   a. Steel Framing
   b. Steel Roofing

2. LEED Credit MRc5.1: Provide manufacturer name and location data for the following materials. Provide separate data for each different manufacturer used:
   a. Steel Framing
   b. Steel Roofing

PART 2   PRODUCTS

2.1 MATERIALS


B. Suspension Rods: Conform to ASTM A307, Grade A.

C. Shop Primer for Ferrous Metal: Fast-curing, lead-free, universal primer, selected by the manufacturer for resistance to normal atmospheric corrosion, compatibility with finish paint systems, and capability to provide a sound foundation for field-applied topcoats despite prolonged exposure.

D. Roofing: Fabricate roof panel face sheets to the profile or configuration selected by the Architect from 26-gage (0.0179-inch), structural quality, Grade C, zinc-coated steel sheets.

E. Welding: Conform to the requirements of the Latest City of Los Angeles Building Code.
F. The canopy shall be prefinished at the factory, or finish painted after installation as specified under Section 09900, colors and degree of gloss as selected by the Architect.

PART 3 EXECUTION

3.1 ERECTION

A. Erection shall comply with CBC requirements and the approved shop drawings.

B. Framing: Erect framing true to line, level, plumb, rigid, and secure. Level base plates to a true even plane with full bearing to supporting structures, set with double-nutted anchor bolts. Use a non-shrinking grout to obtain uniform bearing and to maintain a level base line elevation. Moist cure grout for not less than 7 days after placement.

END OF SECTION
PART 1   GENERAL

1.1    SUMMARY

A. Furnish and install steel security grilles and gates as indicated on the drawings and specified.

1.2    SUBMITTALS

A. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:

1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials. Provide separate data for each different manufacturer used:
   a. Steel Assemblies

2. LEED Credit MRc5.1: Provide manufacturer name and location data for the following materials. Provide separate data for each different manufacturer used:
   a. Steel Assemblies

1.3    QUALITY ASSURANCE

A. Submit shop drawings that detail the materials, dimensions, and profiles of all materials used in the fabrication of the grilles and gates. Include installation instructions.

B. Perform shop and field welding required in connection with the work of this Section in accordance with pertinent recommendations of the American Welding Society.

C. Comply with following standards, as pertinent:

   1. Steel plates, shapes, and bars: ASTM A36;
   2. Steel tubing (welded or seamless): ASTM A500; (hot dip galvanized A501);

PART 2   PRODUCTS

2.1    MATERIALS

A. Steel Tubing: All tubing used shall be not lighter than 14 gage, hot-dipped galvanized steel. All open tops and end of rails shall have fully welded end caps. Connections between horizontal and vertical members, rails, and posts shall be welded.

B. Welding electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded and as required for color match, strength, and compatibility with fabricated items.

C. Bolts and nuts: Provide tamperproof type complying with ASTM A307, grade A;
D. Machine screws: Provide cadmium plated steel type compiling with Fed Spec FF-S-111;
F. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the City.

2.2 PAINTING
A. Shop prime the steel security grilles. Finish coats may be shop or field painted, using industrial enamel. Apply 2 coats. Color shall be as selected.
B. For repair of galvanizing, use a high zinc-based content paint complying with MIL-P-21035.
C. On galvanized surfaces, use solvent for the initial cleaning, and then treat the surface thoroughly with phosphoric acid etch.
D. Remove etching solution completely before proceeding with paint application.

2.3 FABRICATION
A. Except as otherwise shown on the Drawings, use materials of size, thickness, and type required to produce reasonable strength and durability in the work of this Section.
B. Fabricate with accurate angles and surfaces which are true to the required lines and levels, grinding exposed welds smooth and flush, forming exposed connections with hairline joints, and using concealed fasteners where practicable. Butt splices shall be reinforce with an interior sleeve not less than 6 inches long. All welds shall have a smooth even bead with full penetration.
C. Prior to shop priming, properly clean metal surfaces as required for the applied finish and for the proposed use of the item.

PART 3 EXECUTION
3.1 INSTALLATION
A. Examine the areas and conditions under which the steel security grilles will be installed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.
B. Set work accurately into position, plumb, level, true, and free from irregularity. Drill holes accurately. Where field welding is required, comply with AWS recommended procedures of manual-shielded metal-arc welding for appearance and quality of weld and for methods to be used in correction welding work. Grind exposed welds smooth, and touch up shop prime coats.
C. Do not cut, weld, or abrade surfaces which have been hot-dip galvanized after fabrication and which are intended for bolted field connections.
D. Immediately after erection, clean the field welds, bolted connections, and abraded areas of shop priming. Paint the exposed area with same material used for shop priming.
END OF SECTION
SECTION 05554
TRAFFIC GRADE GRATINGS

PART 1   GENERAL

1.1   SUMMARY
   A. Furnish and install welded steel traffic grade gratings as indicated on the drawings and specified.

1.3   SUBMITTALS
   A. Submit shop drawings detailing fabrication and erection of the traffic grade grating. Include plans, sections, and details of fabrication and installation. Show anchorage and accessory items.

PART 2   PRODUCTS

2.1   GALVANIZED STEEL BAR GRATINGS
   A. Fabricate traffic grade gratings with openings not wider than 1/2" in the direction of travel and to withstand a uniform load of 250 lbs per sq ft or a concentrated load of 8000 lbs per linear ft whichever produces the greatest stress.
   B. Conform to the "Standard Specifications for Metal Bar Grating and Metal Bar Grating Treads" published in ANSI/NAAMM A201 "Metal Bar Grating Manual."
   C. Traffic surface for steel bar gratings shall be plain.
   D. Fabricate removable grating sections with banding bars welded to entire perimeter of each section. Include anchors and fasteners as recommended by manufacturer, for attachment to supports. Provide at least 4 saddle clips, with threaded bolts, nuts and washers.
   E. Provide hot-dip galvanize gratings in accordance with ASTM A123.

PART 3   EXECUTION

3.1   INSTALLATION OF BAR GRATINGS
   A. Install gratings to comply with the approved shop drawings, manufacturer's installation instructions, and the recommendations of NAAMM that apply to grating types and bar sizes provided, including installation clearances and standard anchoring details.

3.2   GALVANIZING REPAIR
   A. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

END OF SECTION
PART 1   GENERAL

1.1 SUMMARY
A. Furnish and install louvered swing gates with hinges as indicated on the drawings and specified.

1.2 SUBMITTALS
The following shall be submitted for review:
A. Manufacturer's Catalog Data
B. Shop Drawings
   1. Indicate profiles, sizes, connection attachments, hardware, anchorage, size and type of fasteners, and accessories.
   2. Include erection drawings, elevations, and details where applicable.
C. Welders' Certificates: Submit statements certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.
D. Manufacturer's Instructions: Manufacturer's printed instructions installation of components and assemblies.

PART 2   PRODUCTS

2.1 MATERIALS
A. Cold-Rolled Steel Sheets: Commercial-quality, level, carbon steel, complying with ASTM A366, or ASTM A568.
B. Hot-Rolled Steel Sheets and Strips: Commercial-quality carbon steel, pickled and oiled, complying with ASTM A569, free of scale, pitting, or surface defects.
C. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A526 and ASTM A525 with A60 or G60 coating designation, mill phosphatized.
D. Hot rolled plates, shapes, and bars shall conform to ASTM A36.
E. Hot rolled bars and bar sizes shall conform to ASTM A575, Grade M1020.
F. Provide stainless steel hinges, latches, stops, and other operating hardware for proper operation of the hinged gates.
G. Anchorage devices shall be expansion shields conforming to FS FF-S-325, Type, and Class suitable for the construction involved.

H. Machine screws shall be galvanized steel, cross-recess drive, flat-head, conforming to FS FF-S-92, Type III.

I. Welding materials shall conform to AWS D1.1 and be of the type required for materials being welded.

2.2 FABRICATION

A. Subject to compliance with specified requirements, louvers shall be the fixed type as fabricated by Airolite, or an "Or Equal" product of one of the following:

1. Air Louvers, Inc.
2. Ruskin Manufacturing, Inc.

B. Joints shall be milled to a close fit. Corner joints shall be coped or mitered, well-formed, and in true alignment. Joints exposed to the weather shall be formed and fabricated to exclude water. Exposed surfaces shall have a smooth finish and sharp, well-defined lines and arrises.

C. Welding: Continuously seal joined members by continuous welds. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.

2.3 GALVANIZING

A. Galvanizing of iron and steel hardware shall be in accordance with ASTM A153. Galvanizing of steel plates, bars, and shapes, 1/8-inch thick and heavier, shall be in accordance with ASTM A123.

B. Galvanizing of assembled steel products shall be in accordance with ASTM A123.

2.4 SHOP PRIMING AND FINISH PAINTING

A. Shop Priming: All steel shall be galvanized and shop primed. Shop priming shall be preceded by pretreatment of the galvanized surfaces to ensure proper adhesion of the primer. The shop primer shall be a rust inhibitive product, customarily used in the fabricator's plant, or one of the following products (or equal):

1. Tnemec Co., "No. 99 Metal Primer".
2. Rust-Oleum Co., "No. 769 Demo-Proof Red Primer".

B. Finish painting shall be accomplished after installation at the jobsite.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install gates and operating hardware as recommended by the manufacturer.
B. Exposed joints shall be continuously welded, with welds ground smooth. Any necessary reinforcement shall be made and the frames shall be reinforced, drilled and tapped as required for finish hardware.

C. Fasteners, anchoring devices, finish hardware, accessories, field bracing, and other components shall be provided as required for a complete installation.

END OF SECTION
PART 1 GENERAL

1.1 DESCRIPTION

A. All rough carpentry work indicated on the Contract Drawings and as hereinafter specified, including:

1. Blocking and nailers and framing anchors.
2. Miscellaneous wood, nails, screws and rough hardware indicated or and required for complete and proper installation.
3. Wood framed partition construction.

B. Related Sections:

1. Documents affecting work of this Section include, but are not necessarily limited to the GENERAL CONDITIONS, and Sections in DIVISION 1 - GENERAL REQUIREMENTS of these Specifications.
2. Concrete Formwork in Section 03300.
3. Finish Carpentry and Millwork in Section 06200.
4. Built Up Roofing in Section 07500.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for the proper performance of the work of this Section.

B. Codes and Standards:

1. In addition to complying with the pertinent codes and regulations of the City of Los Angeles Building code, comply with the following:
   a. "Product Use Manual" of the Western Wood Products Association for selection and use of products included in that manual;
   b. "Plywood Specification and Grade Guide" of the American Plywood Association;

1.3 SUBMITTALS

A. Submit shop drawings showing the locations of backing, furring, blocking, and nailers.

B. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:
1. LEED Credit EQc4.1: Provide adhesive and sealant VOC Emissions Data for the following materials. This information should be available on Material Safety Data Sheets (MSDS) or other product manufacturer's literature. Provide the product manufacturer's most current VOC emissions data:
   a. Glue (Adhesive)

2. LEED Credit EQc4.4: Provide documentation from the manufacturer for each type of composite wood used indicating that panels and cores installed at the project do not contain any ADDED urea-formaldehyde. Products include, but are not limited to the following:
   a. Plywood
   b. Other composite wood products if used (Plywood, OSB, MDF, Particleboard, Hardboard, Chipboard, Glued Block, Structural composite Lumber, etc.)

1.4 GENERAL REQUIREMENTS

A. Verification of Job Conditions: Required and take field measurements as may be required. Report to the City Engineer or Consultant any discrepancies between the Drawings and job-site conditions, for further instructions.

B. Coordination and Cooperation: Do work of this Section in a fully coordinated and cooperative manner with work of other trades to provide complete and proper installation and to expedite the job without delays.

C. Defective Work: All work of this Section that is not set true to line, plane and elevation or is damaged or marred or is not in a condition to receive other trade work will not be accepted. Remedy remove or replace defective work to a first class condition as approved by the City Engineer or Consultant, at no added cost to the City.

D. Clean-Up: During the progress of the work of this Section, keep the premises free of debris and waste resulting from the work of this Section. Upon completion, all surplus materials and debris shall be removed from the job-site.

1.5 PRODUCT HANDLING

A. Delivery: Deliver the rough carpentry materials to the job-site and store in a safe area, out of way of traffic and shored up off the ground surface, where directed by the City Engineer.
   1. Identify framing lumber as to grades and store each grade separately from other grades.
   2. Protect metal items with adequate waterproof outer wrapping and properly identify or label such items.
   3. Use extreme care in off loading of lumber to prevent damage, splitting and breaking of materials.

B. Protection: Stack lumber to prevent warping and keep dry.
PART 2   PRODUCTS

2.1   GRADE STAMPS

A. Identify framing lumber by the grade stamp of the West Coast Lumber Inspection Bureau, or such other grade stamp as is approved in advance by the City Engineer or Consultant.

B. Identify plywood as to species, grade, and glue type by the stamp of the American Plywood Association.

C. Identify other materials of this Section by the appropriate stamp of the agency approved in advance by the City Engineer or Consultant.

D. Conform to the Los Angeles City Building Code.

2.2   MATERIALS

A. Provide materials in the quantities needed for the work shown on the Drawings and meeting or exceeding the following standards of quality at the time of delivery:

1. Furnish lumber manufactured to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

B. Seasoning:

1. Rough lumber to be air dried and well seasoned to have average moisture content not to exceed 19 percent.

2. Finish lumber to be kiln dried as closely as practicable to have an average moisture content not exceeding 12 percent.

C. Composite Wood (LEED Credit EQc4.4): Use only composite wood products including composite lumber and cores that have no added urea-formaldehyde.

2.3   PRODUCTS

A. Structural Lumber: Provide all structural lumber, studs, joists, and other framing members of the species and grade indicated on the drawings.

B. Blocking and Nailers: Douglas Fir, "Construction" grade, pressure treat with chromate zinc chloride.

C. Plywood: Conform to U.S. Product Standard P.S. 1-74. Plywood shall be grade-marked by the American Plywood Association (APA), Pittsburgh Testing Laboratories (PTL) or Timber Engineering Company (TECO). Plywood shall be exterior grade, Structural I.

1. Provide tongue and groove plywood on the roof.


F. Preservative Treated Wood:
1. Wood and plywood specified as treated wood shall be pressure treated wood in accordance with UBC Standards "Preservative Treatment by Pressure Process and Quality Control Standards."

2. Seasoning: Treated lumber shall be air seasoned after treatment, for at least 2 weeks before using in the work.

3. Creosote shall not be used for treating wood in contact with painted or plastered surfaces.

4. When treated wood has been notched, dapped, drilled or in any way cut into, such newly cut surfaces shall be painted with a heavy coat of the preservative material used in the treatment of the wood.

G. Fire Retardant: All wood shall be treated with Baxter "Pyresote", Barnard "Bar Flame" or equal.


I. Factory made metal devices, joist hangers, anchors and other metal work used for framing shall be as manufactured by Union, Simpson, Teco or equal and as approved by the Architect.

J. Load Bearing Studs: Douglas Fir WCLIB No. 1 grade.

K. Beams and Stringers: 5-inch and thicker, width more than 2-inch greater than thickness, Douglas Fire WCLIB No. 1 structural beams and stringers.

L. Wall Sills: Treated Douglas Fir of WCLIB grade for wall framing or Redwood CRA Foundation grade as market or branded by an approved agency of the Los Angeles City Department of Building and Safety.

2.4 MINIMUM SURFACING

A. General: All faces required to be left exposed; where specifically indicated on the Drawings or specified; where necessary to achieve proper connections to other members.

B. S1E: Blocking, studs, joists, rafters, purlins, bridging and other members in which uniform width must be maintained.

C. S1S1E: Plates, sills and other members in which uniform width and thickness must be maintained.

D. S4S: Exposed wood except where noted otherwise.

2.5 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the City Engineer or Consultant.

1. Glue: As suitable for required joining; water-resistant where subject to moisture conditions.
2. Stock Framing Connectors and Brackets: “Simpson,” “Teco” or “Trimfast” galvanized metal of types and sizes indicated or required. Use nails furnished by the connector manufacturer.

B. Adhesives and Sealants (Glue) (LEED Credit EQc4.1): Only use adhesives and sealants in the interior of the building that meet or do not exceed the VOC limits of the CURRENT requirements of South Coast Air Quality Management District (SCAQMD) Rule No. 1168 on the interior of the building.

1. Current requirements refers to the date on which the materials are installed in the building.

2. A copy of SCAQMD Rule No. 1168 is included in section 01022 that was current as of the date of this specification. Refer to http://www.aqmd.gov/rules for the actual current version of the rule that will be applicable at the date of installation during construction.

3. Interior refers to all building construction that is inside of the exterior weatherproofing material.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until detrimental conditions are corrected.

3.2 COMPLIANCE

A. Do not permit materials not complying with the provisions of this Section to be brought onto or to be stored at the job-site.

B. Promptly remove non-complying materials from the job-site and replace with materials meeting the requirements of this Section.

3.3 WORKMANSHIP

A. Produce joints which are tight, true and well nailed, with members assembled in accordance with the Contract Drawings and with pertinent Codes and Regulations.

B. Selection of Lumber Pieces:

1. Carefully select the members.

2. Select individual pieces to that knots and obvious defects will not interfere with placing bolts or proper nailing, and will allow making of proper connections.

3. Cut out and discard defects which render a piece unable to serve its intended function.

4. Lumber may be rejected by the City Engineer or Consultant, whether or not it has been installed, for excessive warp, twist, bow, crook, mildew, fungus or mold, as well as for improper cutting and fitting.
3.4 GENERAL FRAMING

A. General: Execute rough carpentry in accordance with the Los Angeles City Building Code, Divisions 25 and 48 as applicable.

1. In addition to framing operations normal to the fabrication and erection indicated on the Drawings, install wood blocking and backing required for the work of other trades.

2. Set horizontal and sloped members with crown up.

3. Do not notch, cut, or bore members for pipes, ducts, or conduits, or for other reasons except as shown on the Drawings or as specifically approved in advance by the Consultant or City Engineer.

4. Make proper allowances for shrinkage where possible. Splicing between bearings not permitted.

5. The contact surfaces of any member coming in contact with an exterior concrete or masonry wall regardless of height above ground shall be treated wood or shall be painted with two coats of an approved preservative.

B. Bearings:

1. Make bearings full unless otherwise indicated on the Drawings.

2. Finish bearing surfaces on which structural members are to rest so as to give sure and even support.

3. Where framing members slope, cut or notch the ends as required to give uniform bearing surface.

C. Furring and/or Stripping: Provide Douglas Fir Boards, S4S, in accurate spacing and straight alignment, and at right angles to framing. Securely nail to framing at every bearing with suitable box nails or other fastening as approved by the City Engineer.

D. Crickets: Construct crickets of lumber and plywood, or of rigid roofing insulation in forms that will divert water away from the vertical surface.

E. Wood Nailers:

1. Materials: Pressure treated lumber, sizes, and shapes as indicated on the Drawings.

2. Installation: In level position, tightly bolt in place with nuts or heads countersunk and make ready for receiving sheet metal copings; as indicated on the Drawings.

F. Plywood Backing:

1. Required: For supports for Mechanical and/or Electrical equipment on walls. Back prime before installation.

2. Material: 3/4-inch plywood "B-D" grade; sizes as noted or indicated on the Drawings.
3. Installation: At location indicated on the Drawings; bolt to structural framing so as to bear weight of equipment; countersink all fasteners.

3.5 BLOCKING AND BRIDGING
A. Install blocking as required to support items of finish and to cut off concealed draft openings, both vertical and horizontal, between ceiling and floor areas.

3.6 INSTALLATION OF PLYWOOD SHEATHING
A. Placement: Place plywood so the side bearing the grade stamp or other markings will be concealed from view in the finished structure. Place plywood with face grain perpendicular to supports and continuously over at least two supports, except where otherwise shown on the Drawings. Center joints accurately over supports, unless otherwise shown on the Drawings.

B. Protect Plywood from moisture by use of waterproof coverings until the plywood in turn has been covered with the next succeeding component or finish.

3.7 FASTENING

B. Nailing:
1. Use only common wire nails or spikes of the dimension shown on the Nailing Schedule, except where otherwise specifically noted on the Drawings. Sinker nails are not allowed.

2. For conditions not covered in the Nailing Schedule, provide penetration into the piece receiving the point of not less than 1/2 the length of the nail or spike, provided, however, that 16d nails may be used to connect two pieces of 2" (nominal) thickness.


4. Prebore as required.

5. Remove split members and replace with members complying with the specified requirements.

C. Bolting:
1. Drill holes 1/16" larger in diameter than the bolts being used. Drill straight and true from one side only.

2. Do not bear bolt threads on wood, but use washers under head and nut where both bear on wood, and use washers under all nuts.

D. Screws: For lag screws and wood screws, prebore holes same diameter as root of threads, enlarging holes to shank diameter for length of shank.

END OF SECTION
PART 1   GENERAL

1.1 DESCRIPTION

A. Furnish and install finish carpentry as indicated on the drawings and specified including, nails, screws, and other items as needed for the construction shown on the Contract Drawings, and as needed for a complete and proper installation.

B. Finish Carpentry includes, but is not limited to:

1. Book shelf ends, Detail 10/A6.5
2. Workstations, Detail 9+10/A6.2 - A6.3
3. Book shelf tops, Detail 8/A6.5
4. Meeting room counter.
5. Staff workroom counter.
6. Verify with Architect before commencing work.

C. Related Sections:

1. Documents affecting work of this Section include, but are not necessarily limited to the GENERAL CONDITIONS, SUPPLEMENTARY CONDITIONS and Sections in DIVISION 1 - GENERAL REQUIREMENTS of these Specifications.
2. Metal Fabrications in Section 05500.
3. Rough Carpentry in Section 06100.
4. Architectural Woodwork in Section 06400.
5. Caulking and Sealants in Section 07900.
6. Wood Doors in Section 08210.
7. Paint Finishes in Section 09900.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for the proper performance of the work of this Section.

1.3 SUBMITTALS
A. Submittals: Comply with provisions in the SUBMITTALS Section 01340 in DIVISION 1 - GENERAL REQUIREMENTS of these Specifications. Submit shop drawings, manufacturer's technical data and material specifications and samples as applicable, for all products specified herein for Architect and City Engineer's review prior to start of work of this Section.

B. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:

1. LEED Credit EQc4.1: Provide adhesive and sealant VOC Emissions Data for the following materials. This information should be available on Material Safety Data Sheets (MSDS) or other product manufacturer's literature. Provide the product manufacturer's most current VOC emissions data:
   a. Glue (Adhesive)

2. LEED Credit EQc4.4: Provide documentation from the manufacturer for each type of composite wood used indicating that panels and cores installed at the project do not contain any ADDED urea-formaldehyde. Products include, but are not limited to the following:
   a. Softwood Plywood
   b. Hardboard Plywood
   c. Closet Shelving, Interior Plywood
   d. Other composite wood products if used (Plywood, OSB, MDF, Particleboard, Hardboard, Chipboard, Glued Block, Structural composite Lumber, etc.)

1.4 REQUIREMENTS

A. Verification of Job Conditions: Required and take field measurements as may be required. Report to the City Engineer or Architect any discrepancies between the Drawings and job-site conditions, for further instructions.

B. Coordination and Cooperation: Do work of this Section in a fully coordinated and cooperative manner with work of other trades to provide complete and proper installation and to expedite the job without delays.

C. Defective Work: All work of this Section that is not set true to line, plane and elevation or is damaged or marred or is not in a condition to receive other trade work will not be accepted. Remedy remove or replace defective work to a first class condition as approved by the City Engineer or Architect, at no added cost to the City.

D. Priming and Backpainting: Priming and backpainting of all carpentry and millwork is specified in Painting - Section 09900. Do not set items until priming and backpainting have been done.

E. Protection: Protect all work against damage of any kind until final acceptance of the building. Repair or replace damaged work to the satisfaction of the City Engineer without additional cost to the City.

F. Delivery, Storage and Handling:
1. No fabrication, finishing or installation shall be performed until Shop and Erection Drawings and finish samples have been approved by the City Engineer or Architect.

2. Defer delivery to the job until the installation and storage areas are complete and dry of all wet-type construction.

3. Maintain relative humidity in storage areas not to exceed 60 percent and protected from extreme changes in temperature and humidity.

4. Protect all surfaces of work subject to damage while in transit.

1.5 REFERENCED SPECIFICATIONS AND STANDARDS

A. Manufacture all millwork in accordance with the standards established in the latest edition of the (WIC) "Manual of Millwork" of the Woodwork Institute of California, or equivalent construction, in the grade or grades hereinafter specified or as shown on the Contract Drawings.

PART 2 PRODUCTS

2.1 GRADE STAMPS

A. Identify lumber by the grade stamp of the West Coast Lumber Inspection Bureau, or such other grade stamp as is approved in advance by the City Engineer or Architect.

B. Identify plywood as to species, grade, and glue type by the stamp of the American Plywood Association.

2.2 MATERIALS

A. General: Provide materials in the quantities needed for the work shown on the Contract Drawings and meeting or exceeding the following standards of quality:

B. Lumber and Plywood: New, clean stock of the species and WIC grades shown below.

1. Douglas Fir for concealed stripping, blocking and framings manufactured and graded in accordance with "Standard Grading and Dressing Rules 16 of WCLIB, "D" VG Finish Grade S4S, kiln-dried to a maximum 12% moisture content.

2. Softwood: WIC Section 3, "Custom" grade Douglas Fir, vertical grain.

3. Hardwood: WIC Section 4, "Custom" grade, solid select White Oak, selected for clear finish.

4. Softwood Plywood: WIC Section 5, "Custom" grade Douglas Fir - rotary cut. Where plywood will be exposed to view in the finished work, knots shall not be visible.

5. Hardwood Plywood: WIC Section 6, "Custom" grade, select Red Birch.

6. Closet Shelving:
   a. Shelves 11-1/2" Wide or Less: Douglas Fir-Hemlock, B and Better grade; or Ponderosa Pine, B and Better grade.

7. Clothes Rods: Douglas Fir, 1-3/8" diameter, with nylon sockets each end and Stanley 7045 steel bracket at center of all rods 48" long or longer.

8. Metal Base: Provide metal base composed of metals of the proper profiles, and dimensions indicated on the drawings. Base shall be free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, “oil cleaning,” stains, discolorations or other irregularities on finished units are not acceptable.

C. Interior Millwork:

1. Interior trim per WIC Section 10, "Custom" grade, select White Oak unless otherwise specified.

2. Miscellaneous interior millwork per WIC Section 11 "Custom" grade, select White Oak, stain grade. Closet shelving shall be WIC "Custom" grade, softwood solid stock or exposed edgebanded plywood, cleat supported unless otherwise indicated.

3. Interior trim per WIC Section 12 "Custom" grade, select Clear White Oak.

D. Composite Wood (LEED Credit EQc4.4): Use only composite wood products including composite lumber and cores that have no added urea-formaldehyde.

2.3 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to the approval of the City Engineer or Architect.

1. Glue: As suitable for required joining; water-resistant where subject to moisture conditions.


3. Stock Framing Connectors and Brackets: "Simpson", "Teco" or "Trimfast", galvanized metal of types and sizes indicated or required. Use nails furnished by the connector manufacturer.


B. Adhesives and Sealants (Glue) (LEED Credit EQc4.1): Only use adhesives and sealants in the interior of the building that meet or do not exceed the VOC limits of the CURRENT requirements of South Coast Air Quality Management District (SCAQMD) Rule No. 1168 on the interior of the building.

1. Current requirements refers to the date on which the materials are installed in the building.

2. A copy of SCAQMD Rule No. 1168 is included in section 01022 that was current as of the date of this specification. Refer to http://www.aqmd.gov/rules for the actual current version of the rule that will be applicable at the date of installation during construction.
3. Interior refers to all building construction that is inside of the exterior weatherproofing material.

PART 3 EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until detrimental conditions are corrected.

3.2 WORKMANSHIP

A. Produce joints which are true, tight and well nailed with all members assembled in accordance with the Drawings.

B. Jointing:

1. Make joints to conceal shrinkage; miter exterior joints; cope interior joints; miter or scarf end-to-end joints.

2. Install trim in pieces as long as possible, jointing only where solid support is obtained.

C. Fastening:

1. Install items straight, true, level, plumb, and firmly anchored in place.

2. Where blocking or backing is required, coordinate as necessary with other trades to ensure placement of required backing and blocking in a timely manner.

3. Nail trim with finish nails of proper dimension to hold the member firmly in place without splitting the wood.

4. Nail exterior trim with galvanized nails, making joints to exclude water and setting in waterproof glue or the sealant described in Section 07920 of these Specifications.

5. On exposed work, set nails for putty.

6. Screw, do not drive wood screws; except that screws may be started by driving and then screwed home.

7. Nailing, Screwing and Bolting: Conform to provisions of Los Angeles City Building Code, Uniform Building code Supplement, Table 25-Q in Division 25 as applicable to Finish Carpentry.

3.3 MILLWORK
A. Assemble all millwork at the mill as far as practicable, and deliver to building ready to set in place. Work material in the best manner known to the trade, mortise and tenon, dowel, block, and glue together so as to avoid the use of nails as much as possible. Follow detail closely, cut moldings cleanly and define sharply and make miters accurately. Butt joints without an approved device for preventing the separation of the joint will not be accepted. Set all nails, and where screws are used in exposed surfaces, conceal with wood plugs.

3.4 SHELVES, HOOK STRIPS, GUSSETS AND HANGING RODS

A. Shelves:
1. Single boards may be used for shelving 12" or less in width. Built-up shelves more than 12" wide shall be 3/4" thick plywood or particle board with edge bands.
2. Installation: Support shelves at ends and back on hook strips or cleats, as indicated on Drawings; securely screw to the strips or cleats; set level; locate top of coat closet shelves 5-feet, 8-inches above floor, unless otherwise indicated on the Drawings.

B. Hook Strips and Cleats:
1. Material: Douglas Fir boards, S4S; 1-inch x 6-inch for hook strips, 1-inch x 2-inch for cleats except as otherwise indicated on the Drawings.
2. Installation: Securely attach to walls by means of flathead screws, into suitable shields in the masonry; screws countersunk.

C. Hanging Rods:
2. Installation: Set centerline of rod 1-1/2-inches below bottom surface of shelf and 12-inches forward of hook strips.

D. Shelf Struts:
1. Material: Douglas Fir boards, S4S, 1-inch x 3-inch.
2. Installation: Gain into front edges of shelves over gussets; screw 1-inch x 3-inch strut at each shelf with flat head countersunk screws; round exposed ends and edges of struts.

3.5 INSTALLATION OF OTHER ITEMS

A. Install items in strict accordance with the Drawings and the recommended methods of the manufacturer as approved by the City Engineer or the Architect, anchoring firmly into position at the prescribed locations, straight, plumb, and level.

3.6 FINISHING
A. Sandpaper finished wood surfaces thoroughly as required to produce a uniformly smooth surface, always sanding in the direction of the grain; except do not sand wood which is designed to be left rough.

B. No coarse grained sandpaper mark, hammer mark, or other irregularity will be accepted.

3.7 INSTALLATION OF WOOD DOORS, SIDE AND/OR TRANSOM PANELS

A. Fit work accurately, leaving equal clearances at sides and top and allowing for painter's finish. Maximum clearances to be as follows:

1. 1/16-inch between door and frame top and side edges except as otherwise detailed.

2. 1/2-inch over floor coverings.

3. 3/16-inch over thresholds.

4. Undercut bottom edge of door 1-inch or as otherwise indicated on the Drawings.

B. Sand door edges smooth and slightly round arrises, after fitting.

C. Hang doors, side and/or transom panels plumb and square so as to operate freely without binding or sticking. Install transom panels flush with adjoining door face and coordinate graining of transom panel with that of adjacent door.

3.8 CLEANING UP

A. Conform to applicable provisions noted in Section 01710 - CLEANING in DIVISION 1 - GENERAL REQUIREMENTS of these Specifications.

B. Keep the premises in a neat, safe, and orderly condition at all times during execution of this portion of the Work, free from accumulation of sawdust, cut-ends, and debris.

C. Sweeping:

1. At the end of each working day and more often if necessary, thoroughly sweep surfaces where refuse from this portion of the Work has settled.

2. Remove the refuse to the area of the job-site set aside for its storage upon completion of the work of this Section, remove all surplus materials and debris from the job-site.

3. Upon completion of work of this Section, thoroughly broom clean all surfaces.

END OF SECTION
PART 1   GENERAL

1.1 SUMMARY

A. Furnish and install architectural woodwork, casework, trim hardware, countertops, and shelving as indicated on drawings and specified.

1.2 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings of casework indicating materials and hardware, details of construction, dimensions, methods of fastening and installation details. Shop Drawings shall bear a WIC Certified Compliance Label indicating that Shop Drawings fully meet requirements of WIC grade specified. Shop Drawings shall indicate grounds, backing, blocking, sleepers and other items required for installation of casework, which are to be provided and installed as part of the Work.

B. Certificates: Provide WIC Certified Compliance Certificate certifying that materials, fabrication and installation will comply with the specified requirements.

C. Material Samples: Submit 2 inch x 3 inch plastic laminate color Samples of manufacturer’s entire color range.

D. Closeout Submittals: Provide a WIC Certified Compliance Certificate for Installation.

E. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:

1. LEED Credit EQc4.1: Provide adhesive and sealant VOC Emissions Data for the following materials. This information should be available on Material Safety Data Sheets (MSDS) or other product manufacturer’s literature. Provide the product manufacturer’s most current VOC emissions data:
   a. Adhesive

2. LEED Credit EQc4.4: Provide documentation from the manufacturer for each type of composite wood used indicating that panels and cores installed at the project do not contain any ADDED urea-formaldehyde. Products include, but are not limited to the following:
   a. Plastic Laminated Faced Cabinets: Particle Board Core Material
   b. Plastic Laminated Faced Cabinets: Softwood Plywood
   c. Plastic Laminated Faced Cabinets: Hardboard
   d. Wood Casework: Particle Board
   e. Wood Casework: Hardboard
   f. Other composite wood products if used (Plywood, OSB, MDF, Particleboard, Hardboard, Chipboard, Glued Block, Structural composite Lumber, etc.)
1.3 QUALITY ASSURANCE
   A. Comply with WIC Manual of Millwork, grades as specified herein.
   B. Each elevation of casework shall bear WIC Certified Compliance Label indicating that casework fully meets requirements of WIC grade specified.
   C. Each plastic laminate countertop shall bear WIC Certified Compliance Label indicating tops fully meet requirements of WIC grade specified.
   D. Mock-ups: When required by the Architect, submit a full-scale base cabinet, countertop, and wall-hung cabinet, illustrating joinery and plastic laminate finish. Base cabinet shall incorporate a drawer, an adjustable shelf, and a door. Wall-hung cabinet shall incorporate 2 doors, one adjustable shelf and finished end, including required hardware.

1.4 DELIVERY, STORAGE AND HANDLING
   A. Materials shall be delivered to the Project site in undamaged condition, stored in fully covered, well ventilated areas, and protected from extreme changes in humidity and temperature. Refer to WIC Manual for recommended care and storage.
   B. In event of damage immediately furnish necessary repairs or replacements.

1.5 PROJECT CONDITIONS
   A. Store indoors, in ventilated areas with constant but minimum temperature of 60 degrees F. and maximum relative humidity of 25 percent to 55 percent. At least seven days before installation, maintain temperature of 70 degrees F. and relative humidity of 50 percent to 55 percent. Acclimate materials to the installation temperature and humidity for at least 72 hours prior to installation. Maintain conditions until Substantial Completion.

PART 2 PRODUCTS

2.1 PLASTIC LAMINATE FACED CABINETS
   A. Plastic laminate: High pressure plastic laminate conforming to NEMA standard LD-3; 0.050 inches at horizontal surfaces, 0.028 inches at exposed vertical surfaces and edge bands, and 0.042 inch minimum for post-formed countertops.
   B. Particle Board Core Material: 45 lb. density, conforming to ANSI A208.1, Table 1, Grade 1-M-2.
   C. Solid Lumber:
      1. Solid lumber for exposed members, drawers, trays and special details shall be Clear birch or maple.
      2. Unexposed solid lumber for concealed webs or structural members shall be of Clear Douglas fir.
   D. Softwood Plywood: Rotary cut exterior type A-C grade softwood plywood complying with PS1.
   E. Hardboard: Factory finished pressure sealed hardboard conforming to the requirements of PS 58. Oil tempered hardboard shall conform to CS 251.
F. Cabinet Liner: Semi-exposed surfaces shall be finished with 0.020 inch high-pressure laminate cabinet liner, conforming to NEMA Standard LD-3.

G. Edge Banding:
   1. T-type extruded tenite-butyrate 1/16 inch minimum thickness, with serrated leg 3/8 inch in length.
   2. 0.028 inch minimum thickness plastic laminate.

H. Glass Doors: 1/4 inch laminated safety glass.

I. Adhesive: Type II water-resistant, rigid type glue of formula conforming to PS 51.

J. Sealer: Thompson Water Seal 101 or Watco Oil.

K. Base: Cover toe spaces with typical wall base unless otherwise indicated.

L. Adhesives and Sealants (LEED Credit EQc4.1): Only use adhesives and sealants in the interior of the building that meet or do not exceed the VOC limits of the CURRENT requirements of South Coast Air Quality Management District (SCAQMD) Rule No. 1168 on the interior of the building.
   1. Current requirements refers to the date on which the materials are installed in the building.
   2. Rule No. 1168: Refer to http://www.aqmd.gov/rules for the actual current version of the rule that will be applicable at the date of installation during construction.
   3. Interior refers to all building construction that is inside of the exterior weatherproofing material.

M. Composite Wood (LEED Credit EQc4.4): Use only composite wood products including composite lumber and cores that have no added urea-formaldehyde.

2.2. WOOD CASEWORK:

A. Particle Board: 45 lb. density, conforming to ANSI A-208.1, table 1, Grade 1-M-2.

B. Solid Lumber:
   2. Semi-exposed portions: Custom Grade hardwood veneer of the same species as exposed material with a specific gravity in excess of 0.37.
   3. Exposed portions: Premium Grade well matched for color and grain, select white birch veneer.

C. Hardboard: Factory finished, pressure sealed hardboard conforming to requirements of PS 58.

D. Edge Banding: Same species of wood as adjacent to exposed surfaces.
E. Adhesives and Sealants (Glue) (LEED Credit EQc4.1): Only use adhesives and sealants in the interior of the building that meet or do not exceed the VOC limits of the CURRENT requirements of South Coast Air Quality Management District (SCAQMD) Rule No. 1168 on the interior of the building.

1. Current requirements refers to the date on which the materials are installed in the building.

2. A copy of SCAQMD Rule No. 1168 is included in section 01022 that was current as of the date of this specification. Refer to http://www.aqmd.gov/rules for the actual current version of the rule that will be applicable at the date of installation during construction.

3. Interior refers to all building construction that is inside of the exterior weatherproofing material.

F. Composite Wood (LEED Credit EQc4.4): Use only composite wood products including composite lumber and cores that have no added urea-formaldehyde.

2.3. HARDWARE:

A. Drawer Slides for Custom Grade Cabinetry:


2. Drawers and box drawers, up to 24 inches wide: Accuride 3832A.

3. Lateral file drawers, up to 30 inches wide: Accuride 4034 overtravel or 4033 equal travel.

4. Lateral file drawers, more than 30 inches wide: Accuride 3640.

B. Drawer Slides for Premium Grade Cabinetry:

1. Pencil drawers: Full extension type: Accuride 2632.

2. Drawers and box drawers, up to 24 inches wide: Accuride 7432.

3. Lateral file drawers, up to 30 inches wide: Accuride 4034 overtravel or 4033 equal travel.

4. Lateral file drawers, more than 30 inches wide: Accuride 4437.

C. Flipper Door Slides for Premium and Custom Grade Cabinetry: For vertically mounted retracting cabinet doors up to 75 lbs. and 72 inches tall: Accuride 1432 with hinge carrier strip.

D. Mutes: Rubber, approximately 1/4 inch diameter, colors to match adjacent finish.

E. Plastic Grommets: Doug Mockett, or equal; color as selected by Architect.

F. Adjustable Shelves with Clips: Adjustable shelf supports (EDP type, unless otherwise noted) set in 5 mm holes spaced 32 mm on center:


G. Cabinet Hinges: Concealed type, minimum 170 degree opening, self-closing:
1. Hafele America, Co., No. 326.05.

H. Cabinet Locks:
1. Door Locks: Pin tumbler type – National No. 3713 x 2475-172 strike or Olympus 100DR x 12-1 strike.
2. Locks for Sliding Doors: National No. C8142 x thimble strike or Olympus 300 SD x thimble strike.
3. Drawer Locks: National 68-3718 x 68-2480C brass strike or Olympus 200 DW x 12-1 strike.
4. Cabinet locks shall be flush with surface of door and protrude no greater than 3/16”.

I. Top-hung Hardware Assembly for Sliding Doors: Grant No. 6064.

J. Track for Sliding Doors: K & V 455 x or 455.55.

K. Pull Flush Ring at Drawers behind Doors: Safe No. 6116 or BBW 24.

L. Pulls: BBW No. 79P, Quality No. 179 x 180 or Trimco No. 553P.

M. Catches: Magnetic type - Epco No. 592 or Lawrence No. SC1364-AL.

N. Four-way Tension Catch: Glynn-Johnson GJ21A.


P. Shelf Standards and Brackets: K & V No. 255 x 256 or line bored holes for pins as approved by WIC standards Stanley No. 798 x 799, steel zinc plated.

Q. Hanger Rods: 1-1/16 inches minimum diameter metal tubing, aluminum or stainless steel clad, KV660; heavy wall steel tubing KV770.

R. Hanger Rod Flanges: KV757, or flanges KV734, KV735; Ronther Reiss R44-55; or equal.

S. Hardware Finish: With exception of finish hardware items which have finishes specified, hardware shall be furnished with dull chrome US 26D or dull stainless steel US 32D finish.

T. Keying:
1. Key locks inside one room alike. Furnish 3 keys for each lock keyed separately, and 2 keys for each lock in keyed alike groups. Master keys shall be tagged and
delivered to the Engineer. Locks and keys shall be stamped with coded set number / direct digit.

2. Cabinet locks shall be master-keyed and keyed alike. Backside of cabinet lock bolts (on visible side following installation) and change keys shall be stamped with manufacturer’s code, either direct digit or coded series. Change keys shall also be stamped with set numbers direct digit.

3. Master keys shall be as directed by the Engineer.

2.4 FABRICATION

A. Plastic Laminated Casework: Construction of plastic laminated casework shall conform to the material and construction requirements for WIC Custom grade flush overlay construction.

1. Exposed Vertical Panels and Doors: Exposed fixed panels and doors, including exposed ends of cabinets and both ends of each cabinet shall be 3 ply laminate construction consisting of plastic laminate with particle board and a balancing sheet, bonded together under pressure with adhesive. Total nominal thickness of panels and doors shall be 0.75 inch unless otherwise indicated.

2. Exposed bottom of wall-hung cabinets shall be furnished with plastic laminate finish.

3. Semi-exposed Panels: Interior panels, bottoms, and tops shall be 3/4 inch particleboard minimum. Bottoms of upper cabinets spanning 42 inches or more shall be one inch thick.

4. Webs: Stiles, rails and muntins of web frame shall be tongue and grooved at joints and glued. Top and bottom rails shall be continuous. Use of 8 mm wooden dowels, screws or biscuits shall be in accordance with WIC Standards.

5. Cabinet bases may be integral or separate. Bases shall be 3/4 inch thick plywood securely jointed at 4 corners to a supporting block 1-1/2 inches thick.

6. Ends: Cabinet ends shall be minimum 3/4 inch thick, lock-jointed, doweled, glued, and screwed to webs or top and bottom of the cabinet.

7. Backs shall be 1/4 inch thick plywood or 1/4 inch thick particle board, and shall be plowed into sides and top (except countertops) glued and nailed on 4 inch centers. Back shall be braced with horizontal 3/4 inch x 3-1/2 inch backing strips on 3 feet centers maximum. Cabinets with exposed finish backs shall have 3/4 inch backs of laminate construction. Where exposed finished cabinet end and back form an external corner, plastic laminates shall meet at corner.

8. Adjustable shelving shall be 3/4 inch thickness particleboard for spans up to 25 inches and one inch thickness for spans over 25 inches up to 34 inches. Adjustable shelving over 34 inches in span shall be one inch thick plywood core with 0.020 inch cabinet liner both sides. Shelving hardware shall be adjustable to one inch centers. Faces and edges of shelving shall be finished with 0.020 inch thickness cabinet liner both sides.

9. Drawers:
a. Sides, backs, and sub-fronts of drawers shall be of dovetail or dowel construction and made of 1/2 inch thick clear birch or maple solid stock. Drawer bottoms shall be in accordance with WIC requirements, glue blocked and nailed.

b. Drawers shall be fitted with ball bearing slides accurately installed for smooth drawer operation.

c. Drawer fronts shall be of 3/4 inch thick plastic laminate construction, fully edge-banded with plastic laminate T-banding to be used when matching existing. T-banding joint shall occur at center of bottom edge of panel.

10. Doors:

a. Doors shall be of overlay type with flush exposed surfaces. Doors shall be fully edge-banded with plastic laminate. Joint in banding shall occur at center of bottom edge. Doors of cabinets within any group of adjacent units shall be in alignment.

b. Hinges shall be routed into edge of door. Doors over 40 inches in height shall have 3 hinges.


12. Banding:

a. Exposed edges of interior and exterior laminates shall be edge banded with plastic laminate. Edge banding shall be provided in longest available lengths.

b. Edge banding shall be accurately fitted. Where edge band joins plastic surfaces, there shall be no open spaces, voids, or chipping of plastic laminate surface.

c. Exposed cabinet surfaces shall be flush, and any protruding edges of banding shall be machined or trimmed to provide a flat smooth corner at intersection of banding and adjoining surfaces. Plastic laminate edge banding shall be installed on tops, webs, bottoms, ends, and inside partitions. T banding may only be installed on drawer fronts and door edges and only as required to match existing.

B. Wood Casework: Manufacture in accordance with WIC Manual of Millwork, Premium Grade, except, modified as follows:

1. Casework bodies shall be 3/4 inch thick particleboard core. Particleboard core shall have a minimum density of 45 pounds.

2. Exposed surfaces for transparent finish shall be plain sliced select white birch, and shall be Premium Grade veneers and solid stock.

3. Semi-exposed surfaces shall be natural birch Good Grade veneer. Semi-exposed portions behind glass or in open cases shall be of same species and grade as exposed portions.
4. Edge banding shall be wood edge bands of same species as adjacent exposed faces.

5. Cabinet doors shall be particleboard core a minimum of 3/4 inch thickness, unless otherwise noted. Interior faces of cabinet doors shall be same species and grade as exposed surfaces. Cabinet doors shall be flush overlay type No. 1.

C. Plastic Laminate Counter Tops: Each plastic laminate countertop shall bear the WIC Certified Compliance Label.

1. Laminated plastic countertops shall be self-edged, except that plastic countertops containing sink cutouts shall have a no-drip tilt-front edge. Edge shall rise 1/8 inch above counter surface and back and return splashes shall be 6 inches high measured from exposed countertop surface, unless otherwise indicated.

2. Cove and roll front sticking, for plastic laminate back-up, shall be kiln dried clear sugar pine glued to core material. Cove sticking shall be secured in each direction with 2-1/2 inch long wood screws, 3 inches from each end and 10 inches on center.

3. Splash shall be end applied and be set in mastic and secured to top with screws 8 inches on centers. Splash edges shall be self-edged and scribed to wall.

4. Joints shall be splined and fastened with screw clip fasteners on at least 8 inch centers. Water resisting mastic or glue shall be applied in joints. Joints shall not occur at sink cutouts. Sink cutouts shall be sealed.

5. Core material for counters and splashes shall be 3/4 inch thick, 7-ply, rotary cut Philippine mahogany 2-4 faces, type 1, or 3/4 inch 1-M-2 grade particleboard.

6. Metal sink moldings shall be stainless steel, Hudee, Kintrim T-Type or Chromedge Sink-Lok, with bolts and lugs.

7. Mastic: Metal trim shall have a continuous layer of mastic in voids between metal and plywood and sink. Counter cutout edge shall be waterproofed to prevent delamination of countertop. Metal trim shall be applied over finished plastic surfaces without kerfing or routing of molding.

8. Installation of plastic laminate shall be in accordance with published specifications and recommended practices of the plastic laminate manufacturer.

2.5 FINISHING

A. Exposed hardwood parts shall be finished with one coat of lacquer sealer and 2 coats of finish lacquer. Unexposed materials such as backs, webs, back of tops, and the like, shall be sealed with one oil base prime coat. Semi-exposed wood surfaces such as drawer interiors shall be finished with one coat of sanding sealer and one coat of clear gloss lacquer.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install Work of this section as specified in the WIC Manual of Millwork.
B. Cabinets: Install cabinets level, plumb, and secure to walls. Exposed screws shall have finish washers.

C. End Panels and Fillers: Furnish to match exposed surfaces and accurately scribe to walls and neatly and securely fit to cabinets.

D. Completion: Upon completion of installation, cabinets including drawers and shelves shall be cleaned. Doors and drawers shall operate easily and freely.

E. Scribe plastic laminated cabinets to walls. Installation of surface-applied moldings is not permitted.

3.2 CLEAN UP

A. Remove debris, rubbish and waste material and legally dispose of off the Project site.

3.3 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Solid composite work surfaces.

1.2 SUBMITTALS

A. Submit in accordance with Section 01330.

B. Submit samples of each color and thickness of material used.

C. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:
   1. LEED Credit EQc4.1: Provide adhesive and sealant VOC Emissions Data for the following materials. This information should be available on Material Safety Data Sheets (MSDS) or other product manufacturer’s literature. Provide the product manufacturer’s most current VOC emissions data:
      a. Joint Adhesive
      b. Sealant

1.3 REGULATORY REQUIREMENTS

A. Accessibility Requirements: Comply with the requirements for the accessibility of the physically disabled of the appropriate jurisdiction and ADA Accessibility guidelines for Buildings and Facilities.

B. Surface Burning Requirements: The panels to have the following surface burning characteristics and smoke generation values per U.L. Classification and labeling in accordance with ASTM E-84 tests and shall be self-extinguishing.
   1. Flame spread: 25 for 3/4" thick panels; 30 for 1/2" thick panels.
   2. Smoke developed: 70 for 3/4" thick panels; 85 for 1/2" thick panels.

1.4 WARRANTY

A. Worktops to be guaranteed against warpage or delaminating for 10 years. The factory authorized fabricator, product installer and material manufacturer must sign the Warranty documents and submit a copy to the Contractor. The project name must be written on the warranty.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. These specifications are based on raw material panels manufactured by Trespa North America, Ltd., or equal.
B. All products specified in this section shall be provided by a single manufacturer.

2.2 MATERIALS

A. Basis of countertop design: Phenolic Virtuon SS (Single Sided).
   1. Core: Black phenolic impregnated kraft papers. To ensure panel quality and consistency, panel must be at least 93 lbs./cubic foot to ensure full saturation of kraft core.
   2. Face sheet: Liquid paint of color selected by Architect, adhered to phenolic core by an Electron-Beam-Cured process to harden surface and provide UltraViolet stability.

B. Thickness: 1/2”.

C. Color: To be selected by Architect from Manufacturer’s Uni-Color standard color pallet.

D. Texture: Satin.

E. Adhesives and Sealants (LEED Credit EQc4.1): Only use adhesives and sealants in the interior of the building that meet or do not exceed the VOC limits of the CURRENT requirements of South Coast Air Quality Management District (SCAQMD) Rule No. 1168 on the interior of the building.
   1. Current requirements refers to the date on which the materials are installed in the building.
   2. Rule No. 1168: Refer to http://www.aqmd.gov/rules for the actual current version of the rule that will be applicable at the date of installation during construction.
   3. Interior refers to all building construction that is inside of the exterior weatherproofing material.

2.3 FABRICATION

A. All exposed edges shall be sanded to a smooth finish and, except as indicated below, shall be rounded to a 1/8” radius at front top edge and at vertical corners.

B. Fix work surface panels with blind fastenings into the back or underside of the panel. Use No. 10, type A sheet metal screws sized to stop at least 1/8” short of the finished face. Pre-drill panel with an 11/64” diameter high speed drills bit aligned with 7/32” clearance holes in the supporting structure.

C. Form tight-fitting butt joints in the work surface using mechanical fasteners positioned to be concealed after installation.

D. Curbs shall be bonded to the top of the work surface to form a square joint. Joints between sections of curb shall be stepped or mitered as necessary to minimize the amount of black core exposed.

E. Cutouts for drop-in sinks shall be routed to form openings with 3/8” minimum depth supporting flanges and such that the rim of the sink when installed is at the same level as the work surface top. Epoxy sinks shall be set in beds of epoxy adhesive. Stainless steel and polypropylene sinks shall be set in beds of silicone sealant.
F. Cutouts for under-mounted sinks shall be routed and sanded to form smooth edged openings with the top edge radiused to approximately 1/8". The bottom edge of the sink opening shall be finished smooth with the edge broken to prevent sharpness. Corners of sink cutouts shall be radiused not less than ¾". Under-mounted sinks shall be supported by brackets blind-fixed to the underside of the work surface.

2.4 SOURCE QUALITY CONTROL

A. Panels shall be of material specifically designed for countertop work surfaces. Fabricated work surfaces shall comply with all current codes and regulations. Tops and shelves shall have uniform thickness (+0.03") and flatness (maximum difference of 0.03") for 10-foot span.

B. Panels to be U.L. registered and labeled for quality consistency.

C. Chemical Resistance: Evaluation of chemical resistance is based on SEFA’s (Scientific Equipment and Fixture Association) standard list of 49 chemicals / concentrations, their required methods of testing and their minimum acceptable results as a means of establishing a minimum acceptable level of performance for all exposed and semi-exposed surfaces.

D. Panels to have screw pullout strength minimums per following chart (lbs.):

<table>
<thead>
<tr>
<th>Screw depth:</th>
<th>#6</th>
<th>#8</th>
<th>#10</th>
<th>#12</th>
<th>1/4&quot;</th>
<th>5/16&quot;</th>
<th>3/8&quot;</th>
<th>7/16&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot; panels:</td>
<td>250</td>
<td>300</td>
<td>340</td>
<td>390</td>
<td>450</td>
<td>560</td>
<td>680</td>
<td>790</td>
</tr>
</tbody>
</table>

E. Uniform load to cause no more than 1/4" deflection at center of the span:

<table>
<thead>
<tr>
<th>Thickness:</th>
<th>12&quot; x 24&quot;</th>
<th>12&quot; x 36&quot;</th>
<th>12&quot; x 48&quot;</th>
<th>24&quot; x 36&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot; panels:</td>
<td>370</td>
<td>110</td>
<td>45</td>
<td>220</td>
</tr>
</tbody>
</table>

F. Performance requirements:

1. Modulus of elasticity: 1,500,000 psi minimum.
3. Compressive strength: 24,000 psi minimum.
4. Weight: 93 lbs. per cubic foot maximum.
5. Flame spread (ASTM E-84): Class 1A (25).
7. Will not support micro-organic growth.
8. Water absorption: 3% maximum.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install work tops as per shop drawings on frames or base cabinets provided per specification.

3.2 PROTECTION
A. After installation, the General Contractor shall protect the worktops from damage. The tops shall be kept free from paint, plaster, cement scratches, or any other destructive forces.

END OF SECTION
SECTION 06622
SOLID SURFACING

PART 1 GENERAL

1.1 SECTION INCLUDES
   A. Furnish and install solid surfacing work as indicated on the drawings and specified.

1.2 SUBMITTALS
   A. Shop Drawings: Indicate dimensions, thicknesses, required clearances, tolerances, materials, colors, finishes, fabrication details, field jointing, adjacent construction, methods of support, integration of components, and anchorages.
   B. Samples: Submit two samples representative of solid surfacing, illustrating color, texture, and finish.
   C. Manufacturer's Installation Instructions: Indicate preparation of opening required, with rough-in sizes. Provide templates for cast-in or placed frames or anchors; tolerances for item placement, and temporary bracing of components.
   D. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:
      1. LEED Credit EQc4.1: Provide adhesive and sealant VOC Emissions Data for the following materials. This information should be available on Material Safety Data Sheets (MSDS) or other product manufacturer’s literature. Provide the product manufacturer’s most current VOC emissions data:
         a. Joint Adhesive
         b. Sealant

PART 2 PRODUCTS

2.1 SOLID SURFACING
   A. Provide Avonite (or equal) solid surfacing in the colors and patterns selected by the Architect, and of the dimensions and profiles indicated on the drawings. Other manufacturers offering "Or Equal" products: Corian, Wilsonart, Nevamar, du Pont.
   B. Resin: Proprietary acrylic type, with integral coloring, and stain resistance to domestic chemicals and cleaners.
   C. Joint Adhesive: Provide the manufacturer's recommended adhesive for inconspicuous non-porous joints.
   D. Sealant: Provide the manufacturer's recommended silicone adhesive in colors closely matching the solid surfacing.
   E. Polishing Cream: Compatible polishing cream to achieve specified sheen.
   F. Core Framing: Softwood lumber, clear and free of knots.
G. Hardware: Provide brass inserts, screws, flat washers, wing nuts, and clips required to make the installation complete.

H. Adhesives and Sealants (LEED Credit EQc4.1): Only use adhesives and sealants in the interior of the building that meet or do not exceed the VOC limits of the CURRENT requirements of South Coast Air Quality Management District (SCAQMD) Rule No. 1168 on the interior of the building.

1. Current requirements refers to the date on which the materials are installed in the building.

2. Rule No. 1168: Refer to http://www.aqmd.gov/rules for the actual current version of the rule that will be applicable at the date of installation during construction.

3. Interior refers to all building construction that is inside of the exterior weatherproofing material.

PART 3  EXECUTION

3.1 INSTALLATION

A. Install components in accordance with the manufacturer's instructions. Align work plumb and level.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Trowel-applied waterproofing membrane under ceramic tile (WP-5).

B. Related work:
   1. Other Sections of Division 7 for other waterproofing membranes.
   2. Division 9 for tilework.

1.2 REFERENCES

A. ANSI A118.10, Load Bearing, Bonded, Waterproof Membranes for Thinset Ceramic Tile and Dimensional Stone Installation.

1.3 PERFORMANCE REQUIREMENTS

A. Provide waterproofing that prevents the passage of water thru waterproofed surfaces.

1.4 SUBMITTALS

A. Data: List of proposed materials and manufacturer data for each.

B. Samples: Submit the following.

C. 1. 12-inch samples of waterproofing membrane mounted on plywood.

D. Shop drawings: Submit large scale details of reinforcement, terminations, and drain and other penetrations through waterproofed surfaces.

E. Certification: Submit letter from the manufacturer to verify its acceptance of the applicator and acceptance of substrates as satisfactory to receive this work.

F. Warranty: Submit sample copies of warranty for waterproofing membrane to be provided under this Section, clearly defining terms, conditions, and time periods for the warranty.

1.5 QUALITY ASSURANCE

A. Applicator’s qualifications: Firm with a minimum of 3 consecutive years of experience in application of the waterproofing proposed for use on projects of similar size and scope.

B. Pre-installation meeting:
1. At least one week prior to the start of installation, arrange a pre-installation meeting between the Contractor, City Engineer, waterproofing manufacturer’s representative, and the waterproofing installer to review system application and coordination with other trades.

2. If more than one trade will be responsible for the work of this Section, these trades shall attend the meeting.

3. Review the Drawings, Specifications, waterproofing manufacturer's installation instructions, surfaces and substrates to be waterproofed, and the conditions under which the waterproofing will be installed.

4. Review the procedures to be followed to provide proper protection of the waterproofing during and after application.

5. Record minutes of the meeting, decisions made, and corrective measures to be taken before application starts. Send copy of the minutes to the City Engineer no later than 3 days following the meeting.

1.6 JOB CONDITIONS

A. Apply waterproofing materials when the temperature in the space to be waterproofed and the substrate to be waterproofed are above 40-degree F.

B. Do not apply waterproofing materials to damp, wet or frost covered surfaces.

C. Illuminate work areas during installation to provide the same or greater level of illumination required to properly perform this work, and as will occur in the room or space after the building is in operation.

1.7 WARRANTY

A. Warrant waterproofing against faulty materials and workmanship for 10 years after Substantial Completion.

B. Make repairs, including removal and re-installation of tile, required during the warranty period at no cost to the City.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Waterproofing membrane:

   1. Merkote (Hydro-Guard 2000), Mapei (PRP 315), Laticrete (9235), or equal, are also acceptable, if approved by the City Engineer, and if the entire tile installation system, including the waterproofing membrane, is made of products manufactured by a single manufacturer, and that the warranty specified is provided.

B. Reinforcement: TEC Waterproofing Mesh (Part C).

C. Other materials: Compatible with the membrane and as recommended by the membrane manufacturer.
PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine surfaces to be waterproofed.
B. Correct conditions detrimental to the proper and timely completion of this work before proceeding with installation.

3.2 PREPARATION
A. Check that areas to be waterproofed slope to drain, are clean and dry.
B. Fill voids and cracks with materials compatible with membrane components. Remove ridges and fins, leaving a smooth, clean surface.
C. Check that pipes, conduits and other penetrations of waterproofing membrane have been installed before beginning this work.

3.3 INSTALLATION
A. Application: Install materials over substrates where appropriate, in compliance with the membrane manufacturer instructions.
B. Membrane application: Apply a continuous membrane at least 45 mils over the entire surface.
   1. Using the flat side of a 3/16-inch V-notch trowel, "key in" a thin coat of membrane to fill all surface voids.
   2. Immediately afterwards, apply additional material using the notched side of the trowel held at approximately a 45-degree angle to the substrate.
   3. Again using the flat side of the trowel, flatten the ridges to form a smooth, continuous layer approximately 45 to 50 mils DFT (1/18 to 1/20 inch). Make sure there are no voids, bubbles or breaks in the membrane after curing; if any should appear, apply a second coat to fill the imperfections.
   4. Periodically check membrane with a wet-film gage to verify film thickness.
C. Mesh application (flashing):
   1. Construction details:
      a. Flashing with TEC Waterproofing Mesh (Part C) at substrate joints - inside corners, outside corners, anywhere vertical surfaces meet horizontal surfaces such as curbs, bench seats, columns, etc., and where dissimilar materials meet.
      b. Pre-coat the substrate intersections 4 inches on each side with Triple Flex membrane compound. Then fully embed Part C mesh 3 inches in both directions into the pre-coated areas, and trowel-on additional Triple Flex membrane to completely cover and saturate the mesh. The minimum thickness of the flashing shall be 3/32 inch. Allow the flashing to dry before full application of waterproof membrane.
c. Where 2 pieces of mesh meet, overlap the mesh 3 inches at the ends.

2. Drain details:
   a. Extend Triple Flex membrane to the bottom drain flange, with sufficient coverage to channel water flow to and down the drain. Do not cover weep holes with membrane.
   b. Install a continuous 45-mil thick membrane to cover the substrate and up to the drain opening, making sure to embed TEC Waterproofing Mesh (Part C) around the drain opening. The flange shall clamp down on the membrane, with the weep holes unobstructed.

3. Joint details:
   a. Interior control joints: Verify that joint is clean and free from debris. Next, fill the joint with Triple Flex membrane compound and spread 4 inches on either side, embedding the waterproofing mesh over the joint. Install the membrane over the entire surface, ensuring a continuous 45 to 50-mil film as specified in “Membrane Application” above. Place bond breaker tape over the joint and install tile without bridging the joint. After tile is set, fill joint with sealant.
   b. Exterior expansion joints: Verify that the joint is absolutely clean and free from debris. Install backer rod into the joint. Next, compress the specified sealant into the joint according to manufacturer's directions, leaving it flush with the surrounding surface. After the sealant has cured, cover the joint with bond breaker tape. Apply Triple Flex membrane, making sure to embed the flashing mat centered over the joint, with a 3-inch overlap on either side. Place bond breaker tape over the joint and install without bridging the joint. After tile is set, fill joint with sealant.

3.4 FIELD QUALITY CONTROL

A. Request the manufacturer's presence as required to review installation procedures and completed work, and to issue warranty specified.

B. Unsatisfactory conditions disclosed by the manufacturer visits to the site shall be promptly and satisfactorily repaired and the areas re-inspected by the manufacturer before work starts or resumes in affected areas.

C. After completing installation of waterproofing, and just prior to installation of tile, plug drains and other outlets, dam areas that cannot be otherwise partitioned, and test entire membrane area in compliance with ASTM D 5957.

D. Repair leaks and retest the membrane until proven watertight.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION: Division 1 applies to this Section. Provide shower pan waterproofing, complete, as indicated, specified, and required.

A. Related Work Not In This Section: Ceramic tile and mortar setting beds.

1.02 QUALITY ASSURANCE:

A. Waterproofing Applicator: Authorized and approved by the waterproofing material manufacturer.

B. Materials shall comply with current State of California and local Air Quality Management District requirements for volatile organic compounds.

C. Materials shall comply with current State of California and local Air Quality Management District requirements for volatile organic compounds, (not over 350 grams per liter).

1.03 SUBMITTALS:

A. Certificates: Submit a certificate stating waterproofing applicator is approved by the waterproofing material manufacturer and, upon completion, shall submit a certificate stating that waterproofing systems have been installed in conformance with approved submittals and manufacturer's recommendations.

B. Product Data: Submit manufacturer's product data including installation instructions.

C. Drawings: Submit details, prepared by manufacturer of composite sheet waterproofing, specially prepared for each condition of the work. Show all adjoining work, and indicate methods of adhesion and attachment, laps, and related conditions.

D. Samples: Submit samples, not less than 12” square of shower pan waterproofing material. Sample shall be made on plywood.

E. Provide special product data emissions data submittals conforming to Section 01351, for the following materials:

1. Interior adhesives and sealants regulated by South Coast Air Quality Management District (SCAQMD) Rule No. 1168.

2. Interior refers to all building construction that is inside of an exterior weatherproofing material.

1.03 PRODUCT DELIVERY AND HANDLING: Deliver material to the site in original unbroken packages bearing manufacturer's label showing brand, type, and weight. Store materials at site under cover and maintain in dry condition.

PART 2 - PRODUCTS

2.01 MATERIALS:
A. Membrane: Composeal Blue, conforming to ASTM D4551, Grade 40, IAMPO approved, manufactured by Compotite Corporation, P.O. Box 26188, Los Angeles, Ca. 90026 (800) 221-1056 FAX (800) 334-3940, or Chloraloy 240 manufactured by The Noble Company, 614 Monroe Street, Grand Haven, MI 49217 (800) 678-6625 FAX (616) 842-1547. Material shall be as follows:

<table>
<thead>
<tr>
<th>Property, Units</th>
<th>Test Method</th>
<th>Minimum Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thickness, inches</td>
<td></td>
<td>0.040</td>
</tr>
<tr>
<td>Tensile strength, psi</td>
<td>ASTM D412</td>
<td>1,500</td>
</tr>
<tr>
<td>Ultimate elongation, percent</td>
<td>ASTM D412</td>
<td>300</td>
</tr>
<tr>
<td>Tear resistance, pounds/in. width</td>
<td>ASTM D1004</td>
<td>175</td>
</tr>
<tr>
<td>Shrinkage, percent</td>
<td>ASTM D1204</td>
<td>5, maximum</td>
</tr>
</tbody>
</table>

B. Cement: "Composeal Cement" for Composeal membranes, and IPS Weld-On No. 66 for Chloraloy 240. Use only interior adhesives and sealants that meet or do not exceed the VOC limits of the current requirements of South Coast Air Quality Management District (SCAQMD) Rule No. 1168 on the interior of the building.

1. Current requirements refers to the date when the materials are installed in the building.

2. Interior refers to all building construction that is inside of an exterior weatherproofing material.

C. Protectors: Preformed inside and outside curb protectors, furnished by sheet manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION: Verify that subsurfaces to receive shower pan membranes are sloped to drain at 1/4" per foot. Remove all loose objects, drive all projecting nails home, and remove dirt, dust, grease oil, plaster and other foreign materials.

3.02 INSTALLATION: Install membrane system according to manufacturer's directions as approved. Use sheets of sufficient width that seams are not required along the length of the material.

A. Extend sheets up walls not less than 3" above the top of the curb.

B. Solid blocking is specified in Section xxxx. Coordinate installation of blocking, and do not install membrane until blocking is satisfactorily installed. Install membrane flush with the face of the studs. Fasten to studs with flat head roofing nails.

C. Apply furring strips, approximately 1/4" thick above top of sheet to allow membrane to be flush with surface of framing. Attach sheets to steel studs with Type S drywall screws and washers.
D. Provide preformed protector corners for all exterior and at all curb locations. Fold sheet into corners and turn folds out of way between studs. Use furring strips or notched studs as required to provide flush surface. Do not cut pan corners.

E. Extend sheet into clamping ring of floor drains. Pierce sheet and force over bolt holes. Do not cut sheet. Set silicone sealant between pan and subdrain and bolt clamping ring firmly.

3.03 TESTS OF MEMBRANES: All horizontal membranes shall be subjected to standing water test after completion, but before protection board is applied. Tests shall be conducted as soon as possible after completion of membrane in each area. When membrane installation is completed, seal drain, sandbag perimeter fill membrane with water to height of not less than 2", pond test for not less than 24 hours, repair all leaks or defects disclosed, and retest until results are satisfactory and approved. Remove all sandbags, plugs and drain when testing is completed. Clean surfaces of membrane.

3.04 COMPLETION: Protect membrane systems from injury during application and until finished installation is approved.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Hot fluid-applied membrane waterproofing system.
2. Protection sheet.
3. Root barrier.
4. Protection board.
5. Drainage board.
7. Accessories such as primers, adhesives and sealants required for a complete and watertight system.
8. Supervising the work of other sections to obtain acceptable substrate surfaces complying with the waterproofing membrane manufacturer's instructions.

B. Related work: Other Sections of Division 7 for all other waterproofing, flashings and joint sealants.

1.2 DEFINITIONS

A. Adhesion: Adhesion is defined as tenacious gripping of membrane to substrate such that, upon attempt of its removal, the membrane fails cohesively and cannot be cleanly extracted from the substrate.

B. Cohesion: Cohesion is defined as the ability of the elements of the membrane to stick or hold together in a mass that resists separation from each other.

1.3 SYSTEM DESCRIPTION

A. Horizontal waterproofing system. Provide the following, from the substrate out:

1. Surface conditioner.
2. Waterproofing membrane applied to concrete slab.
3. Protection sheet.
4. Topping slab or asphaltic concrete paving.

B. Waterproofing system at planters: Provide the following, from the substrate out:

1. Surface conditioner.
2. Waterproofing membrane applied to cast-in-place concrete planters
3. Root barrier.

5. Soil.

C. Intensive garden roof assembly: Provide the following, from the substrate out:
   1. Surface conditioner.
   2. Waterproofing membrane applied to concrete slab.
   3. Root barrier.
   4. Protection board.
   5. Drainage/water retention element.
   7. Soil.

D. Performance requirements: Provide waterproofing membrane that prevents the passage of water through waterproofed surfaces.

1.4 SUBMITTALS

A. Data:
   1. Submit a list of proposed products, materials and components to be provided for a complete installation, along with their manufacturer’s product data, specifications, typical installation details and other data as necessary to demonstrate compliance with the specified requirements for each item listed.
   2. Submit sample copies of warranty to be furnished under this Section with terms, conditions, and time periods for the warranty clearly defined.

B. Shop drawings: Submit details of waterproofing terminations and protection of waterproofing membrane edges, including locations such as building joints, curbs, edges, openings, tie-ins to other waterproofing systems and other project-specific conditions. Show all flashings, sealants and other accessories and components required for a weather tight installation.

C. Samples: Submit stepped sample of proposed waterproofing membrane system mounted on 12-inch square hardboard backing with each component, including primer, separately identified.

D. Certificates: Prior to the start of the work submit a letter of acceptance from the waterproofing membrane manufacturer, the waterproofing installer and the City’s waterproofing consultant verifying their acceptance of the substrates as satisfactory to receive the work.

E. Manufacturer’s Instructions: Submit manufacturer-prepared instructions concerning the proper surface preparation and waterproofing membrane installation.

F. Manufacturer’s field reports: Provide waterproofing membrane manufacturer’s written acceptance of the installed waterproofing system stating that the Work observed has been done in accordance with the Specifications and with the membrane manufacturer’s requirements.

G. Qualification statements: Submit a letter, prepared by the waterproofing membrane manufacturer, stating the installer is certified by the membrane manufacturer.

1.5 QUALITY ASSURANCE
A. Uniformity: Obtain each component and accessory of the waterproofing membrane system used for the Project from one manufacturer.

B. Manufacturer’s qualifications: Obtain materials only from a manufacturer who will send a qualified technical representative to the Project site before start of this work to verify substrate acceptability.

C. Installer’s qualifications: Firm and individuals with a minimum of 5 consecutive years experience in the installation of specified systems on projects similar in material, design, complexity and extent to this Project, and whose work has resulted in applications with a record of successful in-service performance.
   1. Only a firm authorized, certified, licensed, or otherwise qualified by the waterproofing membrane manufacturer with the necessary experience, staff, and training to install manufacturer’s products shall install specified waterproofing membrane.
   2. Only those installer’s personnel trained and authorized by the waterproofing membrane manufacturer in the procedures pertaining to the proper installation of the specified waterproofing membrane and accessories shall complete the Work of this section.

D. Inspection Service:
   1. City may engage, at its expense, a qualified Inspection Service to:
      a. Review required submittals.
      b. Observe waterproofing systems installation
      c. Perform testing as required to verify material quantities and compliance with the Specifications and the material manufacturer’s requirements.
   2. Written reports documenting waterproofing systems installation will be issued on a daily basis, or as otherwise directed by the City Engineer.
   3. Inspection Service written reports will document the following, as a minimum:
      a. Climatic conditions
      b. Crew size.
      c. Deviations noted and corrective measures required and taken based upon the Specifications and the material manufacturer’s requirements.
   4. Deviations from the Specifications and manufacturer’s requirements will be brought to the attention of the waterproofing applicator / installer so that the appropriate corrective action can be implemented.
   5. Notify Inspection Service a minimum of 48 hours prior to starting or resuming waterproofing work.

E. Pre-installation meeting:
   1. At least one week prior to the start of waterproofing membrane installation, arrange a pre-installation meeting between the Contractor, City Engineer, waterproofing membrane manufacturer’s representatives and the waterproofing installer and the City’s waterproofing consultant to review system application and coordination with other trades.
   2. If more than one trade will be responsible for the work of this Section, these trades shall attend the meeting.
   3. Review the Drawings, Specifications, waterproofing membrane manufacturer’s installation instructions, the surfaces and substrates to receive waterproofing membrane and the conditions under which the waterproofing membrane will be installed.
4. Review the procedures to be followed to provide proper protection of the waterproofing membrane during and after application.

5. Record minutes of the meeting, decisions made, and corrective measures to be taken before application starts. Send copy of the minutes to the City Engineer no later than 3 days following the meeting.

1.6 PROJECT CONDITIONS

A. Environmental requirements:
   1. Do not install waterproofing membrane under adverse weather conditions, or when temperature, humidity or other environmental requirements are beyond manufacturer’s recommended limits.
   2. Proceed with the installation only when forecasted weather conditions are favorable and within ranges acceptable to the waterproofing membrane manufacturer.
   3. Install only as much waterproofing as can be made weather tight each day, including all flashing and detail work.
   4. Install uninterrupted water stops at the end of each day’s work, and completely remove them before proceeding with the next day’s work.

1.7 HANDLING

A. Delivery: Deliver materials to project site in original unopened protective wrappings, clearly labeled with manufacturer’s labels intact and legible indicating manufacturer’s name, brand, type, source of product, date of manufacture, and UL classification on package.

B. Storage:
   1. Store materials in compliance with manufacturer’s instructions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.
   2. Remove damaged materials from the job site and replace at no cost to the City.
   3. Containers should be tightly closed and stored away from direct sunlight, combustible materials and sources of heat.

C. Handling:
   1. Handle products to avoid damage and prevent contamination.
   2. Inventory should be rotated. Do not use products whose shelf life has expired.

1.8 SCHEDULING

A. Do not proceed with waterproofing until all curbs, drains, piping, conduits and other items that will be incorporated into the waterproofing systems are installed.

B. Allow concrete to cure for a minimum of 28 days prior to the application of the waterproofing systems.

1.9 WARRANTY

A. Manufacturer’s warranty: Warrant total system against defective materials and workmanship for 15 years after Substantial completion.
B. Replace or repair membrane defects during the warranty period at no cost to the City. Defects include the following:
   1. Loss of waterproofing integrity, including intrusion of water, oils, gasoline, grease, salt, chemicals or acids to substrate.
   2. Adhesive and/or cohesive failure.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
   A. Basis of design is "Monolithic Membrane 6125" fabric-reinforced 250-mil, rubberized asphalt membrane by American Hydrotech, Inc. Other acceptable manufacturers include the following:
      1. Soprema, Inc.
      2. Tremco, Inc.
      3. Or equal.

2.2 MATERIALS
   A. Surface conditioner/primer: Waterproofing membrane manufacturer’s recommended surface conditioner for concrete surfaces complying with ASTM D 41.
   B. Membrane: Hot fluid-applied rubberized asphalt membrane meeting CAN/CGSB-37.50-M89.
   C. Reinforcement: “Flex-Flash F” 1.35 ounce per square yard spunbonded polyester fabric.
   D. Flexible flashings: "Flex-Flash UN" 60-mil thick uncured neoprene flashing/heavy duty reinforcing sheet.

2.3 PROTECTION COURSE
   B. Protection sheet: "Hydroflex 30" 85-mil heavy-duty, rubberized asphalt protection sheet with synthetic fiber reinforcement.
   C. Protection board: 1/4-inch thick, pre-fabricated board with mineral filled, high melt point asphalt core between non-woven glass fiber mats by one of the following:
      1. “786 Protection Course” by Henry Co.
      2. “Protection Course” by WR Meadows.
      3. Or equal.
   D. Drainage board: “Hydrodrain 300” 3-dimensional, crush-proof composite drainage mat.

2.4 GARDEN ROOF ASSEMBLY COMPONENTS
   A. Drainage/water retention element: “FD40” three-dimensional molded panels.

C. Soil: As specified in Division 2.

2.5 ACCESSORIES

A. Adhesives: Waterproofing membrane manufacturer's recommended contact adhesive to bond elastomeric flashing together and to bond elastomeric flashing to an approved substrate.

B. Sealant: Waterproofing membrane manufacturer's recommended sealant to seal flashing seam edge

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions and affecting the work of this Section at site.

B. Verify surfaces to receive waterproofing are clean, dry, free from projections, depressions, loose or dusting materials, oil, grease, waxy films, curing compounds, release agents and other deleterious materials that would negatively affect the quality of installation, adhesion, durability and material and system performance.

C. Verify work performed by other trades complies with the membrane manufacturer's tolerance recommendations for substrates to receive waterproofing.

D. Verify that pipes, conduits and other penetrations of waterproofing membrane have been installed before beginning this work.

E. Correct conditions detrimental to the proper and timely completion of this work before proceeding with installation.

3.2 PREPARATION

A. Request waterproofing membrane manufacturer's presence before start of this work to verify substrate acceptability, and as required thereafter to review installation procedures and completed work, and to issue warranty specified.

B. Promptly repair unsatisfactory conditions disclosed by manufacturer site visits, to the satisfaction of the manufacturer and City Engineer, and have the areas re-inspected by the manufacturer before work starts or resumes in affected areas.

C. Do not begin application if precipitation is imminent or until surfaces to receive waterproofing membrane and membrane are clean, dry and within manufacturer's acceptable temperature range limits.

D. Protection: Protect adjacent surfaces not receive waterproofing.
   1. Use drop cloths, masking or other appropriate form of protection, as required.
   2. Close off drains and other penetrations to prevent spillage and migration of liquid coatings.

E. Surface preparation:
1. General:
   a. Surfaces to receive waterproofing membrane shall be dry. Should surface moisture occur, provide the necessary equipment to dry surface prior to application.
   b. Clean, repair, and prepare surfaces to receive waterproofing membrane in accordance with the manufacturer's installation instructions.
   c. Upon completion of surface preparation, each substrate surface to receive waterproofing shall be separately inspected and accepted in writing by the waterproofing membrane manufacturer and the waterproofing installer and the City’s waterproofing consultant prior to beginning installation, including priming, of the waterproofing membrane.

2. Concrete:
   a. Test concrete surfaces for moisture content.
      1) Perform patch test with hot membrane applied directly to primed, dry concrete surface.
      2) Discontinue application if foaming, severe pin-holing or less than full adhesion occurs.
      3) Contact waterproofing membrane manufacturer for direction on how to proceed if less than full adhesion occurs and any conditions develop that may inhibit waterproofing system performance.
   b. Protrusions and depressions:
      1) Grind fins and projections smooth and flush with adjacent surfaces.
      2) Patch rock pockets and depressions greater than 1/4-inch wide or 1/8-inch deep with non-bituminous material acceptable to the waterproofing membrane manufacturer.
   c. Cracks over 1/16-inch but less than 1/4-inch wide and cold joints:
      1) Apply membrane at 125-mil thickness a minimum distance of 2 inches on each side of crack or control joint area.
      2) Center 6-inch wide reinforcement strip over crack and embed firmly into the warm membrane.
      3) Apply second 125-mil membrane coat over reinforcing sheet, totally encapsulating within membrane.
      4) Proceed with membrane installation.

3.3 INSTALLATION

A. Comply with manufacturers instructions for installation, using manufacturer-recommended accessories.

B. Surface conditioner/primer: Apply surface conditioner to the concrete evenly at a rate recommended by the waterproofing membrane manufacturer depending on surface texture.
   1. Surface conditioner should "tan" the surface, not blacken it.
   2. Allow sufficient time for the surface conditioner to thoroughly dry prior to the membrane application.
C. Flashings: Install flashings in compliance with the manufacturer's standard guideline details and the approved shop drawings.
   1. Penetrations flashed directly with membrane and reinforcement shall be firmly secured and either cast into, or grouted to, structural substrate to prevent lateral and vertical movement.
   2. Reinforce penetrations using flexible flashing or reinforcement as recommended by the membrane manufacturer, depending on location and exposure, and applied and detailed in compliance with approved submittals.
   3. Directly seal flashing to penetrations; do not terminate flashing to an intermediate element which itself could fail and admit moisture beneath membrane.
   4. Complete flashings before installing waterproofing membrane over substrate field.

D. Drains and Overflows:
   1. Apply membrane at 125-mil thickness a minimum distance of 18 inches all around drain.
   2. Center sheet of flexible flashing over drain bowl and embed firmly into the warm membrane. Flexible flashing shall extend onto the deck a minimum of 12" in all directions.
   3. Apply second 125-mil membrane coat over flexible flashing, totally encapsulating within membrane.
   4. Proceed with membrane installation.

E. Membrane:
   1. Apply membrane at a rate to provide a continuous, monolithic coat in compliance with the manufacturer's instructions to the thickness specified.
   2. Embed root barrier or protection sheet firmly into the warm membrane. Overlap adjoining sheet edges a minimum of 4 inches to ensure complete coverage.

F. Protection:
   1. After inspections and tests are completed, cover the membrane with a layer of protection board embedded in the membrane.
   2. Rigid board materials are not to be overlapped.

G. Garden roof components: Install garden roof components in compliance with the waterproofing membrane manufacturer's recommendations for intensive garden roof system.

H. The completed membrane/protection assembly must be covered with subsequent topping materials as soon as possible, within 30 days of membrane installation.

3.4 FIELD QUALITY CONTROL
A. Site tests and inspection: The work of this section is Subject to review by the City Engineer and membrane manufacturer and the City's waterproofing consultant.
   1. Examine installations for defective materials and workmanship.
   2. Inspect surfaces coated to ensure that areas have not been missed.
   3. Repair missed areas and holidays in the membrane.

B. Adhesion testing: Perform adhesion tests twice daily, but in no case less than once for each 10,000 square feet of applied membrane.
C. Water test:
   1. After completing installation of waterproofing membrane, plug drains and other outlets, dam areas that cannot be otherwise partitioned, and test membrane in compliance with ASTM D 5957.
   2. Repair leaks and retest the membrane until proven watertight at no additional cost to the City.

D. Manufacturer’s inspection: Notify the manufacturer of job completion, by means of manufacturer’s Notification of Completion form, in order to schedule a final inspection date.
   1. Hold a meeting at the completion of the Project, attended by all parties that were present at the pre-job conference.
   2. Note defects, track items required for completion, list items identified as being in non-compliance with Contract Documents, and itemize membrane manufacturer’s recommendations into a punch list. These items must be immediately corrected to the satisfaction of the City Engineer and membrane manufacturer prior to demobilization.
   3. Complete, sign, and mail the punch list form to the waterproofing membrane manufacturer for issuance of specified warranty.

3.5 PROTECTION

A. Protect finished waterproofing membrane surfaces that might be subjected to damage by construction activities or materials, until the building is turned over to the City.

B. Restore damaged areas to match adjacent areas as recommended by the waterproofing membrane manufacturer and approved by the City Engineer.

C. Remove and replace materials that are damaged or cannot be satisfactorily repaired, as determined and directed by the City Engineer, at no cost to the City.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Cold fluid-applied traffic coating.
   2. Supervising the work of other Sections to obtain acceptable substrate surfaces complying with the traffic coating manufacturer's instructions.
   3. Supervision of sheet metal installation for flashings to be embedded in/or installed at the perimeter of traffic coating.

B. Related work:
   1. Division 3 for concrete.
   2. Division 7 for flashings and sheet metal.
   3. Division 7 for joint sealants.

1.2 DEFINITIONS

A. Adhesion: Adhesion is defined as tenacious gripping of traffic coating to substrate such that, upon attempt of its removal, the traffic coating fails cohesively and cannot be cleanly extracted from the substrate.

B. Cohesion: Cohesion is defined as the ability of the elements of the traffic coating to stick or hold together in a mass that resists separation from each other.

1.3 SYSTEM DESCRIPTION

A. Fluid-applied, seamless, waterproof, elastomeric composition traffic-bearing deck surfacing system composed of a waterproof membrane, traffic surfacing and finish coat(s).

1.4 SUBMITTALS

A. Data:
   1. Submit a list of proposed products, materials and components to be provided for a complete installation, along with their manufacturer’s product data, specifications, typical installation details and other data as necessary to demonstrate compliance with the specified requirements for each item listed.
   2. Submit sample copies of warranty to be furnished under this Section with terms, conditions, and time periods for the warranty clearly defined.

B. Samples:
   1. Submit color samples from manufacturer’s standard color palette for color selection by the City Engineer.
2. Submit stepped sample of proposed traffic coating system, in selected color and finish, mounted on 12-inch square hardboard backing with each component, including primer, separately identified.

C. Certificates: Prior to the start of the work submit a letter of acceptance from the traffic coating manufacturer and the traffic coating installer verifying their acceptance of the substrates as satisfactory to receive the work.

D. Manufacturer’s Instructions: Submit manufacturer-prepared instructions concerning the proper surface preparation and traffic coating installation.

E. Manufacturer’s field reports: Provide traffic coating manufacturer’s written acceptance of the installed traffic coating system stating that the Work observed has been done in accordance with the Specifications and with the traffic coating manufacturer’s requirements.

F. Qualification statements: Submit a letter, prepared by the traffic coating manufacturer, stating the installer is certified by the traffic coating manufacturer.

G. Closeout:
   1. Submit the traffic coating manufacturer’s recommendations for periodic inspections of the traffic coating, and a copy of troubleshooting and maintenance recommendations.
   2. Identify common causes of damage with instructions for temporary patching until permanent patching can be made.
   3. Submit the traffic coating manufacturer’s recommendations for cleaning and resurfacing materials, including precautions against materials and methods that may be detrimental to the quality of application, durability and material performance.

1.5 QUALITY ASSURANCE

A. Uniformity: Obtain each grade, type, composition, and variety of traffic coating used for the Project from the same manufacturer.

B. Manufacturer’s qualifications: Obtain materials only from a manufacturer who will send a qualified technical representative to the Project site before start of this work to verify substrate acceptability.

C. Applicator’s qualifications: Firm and individuals with a minimum of 5 consecutive years experience in the installation of specified systems on projects similar in material, design, complexity and extent to this Project, and whose work has resulted in applications with a record of successful in-service performance.
   1. Only a firm authorized, certified, licensed, or otherwise qualified by the traffic coating manufacturer with the necessary experience, staff, and training to install manufacturer’s products shall install specified traffic coatings.
   2. Only those installer’s personnel trained and authorized by the traffic coating manufacturer in the procedures pertaining to the proper installation of the specified traffic coating and accessories shall complete the Work of this section.

D. Regulatory requirements: Coefficient of friction of coating finished surface shall be not less than 0.6 for level surfaces and 0.8 for ramps when tested in compliance with ASTM C 1028 (field test) or ASTM D 2047 (laboratory test).

E. Pre-installation meeting:
1. At least one week prior to the start of installation, arrange a pre-installation meeting between the Contractor, City Engineer, traffic coating manufacturer's representatives and the traffic coating installer to review system application and coordination with other trades.

2. If more than one trade will be responsible for the work of this Section, these trades shall attend the meeting.

3. Review the Drawings, Specifications, traffic coating manufacturer's installation instructions, the surfaces and substrates to receive traffic coating and the conditions under which the traffic coating will be installed.

4. Review the procedures to be followed to provide proper protection of the traffic coating during and after application.

5. Record minutes of the meeting, decisions made, and corrective measures to be taken before application starts. Send copy of the minutes to the City Engineer no later than 3 days following the meeting.

1.6 PROJECT CONDITIONS

A. Do not proceed with application of materials when temperature of the surfaces to receive coatings is less than 50-degree F and when ambient temperature is, or will be, below 40-degree F before coatings cure.

B. Do not start application unless surfaces to receive coatings are clean and dry, within acceptable temperature limits, or if precipitation is imminent (for exterior coatings).

1.7 HANDLING

A. Delivery: Deliver products to project site in original unopened containers clearly labeled with manufacturer's labels intact and legible indicating manufacturer's name, brand, type and expiration date.

B. Storage:
   1. Store materials in compliance with manufacturer's instructions to prevent deterioration from moisture, heat, cold, or other detrimental effects.
   2. Containers should be tightly closed and stored away from direct sunlight, combustible materials and sources of heat.

C. Handling:
   1. Handle products to avoid damage to container and to prevent contamination.
   2. Inventory should be rotated. Do not use products whose shelf life has expired.

1.8 WARRANTY

A. Manufacturer warranty: Warrant traffic coating against defective materials and workmanship for 5 years after installation.

B. Replace or repair defective coating during the warranty period at no cost to the City. Defective coating is defined as follows:
   1. Loss of waterproofing integrity, including intrusion of water, oils, gasoline, grease, salt, deicer chemicals or acids into deck substrate.
2. Adhesive and/or cohesive failure.
3. Discernable color changes from a control sample of the original application, beyond manufacturer's published information.
4. Hardening beyond the Shore A hardness represented by the manufacturer's data.
5. Cracking or brittleness, other than caused by substrate movement.
6. Abrasion or tearing failure resulting from normal traffic.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Pedestrian traffic coating: Basis of design is “Standard Peda-Gard” urethane-based traffic coating by the Neogard Corp. Other acceptable materials/manufacturers include the following.
   1. Tremco, Inc.
   2. Pacific Polymers.
   3. 3M.
   4. Or equal.
B. Vehicular traffic coating: Basis of design is “Auto-Gard F” urethane-based traffic coating by the Neogard Corp. Other acceptable manufacturers include the following.
   1. Tremco Inc.
   2. Pacific Polymers.
   3. 3M.
   4. Or equal.

2.2 MATERIALS
A. Primer: As recommended by the traffic coating manufacturer.
B. Backer rod: Closed cell urethane foam rod.
C. Sealant: Single- or 2-component moisture-cured polyurethane compatible with the elastomeric coating and acceptable to the coating manufacturer.
D. Sheet flashing:
   1. Flexible flashing: Minimum 60-mil uncured neoprene.
   2. Elastomeric liquid material: As recommended by the traffic coating manufacturer.
E. Color: To be selected by the City Engineer from the manufacturer’s standard palette.
F. Aggregates: Graded (20 to 40 mesh) hard aggregate having a minimum hardness of 6.5 or more on the Moh’s Scale or as recommended by the coating manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine substrates and conditions and affecting the work of this Section at site.

B. Verify surfaces to receive traffic coating are clean, dry, free from projections, depressions, loose or dusting materials, oil, grease, waxy films, curing compounds, release agents and other deleterious materials that would negatively affect the quality of installation, adhesion, durability and material and system performance.

C. Verify work performed by other trades complies with the traffic coating manufacturer's tolerance recommendations for substrates to receive traffic coating.

D. Correct conditions detrimental to the proper and timely completion of this work before proceeding with installation.

3.2 PREPARATION

A. Request traffic coating manufacturer's presence before start of this work to verify substrate acceptability, and as required thereafter to review installation procedures and completed work, and to issue warranty specified.

B. Promptly repair unsatisfactory conditions disclosed by manufacturer site visits, to the satisfaction of the manufacturer and City Engineer, and have the areas re-inspected by the manufacturer before work starts or resumes in affected areas.

C. Do not begin application if precipitation is imminent or until surfaces to receive traffic coating are clean, dry and within manufacturer's acceptable temperature range limits.

D. Protection: Protect adjacent surfaces not receive traffic coating.
   1. Use drop cloths, masking or other appropriate form of protection, as required.
   2. Close off drains and other penetrations to prevent spillage and migration of liquid coatings.

E. Surface preparation:
   1. Surfaces to receive traffic coating shall be dry. Should surface moisture occur, provide the necessary equipment to dry surface prior to application.
   2. Clean, repair, and prepare surfaces to receive traffic coating in accordance with the manufacturer's installation instructions.
   3. Upon completion of surface preparation, each substrate surface to receive a traffic coating shall be separately inspected and accepted by the traffic coating manufacturer and the traffic coating installer prior to beginning installation, including priming, of the traffic coating.
   5. Patch rock pockets and depressions greater than 1/4-inch wide or 1/8-inch deep with non-bituminous material acceptable to the traffic coating manufacturer.
   6. Cracks and cold joints:
      a. Clean and prime visible hairline cracks up to 1/16-inch in width and cold joints as necessary. Treat with liquid flashing a minimum distance of 2 inches on each side of crack to yield a total dry thickness of 30 mils.
      b. Rout-out large cracks over 1/16-inch wide and seal with traffic coating manufacturer’s recommended sealant.
1) Apply sealant to inside area of crack only and tool smooth and flush with adjacent surfaces.
2) Do not apply sealant to substrate surface.
3) Treat sealed cracks with liquid flashing a distance of 2 inches on each side of crack to yield a total dry thickness of 30 mils.

7. Control joints: Seal secondary control joints with sealant as specified above for large cracks.

F. Test concrete surfaces for moisture content. Verify concrete surfaces are sufficiently dry to receive traffic coating in compliance with the traffic coating manufacturer’s recommendations.

1. Conduct calcium chloride or other acceptable moisture test, one for every 1,000 square-foot of flooring, to verify that concrete surfaces are within limits acceptable to traffic coating manufacturer.
2. Where recommended limits are not provided by the traffic coating manufacturer, tests where extractable water exceeds 4 pounds per 1000 square feet per 24 hours require additional drying time or special preparation as recommended by the traffic coating manufacturer.
3. Allow sufficient time in the construction schedule to allow concrete surfaces to dry sufficiently, force dry concrete surfaces, or provide a compatible surface coating so water vapor emission will be at a level acceptable to the traffic coating manufacturer.

G. Clean surfaces in accordance with traffic coating manufacturer's installation instructions.

3.3 APPLICATION
A. General: Install traffic coating systems in compliance with their manufacturer’s installation instructions and the following.

B. Primer: Prime surfaces to be coated.

C. Basecoat: Apply basecoat within 24 hours of application of primer. If basecoat cannot be applied within 24-hours, re-prime.

D. Wearing coat: Apply wearing coat. Immediately broadcast aggregate, evenly distributed, into wet coating.

E. Double texture (at ramp): After first wearing coat has dried, remove loose aggregate and apply additional wearing coat and top coat.
   1. Immediately broadcast aggregate, evenly distributed, into wet coating.
   2. When dry, remove excess aggregate and recoat surface with elastomeric topcoat.

3.4 FLASHINGS
A. Install flashings concurrently with traffic coating as the work progresses.

3.5 FIELD QUALITY CONTROL
A. Site tests and inspection: The work of this section is Subject to review by the City Engineer and the traffic coating manufacturer.
   1. Examine installations for defective materials and workmanship.
2. Inspect surfaces coated to ensure that areas have not been missed.
3. Repair missed areas and holidays in the traffic coating.

B. Adhesion testing: Perform adhesion tests twice daily, but in no case less than once for each 10,000 square feet of applied traffic coating.

C. Manufacturer's inspection: Notify the manufacturer of job completion with the manufacturer's printed Notification of Completion form to schedule a final inspection date.
   1. Hold a meeting at the completion of the Project, attended by all parties present at the pre-job conference.
   2. Note defects, track items required for completion, list items identified as being in non-compliance with Contract Documents, and itemize traffic coating manufacturer's recommendations into a punch list. These items must be immediately corrected to the satisfaction of the City Engineer and traffic coating manufacturer prior to demobilization.
   3. Complete, sign, and mail the punch list form to the traffic coating manufacturer for issuance of specified warranty.

3.6 PROTECTION

A. Protect finished traffic coating surfaces that might be subjected to damage by construction activities or materials, until the building is turned over to the City.

B. Restore damaged areas to match adjacent areas as recommended by the traffic coating manufacturer and approved by the City Engineer.

C. Remove and replace damaged materials that cannot be satisfactorily repaired, as determined and directed by the City Engineer, at no cost to the City.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:

1. Composite sheet resealable membrane waterproofing systems impervious to water and gas and on below grade walls impervious to water (WP-2).
2. Sealants, waterstops and waterproofing flashings needed to ensure a complete waterproof system.

B. Related work:

1. Other Sections of Division 7 for other waterproofing membranes.

1.2 REFERENCE

A. “Tremco Waterproofing and Gas Membrane Quality Assurance and Installation Instructions”, which contain specific installation instructions and details.

B. Keep this document at the Project site and make it available to installers at all times.

1.3 PERFORMANCE REQUIREMENTS

A. Provide complete water/gasproofing membrane systems that prevent the passage of water and aliphatic gases thru the gas/waterproof surfaces.

1.4 SUBMITTALS

A. Letter of acceptance: Before proceeding with application, submit letter from the manufacturer to verify acceptance of the applicator, and substrates as satisfactory to receive this work.

B. Product data:

1. Materials list of items proposed to be provided under this Section.
2. Manufacturer’s specifications and other data needed to prove compliance with the specified requirements.
3. Manufacturer’s current recommended installation procedures which, when approved by the City Engineer, will become the basis for accepting or rejecting actual installation procedures used on the Work.
4. Written documentation of applicator qualifications, including reference projects of similar scope and complexity, with current phone contacts of City Engineer and City for verification.
5. Where work of this Section may potentially contact groundwater, include manufacturer's report confirming laboratory testing of membrane system with project groundwater samples and confirming suitability for installation in Project conditions.
C. Shop drawings: Shop drawings or catalog illustrations in sufficient detail to show installation and interface of the work of this Section with the work of adjacent trades, as well as treatment at lagging, anchors, cast-in-place walls, slabs-on-grade, and footings.

D. Warranty: Sample copies of manufacturer's warranties for assemblies to be furnished under this Section, clearly defining terms, conditions, and time periods for the warranty.

1.5 QUALITY ASSURANCE

A. General: Refer to the Tremco Waterproofing and Gas Membrane Quality Assurance and Installation Instructions.

B. Installer's qualifications:
   1. Firm approved by the system manufacturer which can show evidence that it has experience with bentonite systems similar to this Project for a minimum of 10 years.
   2. Firm shall staff the work of this Section with only qualified personnel experienced in the application of bentonite water/gasproofing systems.
   3. Installer for the membrane impervious to aliphatic gases must be certified by the membrane manufacturer for installation of membrane impervious to aliphatic gases with the membrane specified.

C. Manufacturer's qualifications:
   1. Manufacturer shall have available an in-house technical staff to assist the Contractor in application of products and final inspection of the assemblies specified herein.
   2. Manufacturer shall have successfully produced bentonite water/gasproofing materials and systems for 10 years minimum and have local representation in Southern California.

D. Inspection service:
   1. City may engage, at its expense, an inspection service to observe waterproofing system installation, perform testing as required to verify the material quantities, compliance to specifications and material manufacturer's published requirements. Written reports will be issued on a daily basis to the City Engineer, the Contractor, and waterproofing installer documenting waterproofing and gas membrane system installation.
   2. Inspection Service will document in reports daily work area, climatic conditions, crew size, deviations noted and corrective measures required and taken based upon the manufacturer's published requirements. Deviations from the Specifications and the manufacturer's published requirements will be brought to the attention of the Installer's foreman so that the appropriate corrective action can be implemented.
      a. Furnish the following to inspection service:
         1) Copies of approved submittals.
         2) Representative sample materials requested for testing.
         3) Complete cooperation and assistance for testing and inspection.
      b. Contractor shall give a minimum of 48 hours notification to inspection service.

E. Pre-installation conference:
   1. Prior to commencing the work of this Section, schedule a pre-installation conference at the site to discuss requirements of the Contract Documents, application, and installation procedures.
2. In attendance at this meeting shall be:
   a. City Engineer.
   b. Contractor.
   c. Concrete subcontractor.
   d. Waterproofing material manufacturer's representative.
   e. Water/gasproofing subcontractor.
   f. Water/gasproofing inspection Service.
   g. Sheet metal subcontractor, as applicable.
   h. Plumbing subcontractor, as applicable.

3. Arrange to meet after all penetrations are installed through surfaces to be waterproofed.

4. Attendees shall review pertinent Drawings and Specifications, noting potential problems and making changes, deletions, or additions deemed necessary, and determine availability of specified materials, and submittal requirements, scheduling, forecasted weather conditions, protection of building and materials, and additional items pertaining to Work of this Section.

5. Attendees shall review surfaces to receive water/gas proofing systems and determine their suitability to receive the specified materials.

6. Discussion shall be recorded, including agreement or disagreement on matters of significance. If meeting ends with substantial disagreements, and subject to City Engineer's approval, determine how such disagreements will be resolved and set a date for a future meeting, if required.

F. Sample panel:
   1. Prior to installation, prepare a sample panel of this work at the job site in a location acceptable to the City Engineer.
   2. Make the mockup at least 12 feet square for each of the types of installation expected for the Project. Include, as a minimum, one taped seam, one nailed seam, one heat-welded seam and one sealed penetration.
   3. Make necessary adjustments in the sample panel(s) and secure the City Engineer's approval.
   4. The sample panel(s), when approved by the City Engineer, will be used as a standard for the remainder of this work.
   5. After City Engineer's review, the sample panel(s) may become part of the final Work.

G. Uniformity:
   1. Obtain primary water/gasproofing materials of each type required from a single manufacturer to greatest extent possible.
   2. Provide accessory materials approved by membrane manufacturer.

1.6 HANDLING

A. Maintenance: Keep the products in a dry condition until concrete is cast or walls are backfilled.

1.7 PROJECT/SITE CONDITIONS
A. Where work of this Section will contact groundwater, provide waterproofing manufacturer with sufficient groundwater samples taken from Project at logged locations for manufacturer’s laboratory analysis.

B. Manufacturer shall provide written report confirming laboratory testing with regard to suitability of waterproofing system for installation in Project conditions. Continuous inspection by a specially qualified inspector registered in accordance with the requirements specified in Section 91.170.17 of the Los Angeles Building Code for controlled activities shall be provided.

1.8 WARRANTY

A. Submit a joint and several warranty against water intrusion thru waterproofing, including defective materials and workmanship, for 5 years following Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL

A. Water/gasproofing membrane systems:
   1. Basis of design are variations of “Paraseal GM Membrane” by Tremco, Inc. (formerly Mameco International, Inc.) (LA RR 25425 for the gas membrane system and waterproofing membrane system). Equal systems may be accepted by the Architect/City Engineer, if current LA RR numbers are assigned for the same applications specified.
   2. The membrane system shall consist of 60-mil high-density polyethylene (HDPE) with a sodium-bentonite face designed for buried concrete or masonry construction, with a minimum of 5-inch lap seam edges.

2.2 ACCESSORIES

A. For installation at horizontal-to-vertical junctures: Tremco (formerly Mameco) "Paragranular Granular Bentonite" loose bentonite granules in weatherproof 50 lb. bags and capable of swelling to occupy a minimum volume of 17 ml when 2 g are dispersed into deionized water.

B. For detailing vertical junctures and penetrations: Tremco "Paramastic Expandable Mastic" non-hydrated expandable mastic of trowelable consistency containing not less that 55 percent high swelling Wyoming minerals.

C. Fasteners:
   1. Case-hardened steel nail with fluted shank having a minimum one-inch length and a minimum one-inch diameter cap for use on green concrete and masonry substrates.
   2. Powder-shot steel pin having a minimum 3/4-inch diameter washer for use on concrete substrates.
   3. Steel staples approved by membrane manufacturer for use according to Project conditions.

D. Lap protector tape: Removable tape installed beneath the bentonite layer along perimeter edges.

E. Seam tapes:
2. Permanent seam tape: Reinforced, rubberized-asphaltic waterproofing seam tape 4 inches wide by 60 mils thick for sealing membrane overlaps.


F. Termination bar: Tremco "Paraterm Termination Bar" extruded aluminum bar with upper flange to receive sealant.

G. Sealant: "Vulkem 116/227 Sealant" one or 2-part, gun-grade polyurethane sealant.

H. Flexible flashing and mastic: "Vulkem 201/222T Elastomeric Flashing" one- or 2-part, trowel-grade, polyurethane, liquid-applied, elastomeric waterproofing flashing.

I. Bentonite tape: "Parastick'N'Dry Double-sided Bentonite Tape" pressure sensitive.

J. Penetration boots: Membrane manufacturer's heat-weldable HDPE shapes, including clamps.

K. Waterstop: "Parastop" or "Superstop Expandable Waterstop" flexible, reinforced, bentonite-laminate waterstop strips 1/2-inch by 1-inch by 20 feet.

L. Primer: "Paraprimer Substrate Primer" adhesive/bonding agent.

M. Drainage mat: "Paradrain Drainage Course" composite drainage mats composed of rot resistant non-woven filter fabric on high-density polyethylene drainage core.

N. Base sheet: Minimum 6-mil polyethylene sheet for use as hydration barrier below slabs.

O. Protection course: As recommended by the waterproof system manufacturer and acceptable to the City Engineer.

P. Other materials: As selected by the Contractor and approved by the membrane system manufacturer as compatible, subject to the approval of the City Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION/PREPARATION

A. Examine the areas and conditions under which work of this Section will be performed.

B. Verify conformance with manufacturer's requirements. Including requirements stated in the "Tremco Waterproofing and Gas Membrane Quality Assurance and Installation Instructions".

C. Verify that substrates to be water/gas proofed are free of standing water, dirt and debris, loose material, voids and protrusions or deformations that may inhibit application or performance of waterproofing.

1. Where water/gas proofing will be installed directly on compacted earth, verify that subgrades are stable, smoothed and compacted to project geotechnical requirements (refer to project geotechnical report).

2. Where water/gas membrane will be installed over sand bed, verify that sand has been compacted and covered with polyethylene film.

3. Where waterproofing will be installed on earth retaining system, fill gaps and voids in earth retaining system to conform to waterproofing manufacturer's requirements remove nails in wood lagging.
4. Where waterproofing will be installed on concrete and/or masonry, provide substrates that are free of voids deeper than 3/8-inch and free of surface protrusions more than 1/4-inch above the surface.

5. Where waterproofing will be installed on concrete footings, provide wood float or better finish to surfaces scheduled to receive the membrane.

6. Where waterproofing will include bentonite waterstop strips, provide concrete surfaces as required for that installation.

D. Note termination and penetration conditions to determine methods for creating a waterproof envelope. Verify that where below-grade waterproofing extends to grade, other waterproofing systems provides for substrate continuing uninterrupted watertight systems above grade.

E. Correct conditions detrimental to the proper and timely completion of this work before proceeding with installation.

3.2 INSTALLATION

A. General: Install water/gasproofing systems in accordance with the “Tremco Waterproofing and Gas Membrane Quality Assurance and Installation Instructions”, additional manufacturer's instructions, recommendations and specific project instructions applicable to the Work.

1. Form 2-inch coves with granular bentonite at horizontal-to-vertical junctions such as at footings and horizontal shelves. Form 1-inch coves with sealant, elastomeric flashing or expandable mastic at vertical inside corners, under ledges and at penetrations.

2. Place membrane in manner that assures minimum handling fit closely to and seal around inlets, outlets and other penetrations. Press membrane tight to corner surfaces and securely fasten.

3. Prime concrete, masonry and metal surfaces with substrate primer immediately prior to application of tapes and pressure-sensitive waterproofing accessories.

4. Terminate membrane system with termination bar finished with bead of sealant or terminate to elastomeric flashing using reinforced waterproofing tape.

5. Protect static construction joints in concrete with flexible, reinforced, bentonite-laminate waterstop strips. Install to suitable hardened concrete surface prior to subsequent concrete placement.

6. All membrane seams shall be heat welded.

B. Backfilled wall installation:

1. Install membrane sheets in vertical or horizontal lifts with HDPE side facing applicator to prepared surfaces conforming to manufacturer's requirements.

   a. Vertical installation: Securely fasten membrane at 12 inches o.c. along top edge with sheet extending out onto footing surfaces 6 inches minimum, overlapping below-slab membrane 6 inches. Install subsequent membrane sheets to overlap previous sheets 1-1/2 inches minimum securely fasten membrane 24 inches o.c. through both sheets at overlaps. Securely fasten 18 inches o.c. to tops of footing surfaces and horizontal shelves. Apply seam tape to seam overlaps.
b. Horizontal installation: Start membrane at lowest portion of wall. Attach membrane securely at 24 inches o.c. along top edge with sheet extending out onto footing surfaces 6 inches minimum, overlapping under slab membrane 2 inches. Install subsequent membrane sheets to overlap previous sheets minimum 1-1/2 inches in shingle fashion with staggered end laps. Attach membrane securely at 24 inches o.c. through both sheets at overlaps securely fasten 18 inches o.c. to tops of footing surfaces and horizontal shelves apply seam tape to seam overlaps.

2. Waterproof penetrations in accordance with the waterproofing manufacturer's recommendations.

C. Blind side wall installation:

1. Ensure that surfaces to be waterproofed comply with manufacturer requirements as applicable to the earth retaining system employed prior to commencing installation contact manufacturer for requirements of project conditions not provided for in installation manuals.

2. Install waterproofing membrane starter-strip with bentonite side facing applicator to vertical surfaces of earth retaining system prior to placement of concrete footings or foundation mat slab.

3. Prepare vertical inside corners that occur along the earth retaining system by fastening a minimum 12 inches wide strip of membrane with bentonite-side facing applicator pressed tight into corner securely fasten along both edges 24 inches o.c.

4. Install membrane sheets vertically with bentonite-side facing applicator. Overlap sheets 5 inches minimum for poured-in-place walls. Securely fasten membrane through both sheets at overlap areas with nails every 24 inches o.c. and staples every 3 inches o.c.

5. Verify which penetrations must be accessed after concrete placement for completion of waterproofing detail treatment and ensure that sufficient access to membrane is provided within a formed box out. Verify which penetrations will not be accessed after concrete placement for completion of waterproofing detail treatment and ensure that final detailing procedures are completed prior to erection of concrete formwork or shotcreting waterproof penetrations in accord with manufacturer's current procedures contact manufacturer for procedures at project conditions not provided for in installation manuals.

6. Protect membrane system from excessive rain.

7. Inspect and repair damages to membrane system immediately prior to erection of concrete formwork or shotcreting. Ensure that concrete directly contacts membrane.

8. Complete waterproofing details and terminations at grade line coordinating with other trades.

D. Underslab installation:

1. Lap seams a minimum of 5 inches.

2. Thoroughly clean welding seams.

3. Heat-weld seams in accordance with membrane manufacturer's instructions.

4. Install boots, clamps and sealant in accordance with membrane manufacturer's instructions.

E. Drainage mats and waterstops: Install where indicated and according to their manufacturer's installation instructions and after inspections and repairs have been completed.

3.3 TESTING/CERTIFICATION
A. After heat-welding seams, test them with a vacuum box to the satisfaction of the special inspector.

B. Verify that bentonite on the membrane has been kept dry, and that the granules have not been activated; if they have, replace the affected areas.

C. Prior to placing concrete slab over the water/gas membrane, membrane installer shall certify that the installed system has been installed and tested in accordance with the membrane manufacturer’s instructions and found to be free of leaks.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION: Division 1 applies to this Section. Provide composite sheet waterproofing, complete, as indicated, specified, and required.

A. Work In This Section: Principal items include:
   1. Composite sheet waterproofing on vertical retaining walls.
   2. Composite sheet waterproofing in planters.
   3. Composite strip waterproofing at sills, under roof edges, valleys, eaves, ridges and other flashings as indicated. Coordinate this work with Section xxxx.

B. Related Work Not In This Section:
   1. Built-up roofing.
   2. Membranes under ceramic tile.
   3. Parge coats on masonry to receive waterproofing.
   5. Underlayment below clay tile roofing.

1.02 QUALITY ASSURANCE:

A. Manufacturer: Sheet membrane waterproofing system shall be manufactured by a firm with a minimum of 20 years experience in the production of self-adhesive sheet membrane waterproofing.

B. Installer: A firm which has at least 3 years experience in work of the type required by this section, and is recommended by manufacturer to install the specified products.

C. Pre-Installation Conference and Inspection: After approval of submittals but prior to starting installation of work of this section, the Contractor shall hold a meeting at the site attended by representatives of the Architect, Contractor, waterproofing applicator, and a technical representative of the waterproofing material manufacturer. The waterproofing applicator and material manufacturer's technical representative shall inspect the substrates to receive work of this section and report defective conditions to City Engineer and Contractor.

D. Manufacturer's Representative: Make arrangements necessary to have a trained representative of the manufacturer on-site periodically during membrane waterproofing work to review installation procedures.

E. Materials shall comply with current State of California and local Air Quality Management District requirements for volatile organic compounds, (not over 350 grams per liter).

F. The use of chlorinated primers is prohibited.

1.03 SUBMITTALS:
A. Manufacturer's Qualifications: Provide a list of projects of similar design and complexity completed within the past 5 years.

B. Installer's Qualifications: Submit a certificate, prepared by the waterproofing system manufacturer, stating waterproofing applicator is approved by the waterproofing material manufacturer and, upon completion, shall submit a certificate stating that waterproofing systems have been installed in conformance with approved submittals and manufacturer's recommendations.

C. Product Data: Submit manufacturer's product data including installation instructions.

D. Drawings: Submit details, prepared by manufacturer of composite sheet waterproofing, specially prepared for each condition of the work. Show all adjoining work, and indicate methods of adhesion and attachment, laps, and related conditions.

E. Samples: Submit samples, not less than 12" square of each type of composite sheet membrane, on plywood. Submit 12" square samples of each type drainage and protection board.

1.04 PRODUCT DELIVERY AND HANDLING:

A. Deliver material to the site in original unbroken packages bearing manufacturer's label showing brand, type, and weight.

B. Store materials at site under cover and maintain in dry condition. Protect from damage from excessive temperature and construction operations. Do not double-stack pallets of membrane. Protect mastic and adhesive from moisture and potential sources of ignition. Store drainage composite or protection board flat and off the ground. Provide cover on top and all sides of pallets and provide for adequate ventilation. Protect surface conditioner from freezing.

C. Remove and dispose of damaged material in accordance with applicable regulations.

1.05 JOB CONDITIONS:

A. Coordination: Coordinate substrate surface requirements with all related work.

B. Protection: Place temporary coverings and protection to prevent staining or marring of surfaces not to be covered with waterproofing.

C. Application temperatures: Temperature of surfaces to receive waterproofing shall be not less than 40 degrees F.

1.06 WARRANTY: Furnish a warranty against defects in material or workmanship for 5 years covering coating performance of the systems for the entire warranty period including ruptures caused by substrate cracks up to 1/16" width.

PART 2 - PRODUCTS

2.01 MATERIALS: Unless otherwise specified, all waterproofing materials shall be the products and systems of W. R. Grace & Company. Products of Johns Manville or GAF are acceptable where indicated.

A. Composite sheet waterproofing for vertical retaining walls and for planter interiors.
1. "Bituthene System 4000", self-adhesive, cold-applied composite sheet consisting of a thickness of 0.056" of rubberized asphalt and 0.004" of cross-laminated, high density polyethylene film specially formulated for use with water-based surface conditioner. Provide rubberized asphalt membrane covered with a release sheet which is removed during installation. No special adhesive or heat shall be required to form laps.

2. The material shall conform to the following:

<table>
<thead>
<tr>
<th>PHYSICAL PROPERTY, UNITS</th>
<th>TEST METHOD</th>
<th>ACCEPTABLE VALUE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Color</td>
<td></td>
<td>Dark gray black</td>
</tr>
<tr>
<td>Thickness, inch</td>
<td>ASTM D 3 767 Method A</td>
<td>0.060 nominal</td>
</tr>
<tr>
<td>Flexibility, 180° bend over 1&quot; mandrel at -45°C F.</td>
<td>ASTM D 1970</td>
<td>Unaffected</td>
</tr>
<tr>
<td>Tensile strength, membrane, Die C modified, pounds/in²</td>
<td>ASTM D 412</td>
<td>325, minimum</td>
</tr>
<tr>
<td>Elongation, ultimate failure of rubberized asphalt, percent</td>
<td>ASTM D 412</td>
<td>300, minimum</td>
</tr>
<tr>
<td>Crack Cycling at -25°F at 100 Cycles</td>
<td>ASTM C 836</td>
<td>Unaffected</td>
</tr>
<tr>
<td>Tensile Strength, Film, lb/in²</td>
<td>ASTM D 882</td>
<td>5,000, minimum</td>
</tr>
<tr>
<td>Peel Strength, pounds per inch</td>
<td>ASTM D 903</td>
<td>9</td>
</tr>
<tr>
<td>Puncture Resistance, pounds</td>
<td>ASTM E 154</td>
<td>50, minimum</td>
</tr>
<tr>
<td>Lap adhesion, pounds per inch</td>
<td>ASTM D 1876</td>
<td>5, minimum</td>
</tr>
<tr>
<td>Resistance to hydrostatic head, feet</td>
<td>ASTM D 5385</td>
<td>231, minimum</td>
</tr>
<tr>
<td>Exposure to fungi in soil, 16 weeks</td>
<td>GAS-PBS 07115</td>
<td>Unaffected</td>
</tr>
<tr>
<td>Permeance, perms</td>
<td>ASTM E 96, Method B</td>
<td>0.05, maximum</td>
</tr>
<tr>
<td>Water absorption, percent</td>
<td>ASTM D 570</td>
<td>0.1, maximum</td>
</tr>
</tbody>
</table>

3. Surface conditioner: Bituthene 4000, latex based surface conditioner.

4. Adhesives fillets and sealers: Types as recommended by manufacturer for use with specified membrane sheet.

B. Composite strip waterproofing sheet for sills, under copings and flashings where indicated:

1. "Vycor", 0.040" thick, consisting of polyethylene sheet and rubberized asphalt, self adhering, or Johns Manville "NordShield" or GAF "StormGuard Film Surfaced Leak Barrier" (smooth)
2. Primer for composite strip waterproofing: Bithene Water Based Primer, or as recommended by other manufacturers listed above.

C. Drainage Board: W. R. Grace "Hydroduct 2", or equivalent by other manufacturers as listed above.

PART 3 - EXECUTION

3.01 INSPECTION: Inspect and verify condition of substrates and related work. Do not start installation of membranes until defects in substrates have been corrected. Concrete shall be smooth, dry, and free of voids. Masonry shall have parge coat applied as specified in Section 04220.

3.02 APPLICATION OF MEMBRANE ON VERTICAL RETAINING WALLS AND IN PLANTERS.

A. Surface Conditioning: Apply surface conditioner and allow to dry, to surfaces to be covered with membrane the same day.

B. Corner Treatment: Pretreat inside corners with liquid membrane compound, to form a fillet or use formed reinforcement fillet recommended by manufacturer. Smooth all surfaces of outside corners.

C. Horizontal Surfaces: Apply 9" wide strips of membrane material over construction joints, cracks and grouted joints. Seal expansion joints as recommended by manufacturer. At drains and vertical projections, apply two layers of membrane sheet extended out not less than 6" in all directions, and seal. At drains extend the membrane into the clamping ring and seal. Over prepared surfaces apply membrane in one layer and roll into place. Lap sheets 2-1/2" at edges and ends.

D. Vertical Surfaces: Apply membrane vertically in heights to 8 feet. Lap seams 2-1/2". Roll membrane with hand roller. Extend membrane over top of foundation walls, planter walls and parapet walls, except where reglets are provided for termination.

3.03 COMPOSITE SHEET AND STRIP WATERPROOFING:

A. Provide at sills, copings, eaves, ridges, and under other flashing as indicated. Provide at parapet caps and for all horizontal surfaces to be plastered, which are exposed to weather. Provide under sheet metal where indicated.

B. Examine the solid substrates to receive water repellant backing, and remove all high areas, ridges and sharp edges which could damage backing. Be sure that all nails are set below surface of substrate.

C. Do not fold over exposed edges. Cut the membrane into 10 to 15 foot lengths and reverse roll.

D. Separate membrane from release paper, press firmly into place, seal seams with adhesive, and roll to eliminate bubbles and assure full adhesion. Lap sides of sheets not less than 3.5" and ends not less than 6".

3.04 PROTECTION BOARD: Cover all surfaces, vertical and horizontal, with protection board, unless indicated otherwise. Apply with adhesive recommended by manufacturer, and compatible with membrane materials.
3.05  TESTS OF MEMBRANES: All planter membranes shall be subjected to standing water test after completion, but before protection board is applied. Tests shall be conducted as soon as possible after completion of membrane in each area. When membrane installation is completed, seal drain, sandbag perimeter fill membrane with water to height of not less than 2", pond test for not less than 24 hours, repair all leaks or defects disclosed, and retest until results are satisfactory and approved. Remove all sandbags, plugs and drain when testing is completed. Clean surfaces of membrane.

3.06  COMPLETION: Protect membrane systems from injury during application and until finished installation is approved.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Penetrating, reactive water-repellent coating on exposed vertical surfaces of concrete, concrete masonry units (CMU) and plaster.
   2. Supervising the work of other sections to obtain finished surfaces complying with the water-repellent coating manufacturer's instructions.

B. Related work:
   1. Division 9 for penetrating concrete floor sealer.
   2. Division 9 for painting.

1.2 SYSTEM DESCRIPTION

A. Design requirements:
   1. In addition to specifying coating systems, this Section establishes requirements for surface preparation assemblies to receive graffiti-resistant coatings. Coordinate surface preparation requirements of this Section with the work of other sections.
   2. When compared visually to an untreated sample under same lighting conditions, water-repellent coatings shall not change the color and sheen of the coated substrate, and shall be invisible after application and over the life of the building.

B. Performance requirements: Provide water-repellent coatings with the following properties based on testing manufacturer's standard products, according to test methods indicated, applied to substrates simulating Project conditions using the same materials and application methods to be used for Project.
   1. Absorption: Minimum 90 percent reduction of absorption after 24 hours in comparison of treated and untreated specimens.
      b. CMU: ASTM C 140.
      c. Plaster: ASTM C 926
   2. Water-vapor transmission: Maximum 10 percent reduction in rate of vapor transmission in comparison of treated and untreated specimens, ASTM E 96.
   3. Water penetration and leakage through masonry: Maximum 90 percent reduction in leakage rate in comparison of treated and untreated specimens, ASTM E 514.
   4. Durability: Maximum 5 percent loss of water repellency after 2500 hours of weathering in comparison to specimens before weathering, ASTM G 53.
   5. Permeability: Minimum 80 percent breathable in comparison of treated and untreated specimens, ASTM D 1653.
   6. Chloride-ion intrusion in concrete: Transportation Research Board, National Research Council's NCHRP Report 244, Series II tests.
a. Reduction of Water Absorption: 80 percent.
b. Reduction in Chloride Content: 80 percent.

1.3 SUBMITTALS

A. Data:
1. Submit manufacturer’s data of the proposed water-repellent coating, including recommended coverage rates.
2. Submit sample copies of warranty to be furnished under this Section with terms, conditions, and time periods for the warranty clearly defined.

B. Samples: Submit 6-inch square by 1-inch thick samples of water-repellent coating applied to materials specified in other sections.

C. Test reports: Submit reports from a qualified independent testing agency indicating that physical properties of proposed products comply with specified requirements based on comprehensive testing of current product formulations.

D. Certificates: Submit a letter from the manufacturer certifying the material furnished complies with the specified requirements and the substrates are acceptable and satisfactory to receive the work of this section.

E. Qualification statements: Submit a letter from the manufacturer verifying its acceptance of the coating applicator.

1.4 QUALITY ASSURANCE

A. Manufacturer’s qualifications: Obtain materials only from a manufacturer who will send a qualified technical representative to the Project site before start of this work to verify substrate acceptability.

B. Applicator’s qualifications:
1. Firm and individuals with a minimum of 3 consecutive years of experience in the application of specified products on projects similar in material, design, complexity and extent to this Project, and whose work has resulted in applications with a record of successful in-service performance.
2. Only a firm authorized, certified, licensed, or otherwise qualified by the water-repellent coating manufacturer as having the necessary experience, staff, and training to install manufacturer’s products shall apply coatings.

C. Certifications: Submit duplicate copies of manufacturer’s affidavit with each shipment of materials delivered to the jobsite certifying that material furnished complies with specified requirements.

D. Field samples: When requested by the coating manufacturer, or necessary to adjust coating formulation, provide coating manufacturer with sufficient samples of substrate to be coated to determine exact formulation and coverage rates.

E. Mockup:
1. Apply water-repellent coating to the left half of the mockups specified in other sections for material surfaces specified to receive coating. Identify the coated side.
2. Test mockups in accordance with ASTM E 514, modified for field use.
3. Report results of tests and apply additional coating, when appearance is unchanged, or re-formulate and re-apply coating, when test results are not satisfactory.
4. Do not proceed with application at the site until the City Engineer's approval of the coated mockup is obtained and test results are satisfactory.

F. Pre-installation meeting:
1. At least one week prior to ordering specified materials or the start of coating application, arrange a pre-installation meeting between the Contractor, City Engineer, coating manufacturer's representatives and applicator to review product application and coordination with other trades.
2. Review the Drawings, Specifications, coating manufacturer's instructions, and the surfaces and conditions to receive the water-repellent coating. Identify conditions that would be detrimental to proper application.
3. Review the procedures to be followed to provide proper coating protection during and after application.
4. Record minutes of the meeting, decisions made, and corrective measures to be taken before application starts. Send copy of the minutes to the City Engineer no later than 3 days following the meeting.

1.5 HANDLING
A. Handle products to avoid damage to container, deterioration, contamination and inclusion of foreign matter.

1.6 PROJECT CONDITIONS
A. Environmental requirements: Comply with water-repellent coating manufacturer's recommendations regarding environmental requirements and temperature and conditions of surfaces to receive water-repellent coating.
B. Do not apply finish in areas where dust is being generated.

1.7 SEQUENCING
A. Where feasible, delay water-repellent coating application until installation of sealants has been completed in joints abutting surfaces to be coated, or protect sealant bond surfaces to prevent migration of coating onto joint surfaces.
B. Coating application may only precede sealant application if sealant adhesion and compatibility have been tested and verified using substrate, water-repellent, and sealant materials identical to those used in the work.

1.8 WARRANTY
A. Manufacturer's warranty: Warrant water-repellent coating against water penetration through treated surfaces, peeling, cracking, discoloration and other defects of the coating caused by faulty materials and workmanship for 5 years after Substantial Completion.
B. Repair coating defects and failures during the warranty period, at no additional cost to the City.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. The firms listed below make acceptable products for use on the Project. With the assistance of
the selected product manufacturer, select the appropriate water-repellent coating for each
substrate that meets the criteria specified herein and that will perform as specified within the
warranty period.

1. Degussa Building Systems
2. Harris Specialty Chemicals, Inc.
3. Mapei Corp.
4. Pecora Corp.
5. ProSoCo.
6. Or equal.

PART 3 - EXECUTION

3.1 EXAMINATION/PREPARATION

A. Examine surfaces to be coated for conditions that would adversely affect the execution,
permanence and quality of the water-repellent coating.

B. Verify surfaces to receive coating are free from oil, grease, waxy films, curing compounds,
release agents and other deleterious materials that would negatively affect the quality of
application, durability and material performance.

C. Correct conditions detrimental to the proper and timely completion of this work before
proceeding with installation.

3.2 PREPARATION

A. Request the water-repellent coating manufacturer’s presence before start of this work to verify
substrate acceptability, and as required thereafter to review installation procedures and
completed work, and to issue warranty specified.

B. Test application:
    1. Before performing coating work, including bulk purchase and delivery of products,
prepare a small application in an unobtrusive location and in a manner approved by City
Engineer to demonstrate the final effect (visual, physical, and chemical) of planned
application.
    2. Proceed with work only after City Engineer review of test application.

3.3 PROTECTION

A. Cover and protect adjoining work and nearby surfaces, including sealant bond surfaces, from
spillage or blow-over of coating being deposited on these surfaces.

3.4 APPLICATION
A. Start water-repellent coating application in presence of coating manufacturer's technical representative.

B. Apply water-repellent coating using manufacturer-recommended methods and equipment. Do not exceed the application rate recommended by the manufacturer.

C. Completed work shall match approved mockups.

3.5 FIELD QUALITY CONTROL

A. Site tests: The City may employ a testing agency to test applied coating for compliance with specified requirements.
   1. The City will pay test costs, except when testing discloses the coating tested does not comply with these Specifications.
   2. In the event testing shows that the coating is deficient, apply additional coating at no cost to the City.
   3. Contractor shall pay for re-testing until the application demonstrates compliance with specified requirements.

B. Manufacturer's field services: Promptly repair unsatisfactory conditions disclosed by the manufacturer's visits to the site, to the satisfaction of the City Engineer, and have the corrected areas re-inspected by the manufacturer before work starts or resumes in affected areas.

3.6 CLEANING

A. Clean water-repellent coating from adjacent surfaces immediately after spillage.

B. Comply with coating manufacturer's recommendations for cleaning.

3.7 PROTECTION/CLEAN UP

A. Protect finished work in compliance with manufacturer's recommendations.

B. Remove debris from jobsite. Dispose of materials in separate, closed containers in accordance with regulation of authorities having jurisdiction.

END OF SECTION
SECTION 072116
BUILDING INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION: Division 1 applies to this Section. Provide batt and board thermal building insulation, complete.

A. Work In This Section: Principal items include:
   1. Thermal batt insulation in walls and ceilings where indicated.
   2. Rigid board insulation in furring at concrete or masonry walls.
   3. "Zee" channel furring for attachment of insulation.
   4. Thermal insulation for floors of walk-in freezers.

B. Related Work Not In This Section:
   1. Acoustic insulation in interior partitions.
   2. Insulation for mechanical systems.

1.02 SUBMITTALS:

A. Manufacturer's Instructions: Submit insulation manufacturers' printed specifications and instructions.

B. Certification:
   1. Submit certification that Insulation material and installation conform to requirements of CBC 707.3.
   2. Submit certification that blowing agents used in manufacture of batt insulation are formaldehyde free.

C. Data: Provide recycled content data for each different product type, size and manufacturer used, as specified in Section 01351, for the following materials:
   1. Thermal batt insulation.
   2. Batt insulation, unfaced.
   3. Rigid board insulation.

D. Provide special product data emissions data submittals conforming to Section 01351, for the following materials:
   1. Interior adhesives and sealants regulated by South Coast Air Quality Management District (SCAQMD) Rule No. 1168.
   2. Interior refers to all building construction that is inside of an exterior weatherproofing material.

E. Cost Breakdown: Provide special materials cost date breakdown submittals conforming to Section 01351.
PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. Owens Corning
   1 Owens Corning Parkway
   Toledo, OH 43659
   (800) 438-7465
   FAX (419) 248-8052.

B. Johns Manville
   717 17th Street
   Denver, CO 80202
   (800) 654-3103
   FAX (303) 978-3661.

C. USG Corporation
   125 S. Franklin Street
   Chicago, IL 60606
   (800) 874-4968
   FAX (312) 606-5598.

D. The Dow Chemical Company
   1881 West Oak Parkway
   Marietta, GA 30062
   (800) 800-3626
   FAX (770) 590-3532

E. Erico Products Inc.
   34600 Solon Road
   Solon, OH 44139
   (800) 853-0878.

F. Fibrex Insulations, Inc.
   561 Scott Road
   Sarnia, ON N7T 7L4
   (800) 265-7514
   FAX (800) 363-4440.

G. Grace Construction Products
   62 Whittemore Avenue
   Cambridge, MA 02140
   (800) 354-5414
   FAX (617) 498-4314

2.02 MATERIALS:

A. Rigid Board Insulation: Johns Manville Insulshield 300, or OCF Type 703 Industrial Insulation Board, 3.0 pcf density, FRK foil reinforced kraft facing, labeled 25 flame spread, 50 fuel contributed, and 50 smoke developed, or less per ASTM E84, 2” thickness with published 0.65 NRC unless otherwise indicated.
B. Thermal Batt Insulation: Conforming to ASTM C665, foil faced, formaldehyde free, labeled flame spread of 25 or less per ASTM E84 where exposed or required by code, thermal resistance R-19 under roof decks and R-11 in exterior walls unless otherwise indicated, batts with flanges for use under roof decks and friction-fit batts for use in metal framing. Insulation used in conjunction with safing for fire resistance in exterior walls shall be of types tested and approved for use with safing.

C. Batt Insulation, Unfaced: Glass fiber batts, conforming to HH-I-521F, Type 1, R-30 Superbatt, formaldehyde free, manufactured by Owens-Corning or equivalent by Johns Manville; and R-11 regular batts.

D. Unfaced Isocyanurate Board Insulation for Cooler and Freezer Floors: Two inch thick “TRYMER 2000” as manufactured by Dow Chemical Company, R-10 for 2” thickness, aged isocyanurate board insulation, conforming to California Insulation Quality Standards, ASTM C 591, Type 1.

E. String Wires: Minimum 18 gage galvanized steel wire.

F. Stud Furring and Insulation at Concrete and Masonry Walls: Grace “Thermo-Stud System consisting of Thermostud boards, metal furring channels and T-clips. Insulation shall be pregrooved to accept furring, and shall be 2” thick unless otherwise indicated. Furring channels shall be U-shaped galvanized steel with serrated edges designed for attachment of insulation to substrate, and incorporating a drywall furring strip.

G. Safing Insulation: UL approved, incombustible, with Code approved galvanized steel closures, clips, and ties to secure safing insulation and conform to Code. Materials shall be as follows:

1. Safing perimeter protection, 4 pcf density, regular color: Fibrex FBS Safing Insulation with Smoke Barrier (FSK foil/kraft laminate reinforced with scrim) or 3M Thermafiber Mineral Fiber Safing, vapor retarding foil-faced, 4” thick, with galvanized steel safing clips.

2. Fire safing at tops of partitions terminating at the underside of fluted decking or irregular surfaces, unfaced, regular color: Fibrex FBX Safing Insulation; or 3M Thermafiber Mineral Fiber Safing.


H. Impaling Clips for Safing Insulation: Galvanized steel Z-clips designed for supporting safing insulation, and as recommended by insulation manufacturer.

I. Vapor barrier for Cooler and Freezer Floors: ASTM D2103, polyethylene sheeting, clear, 10 mil thickness. Provide minimum 2” wide waterproof plastic self-adhering tape. Material shall be Rufco 400 by Raven Industries, Moistop by Fortifiber Corp, Nervastral Barrier by Rubber and Plastics Compound Co., or Vinyl Water Barrier by B.F. Goodrich Corp.

J. Mastic for Insulation Below Freezer Floors: Dow Chemical Company “Styrofoam Mastic No. 11”, H.B. Fuller Co.”MaxBond”, or MACCO Adhesives “Liquid Nails LN 601”, or other approved mastic or adhesive. Where insulation is placed over dampproofing or waterproofing, mastic shall be acceptable to both insulation manufacturer and dampproofing or waterproofing manufacturer. Use only interior adhesives and sealants that meet or do not exceed the VOC limits of the current requirements of South Coast Air Quality Management District (SCAQMD) Rule No. 1168 on the interior of the building.

1. Current requirements refers to the date when the materials are installed in the building.

2. Interior refers to all building construction that is inside of an exterior weatherproofing material.

PART 3 - EXECUTION
3.01 INSTALLATION OF BATTS: Install batts with close fit, free of gaps, holes, or sagging. Maintain nominal 3/4" air space between the insulation and interior wall or ceiling finish. Supplement the installation with wire ties, adhesive, spindle anchors, or staples where required to prevent sagging. Provide spindle anchors where shown or necessary in accordance with manufacturer's instructions, spaced at maximum 12" centers both ways.

A. Batts In Metal Framing: Provide friction-fit batts tightly fitted to stud webs and to metal furring.

B. "Thermostud" System: Install in accordance with manufacturer's recommendations. Fit insulation snugly to minimize gaps. Attach furring to masonry using drive pins, concrete nails, or other approved fasteners.

3.03 INSTALLATION OF RIGID INSULATION ON WALLS: Cut boards to fit between framing members, minimizing gaps. Fill gaps larger than one inch in any dimension with small pieces cut to fit. Hold in place with prong anchors located within 4" of corners and spaced at maximum 12" centers along edges and in the field, or adhere to wall, as approved.

3.04 INSTALLATION OF INSULATION ON FREEZER FLOORS:

A. Depress walk-in freezer floors sufficiently below adjoining floors to permit installation of one layer of vapor barrier, under 4 inch thickness of isocyanurate board insulation installed in two layers, and 3-1/2" minimum thickness concrete wearing surface and quarry tile in mortar setting bed over the isocyanurate board insulation as indicated on drawings.

B. Be sure that concrete to receive insulation is clean, smooth, and free from projections that would damage the insulation. Install vapor barrier over the subslab. Lap joints 6" and tape seal. Seal the joints at edges and around penetrations with tape. Protect vapor barrier from damage until installation of insulation.

C. Install insulation boards in maximum possible sizes, and where cuts are made, they shall be square and clean. Install boards with joints tightly fitted, but not forced, covering entire area indicated. Stagger joints in second layer over the first in both directions.

D. Install under entire walk-in freezers in accordance with accepted manufacturer's recommended installation instructions and as indicated on drawings. Hold in place with mastic or adhesive at rate recommended by insulation manufacturer.

E. Center vertical 2" thick redwood or wolphanized Douglas fir boards between under-floor insulation and centerline of insulation in walk-in cooler and freezer walls and interior partitions so that setting beds of interior rooms and the walk-in coolers and freezers are isolated from adjacent concrete floor all as indicated on drawings.

3.05 SAFING INSULATION: Pack indicated voids, and all other voids as required by Code, and secure insulation with galvanized steel closures, clips, and ties according to Code and UL approvals. Include all penetrations through fire-rated construction that are not fire-safed under other Sections. Coordinate with the requirements specified in Divisions 15 and 16.

A. Perimeter protection: Install safing insulation, without voids, at joints between walls and floor slabs with safing clips spaced at 24" centers. Cut safing approximately 10 percent wider than opening to insure compression fit. Apply 3/8" minimum beads of smoke sealant at perimeters and joints to prevent passage of smoke.

B. At tops of partitions, compress safing for a tight fit.
END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION: Division 1 applies to this Section. Provide water vapor testing and pH testing, and remedial measures necessary to remove excessive moisture and reduce pH from on grade slabs to receive moisture and alkaline sensitive finishes, complete.

A. Related Work Not In This Section:
   1. Resilient flooring.
   2. Thinset ceramic floor tile.
   3. Other moisture sensitive floor coverings as indicated or required.

1.02 REFERENCES:

A. ASTM F 710 Practice for Preparing Concrete Floors and Other Monolithic Floors to Receive Resilient Flooring

B. ASTM F 1869 Measuring Moisture Vapor Emission Rate of Concrete Subfloor using Anhydrous Calcium Chloride

1.03 SYSTEM DESCRIPTION: The work of this Section consists of 2 parts as follows:

A. Moisture and pH testing of all on-grade, below-grade and above-grade floor slabs scheduled to receive moisture sensitive floor finishes, including thin set ceramic tile, resilient flooring and carpet.

B. Remedial measures required to bring moisture content and pH to limits recommended by manufacturers of each floor finish and each adhesive.

C. The remedial work specified in this Section will be required only if the moisture content and/or pH exceed finish flooring manufacturers' recommendations. If required, the unit prices described in Section 01026 will apply. Floor slab testing for moisture and pH shall be performed in every case, and shall not be subject to adjustment of contract price.

1.04 QUALITY ASSURANCE:

A. Qualifications of Manufacturer: Systems and materials shall be product of a manufacturer regularly engaged in engineering and servicing of vapor reduction systems for not less than 10 years. Manufacturer shall supply references of at least 5 satisfactory installations in which specified systems have been in service for at least 5 years.

B. Qualifications of Installer: Installer shall be an employee of manufacturer. Supervisor of crew shall have a minimum 5 years experience in successfully performing moisture testing and remedial work.

C. Materials shall comply with current State of California and local Air Quality Management District requirements for volatile organic compounds, (not over 350 grams per liter).

D. Pre-application Conference and Inspection: After approval of submittals but prior to beginning installation of work of this section, Contractor shall hold a meeting at the site attended by City Engineer, Architect, Contractor, vapor testing and control systems applicator, and the water vapor
testing and control systems manufacturer to describe in detail the systems to be installed and to establish agreement, coordination and responsibilities. The Contractor shall prepare a detailed report of this meeting and furnish copies to all attendees. The surfaces to receive moisture sensitive floor finishes shall be inspected and all defective conditions shall be corrected before beginning work of this section.

1.05 SUBMITTALS:

A. Manufacturer's Experience Qualifications: Submit evidence, satisfactory to Owner, of manufacturer's experience record as specified.

B. Applicator's Experience Qualifications: Submit list of not less than 5 projects, extending over period of not less than 5 years, indicating applicator's experience record. Submit letter from manufacturer showing manufacturer's approval for installer of the products.

C. Data: Obtain from each manufacturer of moisture sensitive floor coverings, the respective recommended test results, and submit prior to commencing work of this section.

D. Moisture Testing Results: Submit written reports covering all moisture test results. Provide a floor plan, indicating finish flooring for each room or space, manufacturer's maximum recommended moisture content, location of each test and the moisture release at each location.

E. Product Data: Submit manufacturer's product data including complete testing and control installation instructions.

F. Remedial Measures: Submit data showing proposed remedial work for each location where moisture test exceeds manufacturer's recommended maximum moisture release.

G. Final Test Reports: Submit reports of tests of floors following completion of remedial work as required.

H. Experience Record: Submit a list of at least five installations on which each of the materials and systems proposed for use have been in satisfactory service for at least 3 years.

1.06 JOB CONDITIONS: Perform testing immediately prior to scheduled installation of moisture sensitive floor finishes.

1.07 DELIVERY, STORAGE AND HANDLING

A. Delivery of Materials: Deliver materials (except bulk material) in manufacturer's unopened containers fully identified with manufacturer's name, trade name, and application instructions.

B. Storage of Materials: Store materials in unopened containers. Store off ground and under cover, protect from damage.

1.08 WARRANTY: Furnish to the Owner a manufacturer's written 10 year warranty, against all defects in materials and workmanship. In the event of treatment system failure by concrete moisture or alkalinity over slab surfaces, joints or cracks, manufacturer shall provide materials and labor to repair or replace the damaged floor system. Warranty shall include all materials and equipment necessary to treat the affected subfloor and to replace the finish flooring.
PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

A. For remedial work:
   2. Koester American Corporation, represented locally by Warren Proctor Marketing, 1940 Pepper Drive, Altadena, CA 91001  (626) 797-1424  FAX (626) 797-2340.

B. For testing:
   2. Sealflex Industries, Inc., 2925 College Avenue, Suite B-4, Costa Mesa, CA 92626  (714) 708-0850  FAX (714) 708-2711.

C. For underlayment: Ardex, Inc., 630 Stoops Ferry Road, Coraopolis, PA 15108, (412) 264-4240

2.02 MATERIALS

A. Moisture Detection Equipment: Calcium chloride testing system, consisting of pre-packaged anhydrous calcium chloride crystal test kits, and an electronic gram weight scale measurable in 1/10 grams.

B. pH Testing Equipment: Wide range of pH testing strips with color chart. Water shall be distilled or deionized, furnished in unopened containers with labels intact.

C. Resin Membrane System, Type 1: MES Penetrant, VOC compliant, low viscosity, anti-microbial chemical formulation, and elastomeric properties to expand and contract with slab movement; formulated to saturate concrete surfaces and mechanically restrict moisture and alkalinity levels, and conforming to the following:

<table>
<thead>
<tr>
<th>PHYSICAL PROPERTIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical property, units</td>
</tr>
<tr>
<td>Water vapor transmission, grains/hour/sq. ft.</td>
</tr>
<tr>
<td>Alkali resistance</td>
</tr>
<tr>
<td>Adhesion strength, psi</td>
</tr>
</tbody>
</table>

D. Resin Membrane System, Type 2: MES Penetrant plus MES Coating, VOC compliant, low viscosity, anti-microbial chemical formulation and elastomeric properties to expand and contract with slab movement; formulated to saturate concrete surfaces and mechanically restrict higher levels of moisture and alkalinity.
## PHYSICAL PROPERTIES

<table>
<thead>
<tr>
<th>Physical property, units</th>
<th>Test Method</th>
<th>Acceptable value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water vapor transmission, grains/hour/sq. ft.</td>
<td>ASTM E 96</td>
<td>1.06</td>
</tr>
<tr>
<td>Alkali resistance</td>
<td>ASTM D 1308</td>
<td>pass</td>
</tr>
<tr>
<td>Adhesion strength, psi</td>
<td>ASTM D 4541</td>
<td>500, (100% concrete failure)</td>
</tr>
</tbody>
</table>

E. Material for Concrete Floor Levelling: Self-levelling, self smoothing, cementitious, factory mixed compound requiring only addition of water at the site. Materials shall be Ardex K-15, conforming to the following:

## PHYSICAL PROPERTIES

<table>
<thead>
<tr>
<th>Physical property, units</th>
<th>Test Method</th>
<th>Acceptable value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial set, minutes</td>
<td>ASTM C191</td>
<td>30, at 70 degrees F.</td>
</tr>
<tr>
<td>Final set, hours</td>
<td>ASTM C191</td>
<td>2, at 70 degrees F.</td>
</tr>
<tr>
<td>Compressive strength, psi:</td>
<td>ASTM C109</td>
<td></td>
</tr>
<tr>
<td>After 24 hours</td>
<td></td>
<td>2,630</td>
</tr>
<tr>
<td>After 28 days</td>
<td></td>
<td>4,100</td>
</tr>
<tr>
<td>Flexural strength, psi:</td>
<td>ASTM C348</td>
<td></td>
</tr>
<tr>
<td>After 24 hours</td>
<td></td>
<td>770</td>
</tr>
<tr>
<td>After 28 days</td>
<td></td>
<td>1,000</td>
</tr>
<tr>
<td>Flammability</td>
<td>ASTM E84</td>
<td></td>
</tr>
<tr>
<td>Flame spread</td>
<td></td>
<td>0</td>
</tr>
<tr>
<td>Smoke developed contributed</td>
<td></td>
<td>0</td>
</tr>
</tbody>
</table>

F. All Other materials: Manufacturer's standard for items required or type be suited for intended use.

PART 3 - EXECUTION

3.01 INSPECTION: Examine substrate, adjoining construction and conditions under which work is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.
3.02 MOISTURE TESTING:

A. Test new and old concrete slabs for adequate dryness, as indicated by each manufacturer of moisture sensitive floor finishes.

B. Testing shall conform to ASTM F 1869 for moisture, and ASTM F710 for pH.

C. Minimum testing requirements are 3 calcium chloride tests for the first 1,000 square feet of floor area, and one for each additional 1,000 square feet or fraction thereof.

D. Unless more stringent requirements are recommended by flooring manufacturer, maximum allowable moisture release at time of flooring installation shall be 3.0 pounds per 24 hours per 1,000 square feet.

E. For each test, perform the following steps:

1. Weigh the sealed dish of crystals immediately prior to exposure. Record starting weight, date and time.

2. Open kit and set crystal dish on clean concrete surface. Immediately install plastic dome over the dish. Mask sure the dome is gasketed to the concrete and is air tight.

3. Leave test to absorb moisture for 60 to 72 hours. Keep room temperature above 55 degrees F. for duration of test.

4. After exposure, remove and discard housing. Replace dish lid and tape shut. Weigh the sample within one hour of removal from floor.

5. Compute the vapor emission in pounds, indicate location of test and vapor emission on report.

6. Delay application of flooring until subfloors are sufficiently dry, or perform remedial measures as specified in this section.

3.03 pH TESTING: Conform to requirements of ASTM F 710. Perform one test per 1,000 square feet or fraction of slab area. Place a few drops of water on the surface of the concrete. Allow to stand approximately 60 minutes. Dip the pH paper into the water and compare to chart. Finish flooring shall not be installed unless pH is 9.0 or less.

3.04 MOISTURE VAPOR CONTROL

A. Areas where moisture content exceeds 3.0 pounds of water per 24 hours per 1,000 square feet shall be treated as follows:

1. Moisture content between 3.0 pounds and 8.5 pounds, pH levels above 10: System I.

2. Moisture content between 8.5 pounds and 12.5 pounds, pH levels above 10: System II.

3. Moisture content over 12.5 pounds: Consult manufacturer of vapor reduction system for specific requirements.

B. Preparation of Slabs to be Treated:

1. Mask and protect walls and equipment.

2. Shot blast or grind concrete surfaces and clean joints.
3. Broom and vacuum slabs to remove dust and debris.

4. Fill cracks, joints and surface irregularities with resin fill.

C. Application of System I: Roll and squeegee penetrant to entire treatment area until saturation. Apply cementitious underlayment on tacky surface, as specified below.

D. Application of System II: Over the penetrant, applied as specified above, roll and squeegee the coating until saturation, while penetrant is still tacky. Apply cementitious underlayment on tacky surface, as specified below.

3.05 pH CONTROL: Where pH of slabs exceeds 9.0 or less if required to finish flooring and adhesive manufacturers, reduce the pH by one or a combination of the following methods:

   A. Abrasive grinding to remove carbonated layer.
   B. Additional waiting time
   C. Application of underlayment

3.06 APPLICATION OF CEMENTITIOUS UNDERLAYMENT:

   A. Preparation: After application of moisture vapor and pH control systems as applicable, apply cementitious underlayment to level and smooth the surface. Apply the underlayment while the resin membrane is still in a tacky state. Install to level the floor, to minimum 1/16 inch thickness.

   B. Mix the material in accordance with manufacturer's instructions, and apply and smooth the material over the floor. Where pumping of the material is feasible, use manufacturer's recommended equipment and methods. Finished surfaces shall be level to within 1/8" in 10 feet in any direction, non-accumulative. Texture of finish shall be smooth, as recommended by finish flooring manufacturers.

3.07 FINAL TESTS: Test surfaces for moisture and pH in sufficient quantity to assure that moisture and pH of treated floors is within finished floor manufacturers acceptable limits.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION: Division 1 applies to this Section. Provide composition shingle roofing, complete.

A. Work In This Section: Principal items include:
   1. Preparation of roof surfaces.
   2. Furnishing and laying of composition shingle roofing.
   3. Elastomeric membrane underlayment.

B. Related Work Not In This Section:
   1. Clay tile at ridges and eaves.
   2. Built-up roofing.
   3. Sheet metal flashings.
   4. Concrete tile roofing.

1.02 QUALITY ASSURANCE:

A. Quality Control Inspection: Refer to Section xxxx.

B. Roofing Applicators: Authorized and approved by the roofing manufacturer.

C. Requirements of Regulatory Agencies: Conform work of this section to code.

D. Preroofing Conference and Inspection: After approval of submittals but prior to beginning installation of work of this Section, Contractor shall hold a meeting at the site attended by City Engineer, Architect, Contractor, the Owner's roofing quality control inspector, the roofing and sheet metal applicators, and the roofing material manufacturer to describe in detail the roof systems to be installed and to establish agreement, coordination and responsibilities. The Contractor shall prepare a detailed report of this meeting and furnish copies to all attendees. The surfaces to receive roofing and sheet metal shall be inspected and defective conditions shall be corrected before beginning work of this section.

1.03 SUBMITTALS:

A. Samples: Submit samples of full range of manufacturer's colors for selection.

B. Certificates: Submit evidence of compliance with ICBO ES AC 127 and compliance with wind uplift requirements.

1.04 PRODUCT HANDLING: Deliver material to the site in original unbroken packages bearing manufacturer's label showing brand and weight. Store materials at site under cover and maintain in dry condition until ready for use. Stack felt rolls on end.
1.05 JOB CONDITIONS:

   A. Owner's Inspection: All work of this section shall be performed under the observation of the Owner's roofing quality control inspector.

   B. Applicator's Inspection: Inspect decks, related work, and adjacent surfaces, and report all conditions which prevent proper execution of roofing installation.

1.06 WARRANTY: Furnish a warranty for two years, to cover watertightness, materials, workmanship, and repair of wind damage, sliding, loosening, or leakage at no additional contract cost for entire warranty period.

PART 2 - PRODUCTS

2.01 MATERIALS:

   A. Self-Adhering Membrane Underlayment: ASTM D 412, Polyethylene-sheet-backed, rubberized asphalt membrane, 40 mil thickness, W.R. Grace "Bituthene 4000".

   1. Primer for Self-Adhering Membrane Underlayment: VOC compliant primer as recommended by membrane manufacturer.

   2. Accessories: Two component urethane, mastic and primer shall be as approved by the membrane manufacturer. Flashing, expansion joint covers, temporary UV protection and corner fillets shall be as recommended by the membrane manufacturer. Materials shall be VOC compliant.

   B. Ice and water shield: W.R. Grace "Vycor", 0.040" thick, consisting of polyethylene sheet and rubberized asphalt, self adhering, with Bituthene Water Based Primer.

   C. Asphalt shingles shall be GAF Timberline 30, color as selected, 12" by 36-15/16", 25 year warranty, 60 mph wind warranty, UL Class A fire rating. Provide hip and ridge cap shingles as indicated or as required. Asphalt shingles shall conform to requirements of ASTM D 3462, shall comply with ICBO AC 127, and shall be as follows:

<table>
<thead>
<tr>
<th>PHYSICAL PROPERTIES</th>
<th>Test Method</th>
<th>Acceptable value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical property, units</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tear strength, g</td>
<td></td>
<td>1700 min</td>
</tr>
<tr>
<td>Fastener pull through resistance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>lbf @ 72°F</td>
<td></td>
<td>20 min.</td>
</tr>
<tr>
<td>lbf @ 32°F</td>
<td></td>
<td>23 min.</td>
</tr>
<tr>
<td>Wind resistance</td>
<td></td>
<td>pass</td>
</tr>
<tr>
<td>Fire resistance</td>
<td>Class A</td>
<td></td>
</tr>
<tr>
<td>Penetration of asphalt 0.1 mm</td>
<td></td>
<td>15</td>
</tr>
<tr>
<td>Asphalt softening point, °F</td>
<td></td>
<td>235 max; 190 min.</td>
</tr>
</tbody>
</table>
### PHYSICAL PROPERTIES

<table>
<thead>
<tr>
<th>Physical property, units</th>
<th>Test Method</th>
<th>Acceptable value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight of displaced granules</td>
<td></td>
<td>1.0 g max.</td>
</tr>
</tbody>
</table>

D. Shingles shall bear manufacturer's service life (warranty) rating as follows:

<table>
<thead>
<tr>
<th>Length of warranty (years)</th>
<th>Approx. minimum weight pounds/square</th>
<th>Approx. maximum weight pounds/square</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td>234</td>
<td>325</td>
</tr>
</tbody>
</table>

E. Fasteners: Galvanized, aluminum or stainless steel roofing nails, minimum 12 gauge shank with minimum 3/8" diameter head, of a length to penetrate through the roofing materials and a minimum 3/4" into the roof sheathing. Where the roof sheathing is less than 3/4", the nails shall be of a length to penetrate through the sheathing. Staples shall not be used.

### PART 3 - EXECUTION

3.01 INSTALLATION:

A. Roof Deck Preparation: Roof sheathing shall be dry, smooth and well nailed. Cover large cracks or knotholes with metal and sweep surface clean. The metal fittings shall be in place, nailed at 4" on center.

B. Roofing Sheet Metal shall be in place before shingles are applied.

C. Application of Elastomeric Membrane Underlayment

1. Surface Preparation: Dust, dirt, loose nails or other protrusions shall be removed. Prime concrete and masonry surfaces. Apply primer at rate of 250-350 square feet per gallon. Primer shall be applied by spray or paint roller.

2. Temperature: Membrane shall be applied only in fair weather when air and surface temperatures are above 40 degrees F.

3. Membrane Application: Membrane shall be applied according to manufacturer's instructions. Membrane shall be adhered directly to roof deck. Membrane shall be cut into 10 to 15 foot lengths and shall be re-rolled. The release paper shall be peeled back one to 2 feet and the membrane shall be aligned on the lower edge of the roof and the first one to 2 feet shall be placed. The release paper under the membrane shall be pulled and peeled from the membrane. The membrane shall be pressed in place. Lower edges shall be rolled firmly with a wallpaper or hand roller. For ice dam protection, membrane shall be applied to reach a point above the highest expected level of ice dams. Ends and edges shall be overlapped a minimum of 150 mm. 6 inches. Membrane shall not be folded onto an exposed face of the roof edge.
4. Valley and Ridge Application: Apply membrane at ridges and eaves for subsequent application of asphalt shingles. The membrane shall be cut into 4 to 6 foot lengths. The release paper shall be peeled and the sheet centered over the valley or ridge, draped and pressed in place working from the center of the valley or ridge outward in each direction. For valleys, membrane shall be applied starting at the low point and working upwards. Sheets shall overlap a minimum of 6 inches.

5. Vertical Membrane Flashings: Apply primer prior to the application of membrane. Primer shall be applied at a coverage rate of 250-350 square feet per gallon. Membrane shall be turned up walls and other vertical surfaces. Vertical membrane terminations shall be mechanically fastened. Vertical terminations shall receive a troweling of mastic as approved by the membrane manufacturer. Membrane may be folded onto the fascia, provided it will be covered by a gutter metal edge or other material.

6. Protection: Elastomeric membrane underlayment shall not be left permanently exposed to sunlight. Membrane shall be covered with exposed roofing materials as soon as possible. Membrane damaged due to exposure to sunlight shall be patched prior to the application of final roof covering.

D. Shingles: Apply shingles over membrane, starting 1/2" beyond eaves with a double course of shingles of 12" wide starting strip, and work towards ridge. Lay the shingles with cutouts at random, with 5-inch exposure, with butts of shingles in a straight continuous line. Nail each shingle strip in manner to conform to code required wind uplift, but not less than 4 nails, one nail 3/4" from each end and 1/2" above cutouts. Trim the last course of shingles evenly at ridge.

1. Staples will not be acceptable.

2. Valleys: Construct valleys by closed cut style, unless otherwise indicated. Install ice and water shield in valleys, extended not less than 18 inches on each side of valley.

   a. Closed valleys: Install shingles that will shed least amount of water first. Each shingle shall extend not less than 12 inches beyond the center of the valley. Shingles that lie on top shall be cut 2 inches back from the centerline of the valley to allow water to flow freely. Place a 2 inch diagonal cut at the upper corner of the shingle to allow water infiltration to flow back to the valley.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION: Division 1 applies to this Section. Provide clay roofing tiles at eaves and ridges as indicated, complete.

A. Work In This Section: Principal items include:

1. Clay roofing tiles and accessories.
2. Grouting of tiles as required.

B. Related Work Not In This Section:

1. Asphalt shingle roofing.
2. Elastomeric membrane underlayment.

1.03 SUBMITTALS:

A. Samples: Submit samples of clay roofing tile, and grout color.

B. Sample Installation: At designated roof area, install sample installation under inspection, including underlayment. Water test the sample vent to assure that no leaks occur. Make such changes in installation methods as may be directed. When approved, install balance of roofing using approved method.

C. Manufacturer's literature and installation specifications for membrane, tile and tile tying system.

1.04 COORDINATION: Coordinate with the installation of asphalt shingle roofing and with related flashing and gutters to ensure proper sequencing.

1.06 WARRANTY: Furnish a warranty for five years. Warranty shall cover watertightness, materials, workmanship, and repair of wind damage, sliding, loosening, or leakage at no additional contract cost for entire warranty period.

PART 2 - PRODUCTS

2.01 MATERIALS:

A. Clay Roofing Tile: Conform to ASTM C 1167, Grade 2 (moderate frost), 2 piece Mission tile, Redland Clay Tile "Old Sedona". Tile shall conform to UBC Std. 32-12. Tile shall be fired clay units of sizes, complete with gable, ridge, and starter units as required.

B. Anchors: Brass type as required, with manufacturer's recommended nails.

C. Nailers: Conform to Section 06100, pressure preservative treated.

D. Mastic: Conform to ASTM D 4586.

E. Grout: Composed by volume of 1-part Portland cement, 2-parts sand, and water to form a firm mixture, with pure ground mineral oxide coloring pigments added as required to match the approved sample where grout is exposed.


PART 3 - EXECUTION

3.01 INSPECTION: Report in writing all conditions that interfere with or prevent the correct installation of the work of this section, and do not install the work of this section until such defective conditions are corrected or eliminated.

3.02 INSTALLATION:

A. General: Install clay tile roof ridges and eaves as indicated. Coordinate with installation of shingles and adjoining materials.

B. Application of Elastomeric Membrane Underlayment: Refer to Section xxxx

C. Ridges and eaves: Secure tiles in place with nails and adhesive, and apply cement mortar for decorative purposes only. Soak tiles in contact with mortar, in clean water for not less than 3 minutes immediately before application. Set tiles in a solid bed of colored grout as required, exposed surfaces finished to match the approved sample installation.

D. Grouting: At ridges and eaves, set tiles in a solid bed of colored grout as required, exposed surfaces finished to match the approved sample installation.

3.03 COMPLETION: Inspect completed installation. Remove and replace broken, cracked, and defective tiles and grout, as approved.

END OF SECTION
SECTION 074143
COMPOSITE METAL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Pre-finished, aluminum-faced composite material (ACM) exterior wall and roof panels.
   2. Perimeter trim, flashings, copings, and closure pieces.
   3. Sealants, gaskets and other accessories for the work of this Section required for a complete and weatherproof installation.
   4. Supplementary parts and components, such as brackets, clips, fasteners, supplementary framing, and other miscellaneous accessories required for a complete installation.

B. Related work:
   1. Division 5 for cold-formed steel supports.
   2. Other Sections of Division 7 for flashings and sheet metalwork.

1.2 DEFINITIONS

A. Water leakage: Uncontrolled water appearing on normally exposed interior surfaces of assemblies from sources other than condensation. Water controlled by flashing and gutters and drained back to the exterior, and that cannot damage adjacent materials or finishes, is not water leakage.

1.3 SYSTEM DESCRIPTION

A. Pressure equalized rain screen: Provide system with reveal joint as detailed on drawings. Provide moisture barrier as specified elsewhere in Division 7.

B. Design requirements:
   1. Engineer, fabricate, assemble and install panels to meet or exceed the criteria indicated and specified, to conform to the profiles indicated and to other requirements of the Contract Documents, to satisfy applicable governing codes and regulations, and to provide a watertight, structurally sound, self-draining assembly capable of withstanding loads and thermal and structural movements indicated without failure. Failure includes the following:
      a. Deflection of panels in excess of specified limits.
      b. Thermal stresses transferred to supporting structure.
      c. Noise or vibration created by thermal and structural movement and wind.
      d. Loosening or weakening of fasteners, attachments, and other components.
      e. Sealant failure.

   2. If required by the authorities having jurisdiction, prepare and submit reviewed shop drawings, specifications, calculations and any other supporting data required by the authorities having jurisdiction for review and approval, and pay fees incurred, prior to beginning installation.
3. Engineering calculations for assemblies shall bear the signature and seal of a California-licensed professional engineer.

4. Fasteners and connections are shown schematically. Employ a California-licensed professional engineer to determine final types and sizes.
   a. In no case shall fasteners or connections conflict with or require revision of the finish profiles of the metal panel assemblies or the supporting work.
   b. Connections to the structural frame shall not impose eccentric loading, or induce twisting or warping.

5. Unless otherwise defined by Contract Documents, the appearance of exposed elements shall be within dimensional limits indicated (section profiles) and be consistent throughout the Project. Do not deviate from profiles indicated without written consent from the City Engineer.

6. Design system so panels can be removed without removing or disrupting adjacent panels or materials.

C. Performance requirements:

1. Wind loads: Provide assemblies, including anchorage, capable of withstanding wind-load design pressures prescribed by the authorities having jurisdiction, but not less than 20 psf inward and outward and 30 psf on parapet and corner panels.
   a. Deflection: Limit deflection of framing members in a direction normal to wall plane to \( L/175 \) of clear span or 3/4-inch, whichever is less. Limit deflection of panels in a direction normal to wall plane to \( L/60 \) of clear span.
   b. Static-pressure test performance: Provide assemblies that do not evidence material failures, permanent deflections of framing members exceeding \( L/100 \) of clear span, gross permanent distortion or permanent set exceeding 1/16-inch at connection points of framing members to anchors when tested according to ASTM E 330.
      1) Test pressure: 150 percent of inward and outward wind-load design pressures.
      2) Test duration: As required by design wind velocity, fastest 1 mile of wind for relevant exposure category.
   c. Provide clips, fasteners, and clip spacing of types indicated and with capability to sustain, without failure, a load equal to 300 percent the design negative uplift pressure.
   d. Provide roof panel fasteners capable of resisting the design negative uplift pressure specified below.

2. Seismic loads: Provide assemblies, including anchorage, capable of withstanding the effects of earthquake motions calculated according to requirements of authorities having jurisdiction.

3. Air infiltration: Provide panels with permanent resistance to air leakage of not more than 0.06 cfm/square foot of fixed wall area when tested according to ASTM E 283 at a static air pressure difference of 1.57 psf.

4. Water penetration: Provide panels that do not evidence water leakage after 15 minutes of exposure when tested according to ASTM E 331 at minimum differential pressure of 6.24 psf but not more than 12 psf.
5. Thermal movements: Provide assemblies, including anchorage, that accommodate thermal movements of systems and supporting elements resulting from the following maximum change (range) in ambient and surface temperatures without buckling, failure of joint sealants, damaging loads on fasteners and other detrimental effects.
   a. Design temperature change (range):
      1) Minimum 120 deg. F, ambient; 180 deg. F, material surfaces.
      2) Base engineering calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
   b. Fasteners: Provide fasteners that resist rotation and avoid shear stress as a result of thermal movements.

1.4 SUBMITTALS

A. Data:
   1. Product data:
      a. Submit a list of proposed products, materials and components to be provided for a complete assembly, along with their manufacturer’s product data, specifications, typical installation details and other data as necessary to demonstrate compliance with specified requirements for each item listed.
      b. Submit sample copies of warranty to be furnished under this Section with terms, conditions, and time periods for the warranty clearly defined.
   2. Design data: Prepare and submit structural calculations for panel systems.
      a. Prepare calculations in compliance with current design rules of American Architectural Manufacturer’s Association (AAMA), American Institute of Steel Construction (AISC) and the American Iron and Steel Institute (AISI). Include analysis for wind and seismic loads on framing members, anchors, and concrete inserts.
         1) Show section property computations for framing members.
         2) Show vertical and horizontal loads on supports.
          3) Test reports are not an acceptable substitute for calculations.
      b. Calculations shall be signed and stamped by a California-licensed professional engineer.

B. Shop drawings:
   1. Submit large scale, dimensioned drawings showing materials, profiles, joints, finishes, and anchorage details.
   2. Provide elevation drawings of each plane showing panel layouts, fastener spacing, details of edge conditions, joints, corners, supports, anchorages, trim, flashings, closures and all other pertinent data.
   3. Label individual components and indicate material gages, weights, design loads, required clearances, and method of field installation.
   4. Identify sealants by product name.
   5. Detail interface with adjacent materials. For interface between components with different profiles, and conditions difficult to illustrate in 2 dimensions, furnish isometric drawings.

C. Samples:
1. Submit minimum 12-inch by actual panel width samples, showing panel color, finish texture and variations to be expected in the work.

2. Submit minimum 24-inch square panel assemblies, complete and with corner condition, mounted on plywood and including all components to be installed under this Section for each assembly sample.

3. Provide samples of fasteners.

D. Test reports:
   1. Product test reports: Submit reports from a qualified testing agency indicating panels comply with specified requirements based on comprehensive testing of current products.
   2. Sealant compatibility and adhesion test reports:
      a. Submit reports from the sealant manufacturer indicating that materials forming joint substrates and joint sealant backings have been tested for compatibility and adhesion with sealants.
      b. Include sealant manufacturer's interpretation of test results for sealant performance and recommendations for primers and substrate preparation needed for adhesion.

E. Closeout: Submit panel manufacturer's recommendations for cleaning and refinishing panel materials, including precautions against materials and methods that may be detrimental to the quality of installation, durability and material performance.

1.5 QUALITY ASSURANCE

A. Fabricator/installer's qualifications:
   1. Firm and individuals with a minimum of 5 consecutive years experience in the fabrication and installation of specified products on projects similar in material, design, complexity and extent to this Project, and whose work has resulted in applications with a record of successful in-service performance.
   2. Only a firm authorized, certified, licensed, or otherwise qualified by the ACM manufacturer as having the necessary experience, staff, and training to fabricate and install ACM panels from manufacturer's products shall install composite metal panel materials

B. Mock-up:
   1. Before beginning work, erect a mockup at a location on the site acceptable to the City Engineer to demonstrate proposed panel installation methods, testing, color and finish.
   2. Mockup size shall be 3 panels wide minimum by full height of wall and shall show typical conditions to be found in the finished work.
   3. City Engineer will review the mockup for joint size, sealant application, fastener locations and spacing, and to determine if the work falls within acceptable ranges for color and texture variation, unevenness, appearance and workmanship.
   4. Make corrections requested by the City Engineer, or remove and replace mockup when corrective work is not acceptable. Repeat mockup until City Engineer's approval is obtained.
   5. Protect approved mockup, which will be used as a standard for all remaining work on the Project, until its removal is authorized. Remove mockup only after completion and final acceptance of the work.
   6. When properly identified for future reference, and when acceptable to the City Engineer, the mockup may remain a part of the work.
1.6 HANDLING

A. Delivery:
1. Provide cardboard covers, strippable film or other standard manufacturer's form of protection.
2. Deliver materials so they will not be damaged, deformed or discolored.
3. Exercise care in unloading, storing, and erecting panels to prevent bending, warping, twisting, and surface damage.

B. Storage:
1. Stack materials on platforms or pallets, covered with tarpaulins or other suitable weathertight ventilated covering, and protected against standing water and condensation between adjacent surfaces.
2. Store panels with one end elevated for drainage.
3. Do not store panels in contact with other materials that might cause staining, denting, or other surface damage.

C. Handling:
1. Handle panels with non-marring slings.
2. Do not bend panels.

1.7 WARRANTY

A. Warrant panels and support system components against defective materials and workmanship for 5 years after Substantial Completion against the following:
1. Structural failure.
2. Sealant failure.
3. Failure of system to meet performance requirements.
4. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
5. Delamination.

B. Replace or repair panel systems defects during the warranty period at no cost to the City.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of design is “Alucobond SL-2000” ACM panels by Alcan Composites USA, Inc. Other acceptable products/manufacturers include the following:
1. “Emburite” ACM panels by the Embury Co.
2. “Alpolic” ACM panels by Mitsubishi Chemical America, Inc.
3. Or equal.

2.2 ACCESSORIES
A. Support framing members: Hot- or cold-rolled steel members of required size and shape, conforming to the following.
   1. Stud and joist framing members: As specified in Section 05400.
   2. Aluminum extrusion panel retention members, clips, angles or panel hangers: Alloy, temper and shape required to meet or exceed performance criteria specified.
   4. Steel plates: ASTM A 283, Grade C.

B. Flashings, closure strips or metal trim: Provide flashings where required to meet or exceed performance criteria that match adjacent panel exposed surfaces in material gage and finish.

C. Clips, pins and fasteners: Concealed, non-corrosive, non-deteriorating clips pins and fasteners of quantity and type recommended by panel manufacturer that are compatible with panel face.
   1. Secure clips in the manufacturer's facility to the greatest degree possible.
   2. Pop rivet attachment of clips and accessories will not be accepted.
   3. Do not overdrive fasteners.

D. Gaskets and sealants used in panel assembly: As specified in Section 07920 and as recommended by the panel manufacturer to meet or exceed performance criteria. Color to be selected by City Engineer from manufacturer’s standard palette.

E. Dissimilar metal protection: Provide dissimilar metal protection as specified in Section 05500.

F. Fire resistance rated/impact resistant panel core material: UL classified, moisture resistant, minimum 1/2-inch thickness.
   1. Adhesive for laminating panel core: Peel strength after 3 weeks at test temperature of 180 deg. F shall achieve value 7 pounds per inch of width. Overlap shear strength after 3 weeks at a test temperature of 225 deg. F shall achieve value 38 pounds per inch of width.
   2. Sound-deadening compound: Basis of design is "Model KDC-E-162" semi-liquid sprayable paste by Kinetics Noise Control or equal.

2.3 FABRICATION

A. Manufacture panels under controlled environment in fabricator's plant to comply with approved shop drawings and calculations and not to exceed specified tolerances. Field fabrication of panels is not permitted.
   1. Comply with dimensions, profiles and details indicated.
   2. Pre-fabricate panels, trim, flashings and accessories to the greatest extent possible at the factory, to minimize field erection and assembly. Pre-drill panels with holes equally and symmetrically spaced and uniformly indented
   3. At the fabricator's option the holes can be punched (preferred method) or drilled.
   4. Fabricate panel joints with captive gaskets or separator strips, which provide a tight seal and prevent metal-to-metal contact, in a manner that will minimize noise from movements within panel system.

B. Install sound dampening/impact resistant panel core to back of all flat panels and formed returns. Cut carefully to fit between return edges with solid core backing material as specified herein.
1. Panels within 8 ft. of a walking surface in pedestrian areas shall receive sound deadening treatment.
2. Overspray of laminating adhesive, which may create smoke and flame spread, is not acceptable.
3. Seal panel core perimeter edges for long-term moisture/condensation resistance with fire resistant material.

C. Fabrication tolerances:
   1. Panel bow: 0.2-percent of panel dimensions in width and length but not more that 0.1875-inch.
   2. Width or length: 0.064-inch.
   3. Thickness: 0.008-inch.
   4. Squareness: Less than 0.1875-inch difference between diagonal measurements.
   5. Camber: Less than 0.032-inch.

D. Install back pans as required sealing all perimeter edges.

2.4 FINISH

A. Finish exposed aluminum surfaces with fluoropolymer coating system specified in Section 05080.

B. Prime steel parts of anchors, anchor inserts, reinforcement and supports with rust-inhibitive primer. After field welding, remove weld slag and touch-up abraded primer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions and measurements affecting the work of this Section at site.

B. Verify framework to receive panels is secure and properly aligned and properly prepared.

C. Correct conditions detrimental to the proper and timely completion of this work before proceeding with installation.

D. Do not begin installation of panels until City Engineer has accepted weather-resistant barrier.

3.2 PREPARATION

A. Prepare surfaces to be in contact with panels and panel surfaces in compliance with panel manufacturers' recommendations prior to installation of panels to framework.

3.3 INSTALLATION

A. Apply a coat of bituminous paint, concealed, on one or both surfaces wherever dissimilar metals would otherwise be in contact, except where gaskets or sealant tape are used between dissimilar metals.
B. Comply with manufacturers instructions for installation of materials, using manufacturer’s recommended accessories.
   1. Set panels accurately in their proper location, alignment and elevation.
   2. Anchor panels and other components of the work securely in place, providing for necessary thermal and structural movement without overstressing the materials and producing distortions in finished surfaces.
   3. Erect the work plumb, level and true to line so that panels in their final location and position are aligned, with uniform flush joints, and not twisted out of plane.
   4. Provide resilient gaskets or spacers between metal components, and between panels, as required to eliminate metal-to-metal contact and movement noises in the completed work resulting from thermal and structural movements without over-stressing the material, breaking connections or producing wrinkles and distortion in finished surfaces.

C. Provide means of draining condensation, which may occur behind the panel construction, to the exterior.

D. Site tolerances:
   2. Joint taper: 1/100-inch per foot of length, with a 6-foot maximum length of tapering in one direction.
   5. Deviation from plumb, 1/16-inch maximum per one story height and a of 1/8-inch maximum per 45 feet.
   6. Deviation from horizontal: 1/8-inch maximum in 30 feet.

E. Completed work shall match approved mockup.

3.4 FIELD QUALITY CONTROL

A. Each and every panel will be subject to the City Engineer's approval or rejection.

B. Panel or panels may be rejected after having been installed.

C. Carefully remove rejected panels and replace with new panels without delay and without cost to the City.

3.5 CLEANING

A. Leave protective coatings or films on panels in place as long as possible where doing so will not produce discoloration or other undesirable visual defects.

B. Remove strippable coatings when, and in the manner, recommended by panel manufacturer's instructions.

C. Clean exposed panel surfaces in compliance with the panel manufacturers’ recommendations to remove dust and other foreign materials from panel facing prior to Substantial Completion.

3.6 PROTECTION
A. Protect panels in place during the construction period to prevent damage and stains. Remove protection when no longer needed.

B. Restore damaged areas to match adjacent areas as recommended by the panel manufacturer and approved by the City Engineer.

C. Remove and replace components which have been stained, corroded, damaged, or that do not match adjacent panels, as directed by the City Engineer, at no cost to the City.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION: Division 1 applies to this Section. Provide modified bitumen sheet roofing, as indicated, specified and required.

A. Work In This Section: Principal items include:
   1. Modified bitumen roofing and insulation on metal roof decks.
   2. Cant strips.
   3. SBS modified bituminous base flashings.
   4. Traffic walkways on roofing.
   5. Supervising installation of sheet metal in connection with roofing.

B. Related Work Not In This Section:
   1. Furnishing and installing sheet metal.
   2. Metal flashing and counterflashing of mechanical and electrical penetrations through roof decks.

1.02 QUALITY ASSURANCE:

A. Manufacturer: Roofing and insulation systems shall be manufactured by a firm with a minimum of 20 years experience in the production of modified bitumen roofing systems.

B. Roofing Applicator: Authorized and approved by roofing manufacturer. Firm shall have not less than 5 satisfactory installations of comparable scope to that specified herein, performed in the local area within the last 5 years.

C. Requirements of Regulatory Agencies: Conform all work of this section to code.

D. Fire Classification: Roofing systems shall bear UL listing as a Class "A" system. Manufactured materials shall bear the appropriate UL label. Roofing installation shall meet Factory Mutual I-90 requirements.

E. Test Cuts: The City or the Architect may order test cuts of roofing, 4" by 36" size, but not more than one test cut per each 2,000 square feet of roof area. Repair test cuts as directed at no extra cost to the City.

F. Preroofing Conference and Inspection: After approval of submittals but prior to beginning installation of work of this section, Contractor shall hold a meeting at the site attended by representatives of City Engineer, Architect, Contractor, roofing, and sheet metal applicators, and the roofing material manufacturer to describe in detail the roof systems to be installed and to establish agreement, coordination and responsibilities among involved persons. The Contractor shall prepare a detailed memo of this meeting and furnish copies to the Architect and all involved persons. The roofing applicator and roofing manufacturer's technical representative shall inspect the substrates to receive work of this section and report defective conditions to the City Engineer and Contractor for correction.
G. On-Site Material Tests: One roll from each pallet of roll goods shall be tested to assure that the selvage edge thickness, roll weight and roll length meet specified requirements. Reject non-conforming materials.

1.03 SUBMITTALS:

A. Manufacturer's Qualifications: Provide a list of 5 projects of similar design and complexity completed within the past 5 years.

B. Installer's Qualifications:
   1. Provide a list of 5 projects of similar design and complexity completed within the past 5 years.
   2. Submit a certificate, prepared by the roofing system manufacturer, stating that roofing applicator is approved by the roofing material manufacturer and, upon completion, submit a certificate stating that the roofing systems have been installed in conformance with approved submittals and manufacturer's recommendations.

C. Product Data: Submit manufacturer's product data including installation instructions.

D. Drawings: Submit details, prepared by manufacturer of roofing, specially prepared for each condition of the work. Show all adjoining work, and indicate methods of adhesion and attachment, laps, and related conditions.

E. Samples: Submit samples, not less than 12" square of each type of roofing, on plywood. Submit 12" square samples of walkway.

F. Application Recommendations: Submit manufacturer's detailed application instructions for the work, including each step of insulation and roofing application and flashing installation.

G. Code Approvals: Submit evidence indicating compliance with local building codes, specified fire ratings and LEED ratings.


1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING: Deliver manufactured materials to site in sealed factory packages with manufacturer's label and identification. Store materials at site under cover until used. Stack felt rolls on end.

1.05 JOB CONDITIONS:

A. Protection: Apply suitable impervious type masking to preclude staining of surfaces to remain exposed wherever roofing abuts or laps on to other finish surfaces, and provide additional protection as necessary to supplement masking; cover entire area of building subject to damage or staining.

B. Protection During Installation: Roofing applicator shall protect roof decks and roofing during installation of Work of this Section. Place plywood, planks, or similar suitable forms of protection to protect the roofing in place.

C. Water Cut-Offs: Cover exposed edges of insulation at end of each day's operations, and when rain is imminent, with manufacturer's recommended materials, and remove the water cutoffs when installation is resumed.

D. Torch Safety: Designate one person, acceptable to City, on each crew to perform a daily fire watch. The designated crew member shall watch for fire or smoldering materials on all areas.
where torches are being used. Continue the fire watch for not less than one hour after roofing material application has been suspended for the day.

D. Protection of Completed Roofing: Contractor shall protect the completed roofing when surfaces must be used in performance of work of other sections. Place plywood, planks, and other protection and do not permit traffic directly on the roofing or membranes. Repair all damage to roofing as approved at no extra cost to the City.

E. Weather Conditions: Do not apply work of this section if temperature of roof deck is below 40 degrees F. Do not install any materials when water in any form is present on the deck or materials are wet.

1.06 WARRANTY: Contractor, materials manufacturer and roofing applicator shall furnish to the City a written warranty against all defects in materials or workmanship and to maintain work of this section in watertight condition for 20 years; warranty shall include the roof insulation, insulation fasteners and plates, and roofing membrane, including confections to roof drainage fittings, roof penetration flashings, sheet metal in connection with roofing, and board type roof walkways.

PART 2 - PRODUCTS

2.01 MATERIALS: Except as otherwise specified, materials shall be products and systems of Siplast, Inc., 1000 East Rochelle, Irving, TX 75062, represented by Jim Conger, Rancho Santa Margarita, CA 92688 (949) 228-2129; or equal.

A. Roof System and Insulation:

1. Insulation:

   a. First layer: ASTM C 1289, Type II, Polysiocyanurate, tapered thickness as indicated, closed cell, rigid polyisocyanurate foam core material, integrally laminated between glass fiber facer, Paratherm, mechanically attached.

   b. Second layer: Gypsum core overlayment panel, 1/2" thick DensDeck, mechanically attached with Parafast fasteners.

2. Base Ply: Paradiene 20TG, glass reinforced elastomer sheet, 62 pounds per square, selvage thickness 114 mils average, 110 mils minimum, roll length 33.5 feet.

3. Top Ply: Paradiene 30TGFR, glass reinforced asphalt elastomer sheet with mineral surfacing, white, 90 pounds per square, selvage thickness 118 mils average, 114 mils minimum, roll length 25.25 feet.

B. Roof System with Aluminum Finish over Gypsum Core or Insulation as indicated:

1. Gypsum core overlayment panel: 1/2" thick DensDeck, mechanically attached with Parafast fasteners (may be omitted where insulation is indicated).

2. Insulation:
   a. First layer: ASTM C 1289, Type II, Polyisocyanurate, tapered thickness as indicated, closed cell, rigid polyisocyanurate foam core material, integrally laminated between glass fiber facer, Paratherm, mechanically attached.
   b. Second layer: Gypsum core overlayment panel, 1/2" thick DensDeck, mechanically attached with Parafast fasteners.

3. Base Ply: Irex 40, heavy duty base sheet, weighing not less than 85 pounds per square minimum, selvage thickness 110 mils average, 106 mils minimum, roll length 34 feet.

4. Top Ply: Veral, conforming to ASTM D 6298, glass reinforced aluminum faced asphalt elastomer sheet, weighing not less than 92 pounds per square, selvage thickness 150 mils average, 146 mils minimum, roll length 25.25 feet. Aluminum facing shall have reflectivity of 88 percent initially, 66 percent after 3 years, 12 percent solar absorption, 0.07 emissivity. Facing shall be uniform in appearance and shall show no discoloration or staining. Energy Star rated, LEED rated and tested.

C. Base Flashings:

1. Irex 30, glass reinforced asphalt sheet, 72 pounds per square, selvage thickness 94 mils average, 91 mils minimum, roll length 33.5 feet.

2. Veral: As specified above.

D. Roof Walkway: Siplast Paratread, modified bitumen sheet, granulated surface, protection course, 30" wide by 20 feet long, 217 mils average thickness.

E. Accessory Items:

1. Insulation fasteners: Type as recommended by insulation manufacturer for attachment to metal roof decks, length equal to insulation thickness plus one inch.

2. Compressible aggregate: Paraslope, asphalt encapsulated compressible aggregate.


4. Asphalt Mastic: PA-1021, ASTM D 4586, Type II.

5. Asphalt: PA-100 interply mopping asphalt.

6. Sealant: Neoprene caulkling, as recommended by roof system manufacturer.

7. Mineral Granules: Color and size to match membrane.

8. Aluminum powder.


10. Flashing primer: Parapro 328, 2 component acrylic primer.
11. Flashing Mastic: Parapro CR, 2 component, consisting of polymethyl methacrylate resin and reactive agent, mixed to a heavy mastic consistency.

12. Fabric: Parapro Fleece, non-woven, needle punched polyester, not less than 40 mils thick.

13. Sheet metal flashings, gravel stops, and similar items: As specified in Section xxxx.

14. Drains and lead flashings: As specified in xxxx

2.02 ROOFING SYSTEMS

A. Roofing and Insulation on Metal Decks:

Insulation, 2 layers, each layer mechanically fastened.
Base ply, torch applied.
Ply sheet, torch applied.
Coating, roller applied.

B. Aluminum Surfaced Roofing and Gypsum core overlayment panel:

Gypsum core overlayment panel, mechanically applied.
Base ply, torch applied.
Ply sheet, torch applied.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS: Verify that roof decks are clean, dry, smooth and free of sharp projections and depressions, and that sheet metal and drainage fittings are in place before starting installation.

A. Outlets: Extend lead down the side of the roof drain. Lead shall receive 18" wide strips of Paradiene 20 around its perimeter, then receive field sheet of Veral that shall extend beyond the clamping ring area. Install clamping ring.

B. Cant Strips: Provide minimum 4" high cant strips at angles between roof deck and vertical surfaces unless otherwise indicated. Fit strips flush at ends and to vertical surfaces, and bevel back from scuppers. Securely fasten strips in place with mechanical fasteners.

C. Flashing Flanges: Strip-in according to manufacturer's specifications for this Work.

D. Membrane Protection: All sleepers, pipe and equipment supports shall be set on sections roof walk way that extend a minimum of 2" in length and width beyond each block.

E. Sealant: Where membrane terminates at plumbing pipes, and at counterflashings and other flanges contacting the roofing system, apply neoprene caulking in a smooth continuous bead.

F. Water Cut-Off: Install a water cut-off at all open edges at end of day's work or when rain is imminent. Use asphalt or plastic cement and roof felts. Remove cut-offs completely prior to resumption of roofing.

G. The application of the complete roofing system, including insulation and membrane shall be finished in one operation each day, except for coatings where required.

H. The application of roofing shall follow the laying of the insulation by an amount limited by the minimum working space required for the operation.
I. Complete application of the roofing system shall be without pockets and blisters.

3.03 INSTALLATION: Conform work of this section to the roofing manufacturer's specifications as submitted and approved for this work and requirements herein.

A. Prime metal flanges, all sheet metal in contact with roofing, and lead drain flashings. Apply a uniform coating of asphalt primer.

B. Insulation Installation:

1. Attach each layer of insulation to the deck using mechanical fasteners at the rate of not less than 15 fasteners per board, in pattern recommended by insulation manufacturer. When approved by City Engineer, and when acceptable to FM I-90 requirements, both layers of insulation may be attached simultaneously. Attach insulation to top of steel roof deck ribs only. Fasteners shall penetrate the top rib by not more than one inch. Lay in parallel courses. Stagger end joints in adjoining courses. Apply insulation flush to parapets and wood nailers.

2. Cant Strips: Where indicated, provide cant strips at intersections of roof with walls, parapets, and curbs extending above roof. Wood cant strips shall bear on and be anchored to wood blocking. Fit cant strips flush against vertical surfaces. Where possible, nail cant strips to adjoining surfaces. Where cant strips are installed against non-nailable materials, install in heavy mopping of asphalt or set in a heavy coating of asphalt roof cement.

3. Protection of Applied Insulation: Completely cover each day's installation of insulation with the finished roofing on same day. Do not permit phased construction. Protect open ends of each day's work with temporary water cutoffs, and remove when work is resumed. Protect open spaces between insulation and parapets or other walls and spaces at curbs, until permanent roofing and flashing are applied. Do not permit storing, walking, wheeling, or trucking directly on insulation or on roofed surfaces. Provide smooth, clean board or plank walkways, runways, and platforms near supports, as necessary, to distribute weight.

C. Membrane Installation: Lay roofing sheets free of wrinkles, creases or fishmouths. Lay sheets directly behind asphalt applicator. Exert sufficient pressure on the roll during application to eliminate air pockets.

1. Starting at the low point of the roof, apply full width base ply sheets lapping each sheet 3" sides and ends. Torch apply. Extend ply to top of cant, adhere with torch only to bottom of cant. Leave sheet dry on cant.

2. At completion of installation of base ply, inspect the roof area for depressions. Fill with compressible aggregate set in hot asphalt. Heat and apply asphalt at equiviscous temperature (EVT) specified by roofing manufacturer. Roll the completed installation to smooth surface level or sloped to match adjoining roofing. Do not proceed until roof surface is in true planes throughout.

3. Starting at the low point of the roof, apply full width top ply sheets lapping each sheet 3" sides and ends. Torch apply. Stagger laps with the layer below. Extend ply to top of cant.

3. Loose ceramic granules of matching color shall be broadcast over excess bitumen seepage, spillage, etc., while the surface is still tacky to ensure a monolithic surface color.

D. Flashing: Complete all flashings daily as work progresses. Install flashing in 3' lengths, using selvage edge for laps.
1. **Base Flashings:** Set stripping ply between base ply and top ply of roofing. Torch apply. Flashing shall extend out 4” on the vertical and horizontal planes. Side laps shall be 3”.

2. **Top Flashing Ply:** Off-set top flashing ply with the layer below. Extend flashing ply 4” onto horizontal surfaces, and not less than 8” up vertical surfaces, and sufficient height to extend 3” behind counterflashing. Fasten at 9” centers under counterflashing.

B. **Edge Metal:** Prime metal flanges and allow to dry prior to installation. Turn the base ply down 2 inches past the roof edge and over the nailer. After the base ply and continuous cleat have been installed, set the flange in mastic and stagger nail at 3 inches on center. Strip in the flange using the stripping ply material, extending a minimum of 4 inches beyond the edge of the flange. Terminate the finish ply at the gravel stop rise of the edge metal. Apply a smooth continuous bead of sealant at the exposed finish ply edge transition to metal flashings incorporated into the roof system.

F. **Lead Pipe Flashings:** Prime the lead flanges and allow to dry before installation. After the base ply as been installed, set the flange in mastic and strip in the flange using the stripping ply material, extending a minimum of 4 inches beyond the edge of the flange. Terminate the finish ply at the flange sleeve juncture of the pipe flashing. Apply a smooth continuous bead of sealant at the exposed finish ply edge transition to metal flashings incorporated into the roof system.

G. **Lead Drain Flashings:** Prime the lead drain flashing and allow to dry prior to installation. After the base ply has been applied, set the lead flashing sheet in mastic and form to turn down inside of the drain bowl. Ply-in the perimeter of the lead flashing using an additional layer of the base ply material, overlapping the perimeter of the lead a minimum of 4 inches. Terminate the finish ply to extend beneath the clamping ring seal. Install the clamping ring with all bolts in place.

E. **Pipe and Equipment Penetrations:** On top of finished roofing ply, before coatings, where applicable are applied, flash pipe and equipment penetrations as follows:

1. Clean and prepare galvanized metal surfaces using flashing metal cleaner and primer.
2. Apply flashing mastic at rate of approximately 0.4 pounds per square foot.

F. **Expansion Joints:** Construct as detailed, and as shown on the approved shop drawings.

G. **Parapet Wall Flashing:** Prime surface, apply torch flashing ply over the wall.

H. **Walkway Areas:** Install only on clean dry surface of roofing. Cut roof walkway rolls into straight, uniform, 5 foot lengths, and allow to relax until flat. Do not make cuts on the roof surface. Position sections leaving a uniform distance between sections of 2” for drainage. Adhere to surface of roofing with plastic cement in daubs approximately 5” square, 3/8” thick.
I. Connections of Roofing Systems: Where aluminum surfaced roofing meets the roofing and insulation system, proceed as follows. Extend the base and top plies of the roofing on the flat roof up the slope not less than 8 inches. Cover the slope with the aluminum surfaced roofing, and extend base and top plies out over the flat roof not less than 8 inches. Torch apply each layer. Terminate the aluminum surfaced roofing in a neat, straight line.

3.03 CLEANING: Clean and repair surfaces to remain exposed that are stained or defaced by Work of this Section. Where cleaning or repairs are not acceptable, remove the defective Work and provide new Work of the same kind as directed, at no extra cost to The City.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. General: For LEED requirements refer to and comply with Section 01351 Environmental Procedures.

B. Section includes:
   1. Fully adhered, single-ply membrane roofing system.
   2. Roofing insulation, fasteners and anchors to attach the roofing insulation to substrates indicated.
   3. Roofing membrane-clad sheet metal flashings at the perimeter and penetrations of the roofing membrane system.
   4. Walkways.
   5. Accessories such as primers, adhesives and sealants required for a complete and watertight system.
   6. Preparation of substrates to receive roofing membrane.
   7. Supplementary parts and components, such as clips, fasteners, supplementary framing, and other miscellaneous accessories required for a complete installation.

C. Related work:
   1. Division 6 for wood nailers and blockings.
   2. Other sections of Division 7 for other building insulation, other flashings and for other joint sealants.

1.2 DEFINITIONS

A. Adhesion: Adhesion is defined as tenacious gripping of membrane to substrate such that, upon attempt of its removal, the membrane fails cohesively and cannot be cleanly extracted from the substrate.

B. Cohesion: Cohesion is defined as the ability of the elements of the membrane to stick or hold together in a mass that resists separation from each other.

C. Conditioned R-value: 6-month conditioned thermal values as determined by the Polyisocyanurate Insulation Manufacturer’s Association (PIMA) Thermal Conditioning Procedure.

1.3 SYSTEM DESCRIPTION

A. Roofing system: Provide the following, from the substrate out:
   1. Concrete substrate.
   2. Rigid insulation.
3. Cover board.
4. Adhesive.
5. Roofing membrane.

1.4 SUBMITTALS

A. Data:

1. Submit a list of proposed products, materials and components to be provided for a complete installation, along with their manufacturer’s product data, specifications, typical installation details and other data as necessary to demonstrate compliance with the specified requirements for each item listed.
2. Submit sample copies of warranty to be furnished under this Section with terms, conditions, and time periods for the warranty clearly defined.
3. Submit manufacturer’s information including Energy Star Rating, reflectivity and emissivity values, including testing methods.

B. Shop drawings:

1. Submit large scale, dimensioned shop drawings indicating materials and methods of installation. Provide plan drawings showing outline of roof areas and their respective size, tapered insulation topographic plans, and drainage patterns.
2. Furnish details of roofing terminations and protection of roofing membrane edges, including locations such as building joints, parapets, curbs, edges, openings, tie-ins to other roofing systems and other project-specific conditions. Show all flashings, sealants and other accessories and components required for a weathertight installation.
3. Include details showing each roofing membrane penetration configuration at every construction assembly penetrated for each type of penetrating item. Show all flashings, sealants and other accessories and components required for a weathertight installation.

C. Samples:

1. Submit 12-inch square samples of single-ply roofing membrane with a welded joint seam at third point.
2. Submit 12-inch long samples of each roofing membrane-clad sheet metal profile proposed for the Work.

D. Certificates: Prior to the start of the work of this section, submit the following:

1. Submit a letter from the roofing insulation manufacturer indicating acceptance for use and performance of the product within the proposed system.
2. Submit technical acceptance of roofing insulation from roofing membrane manufacturer.
3. Submit certifications by producers of roofing and insulating materials that materials supplied comply with requirements of the identified ASTM and industry standards.
4. Submit certification that roofing system specifications meet all identified code and insurance requirements.
5. Submit letters of acceptance from the roofing membrane manufacturer, the roofing installer and the City’s waterproofing consultant verifying their acceptance of the substrates as satisfactory to receive the work.
E. Manufacturer’s Instructions: Submit manufacturer-prepared instructions concerning the proper surface preparation and roofing membrane installation.

F. Manufacturer’s field reports: Provide roofing membrane manufacturer’s written acceptance of the installed roofing system stating that the Work observed has been done in accordance with the Specifications and with the roofing membrane manufacturer’s requirements.

G. Qualification statements: Submit a letter, prepared by the roofing membrane manufacturer, stating the installer is certified by the membrane manufacturer.

H. Closeout:
   1. Submit the roofing manufacturer’s recommendations for periodic inspections of the roofing membrane, and a copy of troubleshooting and maintenance recommendations.
   2. Identify common causes of damage with instructions for temporary patching until permanent patching can be made.
   3. Submit the roofing manufacturer’s recommendations for cleaning and resurfacing roofing materials, including precautions against materials and methods that may be detrimental to the quality of application, durability and material performance.

1.5 QUALITY ASSURANCE

A. Uniformity: Obtain each grade, type, composition, and variety of roofing membrane used for the Project from the same manufacturer.

B. Manufacturer’s qualifications: Obtain materials only from a manufacturer who will send a qualified technical representative to the Project site before start of this work to verify substrate acceptability.

C. Installer’s qualifications: Firm and individuals with a minimum of 5 consecutive years experience in the installation of specified systems on projects similar in material, design, complexity and extent to this Project, and whose work has resulted in applications with a record of successful in-service performance.
   1. Only a firm authorized, certified, licensed, or otherwise qualified by the roofing membrane manufacturer with the necessary experience, staff, and training to install manufacturer's products shall install specified roofing membrane.
   2. Only those installer’s personnel trained and authorized by the roofing membrane manufacturer in the procedures pertaining to the proper installation of the specified roofing membrane and accessories shall complete the Work of this section.

D. LEED Requirements: Roofing membrane must be Energy Star compliant (initial reflectivity of at least 0.65) with an emissivity of at least 0.9 when tested in compliance with ASTM 408.

E. Inspection Service:
   1. City may engage, at its expense, a qualified Inspection Service to:
      a. Review required submittals.
      b. Observe roofing systems installation
      c. Perform testing as required to verify material quantities and compliance with the Specifications and the material manufacturer’s requirements.
2. Written reports documenting roofing systems installation will be issued on a daily basis, or as otherwise directed by the Owner, to the City, City Engineer, Contractor and roofing applicator / installer.

3. Inspection Service written reports will document the following, as a minimum:
   a. Climatic conditions
   b. Crew size.
   c. Deviations noted and corrective measures required and taken based upon the Specifications and the material manufacturer’s requirements.

4. Deviations from the Specifications and manufacturer’s requirements will be brought to the attention of the roofing applicator / installer so that the appropriate corrective action can be implemented.

5. Notify Inspection Service a minimum of 48 hours prior to starting or resuming roofing work.

F. Pre-installation meeting:
   1. At least one week prior to the start of roofing membrane installation, arrange a pre-installation meeting between the Contractor, City Engineer, roofing membrane manufacturer’s representatives, roofing installer and the City’s waterproofing consultant to review system application and coordination with other trades.
   2. If more than one trade will be responsible for the work of this Section, these trades shall attend the meeting.
   3. Review the Drawings, Specifications, roofing membrane manufacturer’s installation instructions, the surfaces and substrates to receive roofing membrane and the conditions under which the roofing membrane will be installed.
   4. Review the procedures to be followed to provide proper protection of the roofing membrane during and after application.
   5. Record minutes of the meeting, decisions made, and corrective measures to be taken before application starts. Send copy of the minutes to the City Engineer no later than 3 days following the meeting.

1.6 PROJECT CONDITIONS

A. Environmental requirements:
   1. Do not install roofing membrane under adverse weather conditions, or when temperature, humidity or other environmental requirements are beyond manufacturer’s recommended limits.
   2. Proceed with the installation only when forecasted weather conditions are favorable and within ranges acceptable to the roofing membrane manufacturer.
   3. Install only as much roofing as can be made weathertight each day, including all flashing and detail work.
   4. Install uninterrupted waterstops at the end of each day’s work, and completely remove them before proceeding with the next day’s work.

B. Existing conditions: Surfaces to receive insulation, membrane and flashings shall be dry. Should surface moisture occur, provide the necessary equipment to dry surface prior to application.
1.7 HANDLING

A. Delivery:
   1. Protect materials from excessive moisture in shipment, storage, and handling.
   2. Deliver materials to project site in original unopened protective wrappings, clearly labeled with manufacturer’s labels intact and legible indicating manufacturer’s name, brand, type, source of product, date of manufacture, and UL classification on package.

B. Storage:
   1. Store materials in compliance with manufacturer’s instructions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.
   2. Store materials outdoors, off the ground on pallets, and fully protected with waterproof breathing type covers and away from combustible materials.
      a. Unvented polyethylene tarpaulins are not acceptable.
      b. Store rolls lying down.
   3. Remove damaged materials from the job site and replace at no cost to the City.
   4. Adhesive containers should be tightly closed and stored away from direct sunlight, combustible materials and sources of heat.

C. Handling:
   1. Handle products to avoid damage and prevent contamination.
   2. Inventory should be rotated. Do not use products whose shelf life has expired.

1.8 SEQUENCING

A. Do not proceed with roofing until all curbs, drains, piping, conduits and other items which will be incorporated into the roofing systems are installed.

1.9 WARRANTY

A. Manufacturer’s warranty: Warrant roofing system against defective materials and workmanship for 20 years after Substantial completion.

B. Replace or repair roofing membrane defects during the warranty period at no cost to the City. Defects include the following:
   1. Loss of waterproofing integrity, including intrusion of water, oils, gasoline, grease, salt, chemicals or acids into deck substrate.
   2. Adhesive and/or cohesive failure.
   3. Abrasion or tearing failure resulting from normal traffic.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of design is “G410” 48-mil, fully-adhered, single-ply membrane by Sarnafil Corp. Other acceptable materials/manufacturers include the following:
2. “Fibertite” 36-mil thick fully-adhered, single-ply membrane by Seaman Corp.
3. Or equal.

B. Color: White.

C. Provide Underwriter’s Laboratories (UL) Class A roof covering.

D. Provide Factory Mutual (FM) 1-90 roofing system.

2.2 INSULATION AND FASTENERS

A. Insulation: Flat polyisocyanurate material compatible with specified roofing membrane, acceptable to roofing membrane manufacturer, thickness as required to obtain a conditioned R-value of at least 19 for the insulation material only.

B. Fasteners: Self-tapping, corrosion-resistant fasteners acceptable to the roofing membrane manufacturer.

2.3 ACCESSORIES

A. Coverboard: As specified in Section 07222.

B. Flashings:
   2. “Sarnastack” vent pipe flashing fabricated from 0.048-inch thick Sarnafil G410 membrane.
   3. “Sarnacircles ‘G’” circular 0.048-inch thick G410 membrane patches welded of T-joints formed by overlapping thick membranes.

C. Pre-molded corners: “Sarnacorner” prefabricated inside and outside corners made of 0.060-inch thick Sarnafil membrane that is heat-welded to membrane or flashing.

D. Primer: As recommended by the roofing membrane manufacturer.

E. Adhesives: As recommended by the roofing membrane manufacturer for the substrate indicated and the environmental conditions under which the roofing membrane will be installed.

F. Backer rod and sealant:
   1. “Sarnafiller” 2-component urethane sealant used for pitch pocket topping.
   2. For all other sealant applications: Sealant specified in Section 07920 and acceptable to the roofing membrane manufacturer.

G. Walkways: “Sarnatread” 36-inch wide, 0.096-inch thick polyester reinforced, weldable, slip-resistant vinyl walkway in lengths and locations indicated and installed so as not to restrict the flow of water across roof surface.

H. Wood nailers: Refer to Section 06110.
1. Creosote or asphaltic-treated lumber is not acceptable.
2. Wood nailers shall conform to FM Loss Prevention Data 1-49.

I. All other materials: As recommended by the roofing manufacturer and accepted by the City Engineer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions and affecting the work of this Section at site.
B. Verify work performed by other trades complies with the roofing membrane manufacturer's tolerance recommendations for substrates to receive insulation and roofing.
C. Conduct insulation fastener pullout tests in accordance with industry standards to help verify condition of deck/substrate and to confirm expected pullout values.
   1. Perform pullout tests by the fastener manufacturer.
   2. Results of these tests plus an assessment by the fastener manufacturer regarding the suitability of the fastener for the Project are required.
D. Verify surfaces to receive roofing are clean, dry, free from projections, depressions, loose or dusting materials, oil, grease, waxy films, curing compounds, release agents and other deleterious materials that would negatively affect the quality of installation, adhesion, durability and material and system performance.
E. Correct conditions detrimental to the proper and timely completion of this work before proceeding with installation.

3.2 PREPARATION

A. Request roofing membrane manufacturer's presence before start of this work to verify substrate acceptability, and as required thereafter to review installation procedures and completed work, and to issue warranty specified.
B. Promptly repair unsatisfactory conditions disclosed by manufacturer site visits, to the satisfaction of the manufacturer and City Engineer, and have the areas re-inspected by the manufacturer before work starts or resumes in affected areas.
C. Do not start application unless surfaces to receive coatings are clean and dry, properly prepared and within acceptable temperature limits.
D. Do not begin application if precipitation is imminent or until surfaces to receive insulation and roofing membrane are clean, dry and within manufacturer's acceptable temperature range limits.
E. Protection: Protect adjacent surfaces not receive roofing materials.
   1. Use drop cloths, masking or other appropriate form of protection, as required.
   2. Close off drains and other penetrations to prevent spillage and migration of liquid coatings.
F. Surface preparation:
1. Surfaces to receive insulation and roofing membrane shall be dry. If surface moisture is present, provide the necessary equipment to dry surface prior to application.

2. Clean, repair, and prepare surfaces to receive roofing membrane in accordance with the manufacturer's installation instructions.

3. Upon completion of surface preparation, each substrate surface to receive roofing shall be separately inspected and accepted by the roofing membranes manufacturer, the roofing installer and the City's waterproofing consultant prior to beginning installation, including priming, of the roofing membrane.

3.3 WOOD NAILER INSTALLATION

A. Install continuous wood nailers at the perimeter of the roof and around roof projections and penetrations as shown on the Drawings, to match the insulation thickness and achieve a smooth transition.

B. Individual nailer lengths shall not be less than 3 feet long.

C. Anchor nailers to resist a minimum force of 300 lb. per lineal foot in any direction.
   1. Nailer fastener spacing shall be at 12 inches O.C.
   2. Stagger fasteners 1/3 the nailer width and install within 6 inches of each end.
   3. Install 2 fasteners at ends of nailer lengths. Nailer attachment shall meet this requirement and that of the current FM Loss Prevention Data Sheet 1-49.
   4. Discard and replace split nailers. Pre-drill if necessary.

3.4 INSULATION

A. Mechanically fasten insulation to substrate with approved fasteners recommended by the insulation manufacturer and the roofing membrane manufacturer, in compliance with Factory Mutual (FM) for fastening rates and patterns, so that insulation boards rest evenly on the substrate.

B. Use at least 2 layers of insulation. Stagger all joints at least 12 inches between layers.

C. Install each insulation board tightly against the adjacent boards on all sides.

D. Do not install more insulation board than can be covered with membrane by the end of the day or the onset of inclement weather.

3.5 ROOF MEMBRANE INSTALLATION

A. Comply with manufacturers instructions for installation, using manufacturer’s recommended accessories.

B. Hot air weld seams.

C. Install flashings concurrently with roofing membrane as the work progresses in accordance with the roofing membrane manufacturer’s instructions.

3.6 FIELD QUALITY CONTROL
A. Site tests and inspection: The work of this section is subject to review by the City Engineer and roofing membrane manufacturer and the City's waterproofing consultant.
   1. Examine installations for defective materials and workmanship.
   2. Inspect surfaces coated to ensure that areas have not been missed.
   3. Repair missed areas and holidays in the membrane.

B. Adhesion testing: Perform adhesion tests twice daily, but in no case less than once for each 10,000 square feet of applied membrane.

C. Quality control of welded seams:
   1. Check welded seams for continuity daily where directed by roofing membrane manufacturer's representative.
   2. Take one-inch wide cross-section samples of welded seams at least 3 times a day.
   3. Correct welds displaying failure from shearing of membrane prior to separation of weld. Patch each test cut.

D. Water test:
   1. After completing installation of roofing membrane, plug drains and other outlets, dam areas that cannot be otherwise partitioned, and test membrane in compliance with ASTM D 5957.
   2. Repair leaks and retest the membrane until proven watertight at no additional cost to the City.

E. Manufacturer’s inspection: Notify the manufacturer of job completion, by means of manufacturer's printed Notification of Completion form, in order to schedule a final inspection date.
   1. Hold a meeting at the completion of the Project, attended by all parties that were present at the pre-job conference.
   2. Note defects, track items required for completion, list items identified as being in non-compliance with Contract Documents, and itemize roofing membrane manufacturer's recommendations into a punch list. These items must be immediately corrected to the satisfaction of the City Engineer and roofing membrane manufacturer prior to demobilization.
   3. Complete, sign, and mail the punch list form to the roofing membrane manufacturer for issuance of specified warranty.

3.7 PROTECTION

A. Protect finished roofing membrane surfaces that might be subjected to damage by construction activities or materials, until the building is turned over to the City.

B. Restore damaged areas to match adjacent areas as recommended by the roofing membrane manufacturer and approved by the City Engineer.

C. Remove and replace materials that are damaged or cannot be satisfactorily repaired, as determined and directed by the City Engineer, at no cost to the City.

3.8 CLEANUP
A. Leave areas around job site free of debris, roofing materials, equipment and related items after completion of job.

END OF SECTION
PART 1 - GENERAL

1.01 DESCRIPTION: Division 1 applies to this Section. Provide prefabricated curbs and supports for equipment, pipes and ducts mounted on the roof, as indicated, specified, and required.

A. Related Work Specified Elsewhere:
   1. Roofing.
   2. Painting.

1.02 SUBMITTALS:

A. Shop Drawings: Show locations and details of standard curbs and modifications.

B. Product Data: Submit manufacturer's complete technical catalog data.

1.03 JOB CONDITIONS: Coordinate the installation of work of this section with adjoining and underlying work to assure correct and watertight work.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

Roof Products & Systems Corp.
484 N. Thomas Drive
Bensenville, IL 60106
(800) 624-8642

Custom Curb, Inc.
3005 South Hickory Street
Chattanooga, TN 37407
(800) 251-3001

Thycurb
913 South Kay Ave.
Addison, IL 60101
(800) 666-2872.

2.02 MATERIALS:

A. Curbs and supports shall be the following models of RPS, or equivalents by one of the other manufacturers listed above. All units shall be products of one manufacturer.

   Roof curbs: RPS Series RC.
   Equipment rails: RPS Series ER.
   Pipe and duct supports: RPS Pipe and Duct Mounting Pedestals.
   Pipe portals: RPS Pipe Portal.
2.03  FABRICATION:

A.  Galvanized steel curbs shall be custom fabricated to support precise equipment to be furnished. Units shall be not lighter than 14 gauge galvanized steel, reinforced internally, with mitered corners, and structural internal braces. Provide diverters for drainage of water.

B.  Integral factory-installed wood nailer, pressure and fire retardant treated. Do not use creosote or asphaltic preservatives.

C.  Curbs for mechanical equipment shall be designed to support the weight and model of equipment to be installed. Coordinate with requirements of Division 15.

D.  Insulation: Factory-installed 3 pound density fiberglass, not less than 1-1/2" thick.

E.  Tops of curbs shall be level. Units shall be arranged to accommodate roof slope indicated.

F.  Equipment rails shall be similar to curbs, except that they shall internally reinforced with an integral base plate, shall have fully mitered and welded corners, 3" cants and a factory installed nailer and cap. They shall be designed to support exact equipment to be provided on the project.

F.  Pipe mounting pedestals shall be constructed similarly to equipment rails and shall be provided with the following:

1.  Continuously threaded galvanized steel rods.

2.  Steel slide channels to permit lateral adjustment over the entire length of the channel, attached to "U" shaped mounting brackets and secured through the side of the counterflashin with lag bolts.

3.  Removable retainer brackets

4.  Rollers of appropriate size for each pipe to be supported.

G.  Duct mounting pedestals shall be constructed similarly to equipment rails and shall be provided with the following:

1.  Continuously threaded galvanized steel rods.

2.  Steel slide channels to permit lateral adjustment over the entire length of the channel, attached to "U" shaped mounting brackets and secured through the side of the counterflashin with lag bolts.

3.  Duct support bracket of correct size for each duct to be supported.

H.  Pipe portals shall be provided wherever pipes penetrate the roof. They shall be similar to curbs, except that they shall be fabricated of 18 gauge galvanized steel. Pipe portals shall be furnished with a laminated, acrylic coated, ABS plastic curb cover with prepunched holes and molded seling ring on an 8" collared opening and an EPDM compression molded cap with stainless steel snap lock clamps.

PART 3 - EXECUTION

3.01  INSTALLATION:

A.  Install curbs, rails, supports and portals as indicated on reviewed shop drawings in a watertight condition. Loads shall not be applied to a cantilever section exceeding 1 -0" in length.
SECTION 079200
SEALANTS AND CAULKING

PART 1 - GENERAL

1.01 DESCRIPTION: Division 1 applies to this Section. This Section covers the caulking of openings and joints indicated, specified, and required to make the building weatherproof and watertight, covers caulking requirements for the entire work, and pertains to all sections requiring caulking, unless specified otherwise. The following specific items shall be caulked as described.

A. All caulking and sealing indicated or required to achieve watertight and airtight construction.
B. Joints between perimeter angles of suspended ceiling systems and adjoining walls and vertical projections shall be sealed with a small bead of white silicone sealant.
C. Joints between door and window frames (jambs and heads of doors, jambs, heads and sills of windows) and adjoining interior walls shall be sealed with a small bead of silicone sealant.
D. Joints around acoustically insulated partitions shall be sealed.

1.02 SUBMITTALS:

A. Samples and Data: Submit the following:
   1. Samples of cured sealants showing full range of designated colors; obtain color instructions prior to submittal.
   2. Technical data by manufacturers of proposed materials.
   3. Material manufacturers' printed preparation and application instructions; when approved, furnish copies to others whose work requires caulking and sealants.
B. Test Reports:
   1. For all sealants: Submit manufacturer's adhesion compatibility test reports according to ASTM C794 for each substrate.
   2. For fire retardant foam and sealant: Underwriter's Laboratories, Inc. certified test reports.
C. Manufacturer's Mixing and Installation Data and Details: For fire retardant foam and sealant, submit complete application instructions and details, covering all conditions of application.
D. Certification: Provide certification that caulking and sealants installation complies with requirements of Title 24, CCR, Section 5317 for air infiltration limitations.
E. Provide special product data emissions data submittals conforming to Section xxxx, for the following materials:
1. Interior adhesives and sealants regulated by South Coast Air Quality Management District (SCAQMD) Rule No. 1168.

2. Interior refers to all building construction that is inside of an exterior weatherproofing material.

1.03 PRODUCT HANDLING: Deliver all caulking and sealant materials to the site in sealed factory-labeled containers, labels bearing statement of conformance to standards specified for each material. Store materials in accordance with manufacturer's instructions, and do not use materials for which the shelf life has expired.

1.04 WARRANTY: Furnish a written warranty against all defects in caulking and sealant materials for 5 years and defects in workmanship for 2 years, covering the following specific conditions, without limitation:

A. Water leakage through sealed joints.
B. Adhesive or cohesive failure of sealant.
C. Staining of adjacent surfaces caused by migration of sealant or primer.
D. Sealant hardened beyond Shore A hardness indicated in approved submittals.
E. Chalking or visible color changes of cured sealants.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

Dow Corning Corp.
P.O. Box 994
Midland MI 48686
(800) 248-2481

GE Silicones
260 Hudson River Road
Waterford NY 12188
(800) 255-8886

Pecora Corporation
165 Wambold Road
Harleysville PA 19438
(800) 523-6688

Sika Corporation
201 Polito Avenue
Lyndhurst NJ 07071
(800) 933-7452

Sonneborn
889 Valley Park Drive
Shakopee MN 55379
(800) 433-9517

Tremco Inc.
3735 Green Road
Beachwood OH 44122
(800) 562-2728
2.02 MATERIALS: Furnish sealants meeting following in-service requirements: Normal curing schedules are acceptable; Non-staining, color fastness (resistance to color change), and durability when subjected to intense actinic (ultraviolet) radiation are required. Furnish the products of only one manufacturer unless otherwise approved, sealant colors as selected to match the adjoining surfaces.

A. Use only interior adhesives and sealants that meet or do not exceed the VOC limits of the current requirements of South Coast Air Quality Management District (SCAQMD) Rule No. 1168 on the interior of the building.

1. Current requirements refer to the date when the materials are installed in the building.
2. Interior refers to all building construction that is inside of an exterior weatherproofing material.

B. Sealants: Subject to the above requirements, provide sealants of types as listed below, no substitutions unless specifically approved in writing for each application:

1. For joints in storefront, and other vertical and sloping surfaces, including surrounds of windows: Conform to ASTM C920, silicone based, single component, non-sag, one of the following:
   - GE Silicones SCS 2000 Series
   - Dow Corning 795
   - Tremco Spectrem 2

2. For joints in concrete, concrete masonry, and plaster walls and other vertical and sloping surfaces: Conform to ASTM C920, silicone based, single component, non-sag, one of the following:
   - GE Silicones Silpruf
   - Dow Corning 790
   - Tremco Spectrem 1 or Spectrem 3

3. For joints in wood and laminated plastic, and between these materials and gypsum wallboard walls:
   - Tremco 834 Latex
   - Pecora AC 20
   - Sonneborn Sonolac

4. For joints in horizontal surfaces, including floor slabs and paving, subjected to foot traffic: Two component, polyurethane based, self-levelling type, conforming to Fed. Spec. TT-S-00227E(3), one of the following:
   - Sonneborn SL 2
   - Vulkem 245
   - Tremco THC 900/901

5. Mildew-resistant sealant at ceramic wall tile, plumbing fixtures, etc:
   - Dow Corning 786
   - GE Silicones SCS 1700, Sanitary Sealant
   - Tremco Trensil 200
6. For joints in galvanized steel: Multicomponent nonsag urethane sealant, Type M, Grade NS, Class 25, with not less than 50 percent movement in extension and 50 percent in compression for a total of 100 percent movement, one of the following:

Vulkem 922; Mameco International.
Sikaflex - 2c NS; Sika Corporation.
DYmeric 511; Tremco.

8. For joints in all materials in food preparation, handling and serving areas:

Dow Corning 999A
Vulkem 921 (white).

B. Primers: As recommended by sealant manufacturer for each condition of application.

C. Joint Backing: Closed cell polyolefin, neoprene, polypropylene, or polyethylene, conforming to ASTM C 1330, Type B or ASTM D 5249, Type 3, permanently elastic, mildew resistant, nonmigratory, non outgassing, nonstaining and compatible with joint substrates and sealants. Joint backing shall be "SofRod" manufactured by Nomaco, Inc., 501 NMC Drive, Zebulon, NC 27597 (800) 345 -7279, Dow "Ethafoam" or Sonneborn "Sonofoam", types recommended by sealant manufacturer for each type substrate and sealant. "Sonofoam". The material shall conform to the following:

<table>
<thead>
<tr>
<th>Physical property, units</th>
<th>Test Method</th>
<th>Acceptable value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water absorption, g/cc</td>
<td>ASTM C 1016</td>
<td>0.03 - 0.10</td>
</tr>
<tr>
<td></td>
<td>Procedure B</td>
<td></td>
</tr>
<tr>
<td>Density, kg/m³</td>
<td>ASTM D 1622</td>
<td>24 - 48</td>
</tr>
<tr>
<td>Ougassing, no. of bubbles</td>
<td>ASTM C 1253</td>
<td>&lt; 1</td>
</tr>
<tr>
<td>Compression recovery, percent</td>
<td>ASTM D 5249</td>
<td>&gt; 90</td>
</tr>
<tr>
<td>Compression deflection, percent</td>
<td>ASTM D 5249</td>
<td>&lt; 20.5</td>
</tr>
<tr>
<td>Tensile strength, kPa</td>
<td>ASTM D 5249</td>
<td>&lt; 200</td>
</tr>
</tbody>
</table>

D. Bond breaker: Polyethylene tape recommended by sealant manufacturer.

E. Fire Retardant Sealant: Dow Corning "Firestop" Sealant, GE Silicones Pensil 100 or Pensil 500 Putty, 3M Brand Fire Barrier Caulk CP 25 and Putty 303, or equal, tested and listed by Underwriter's Laboratories, Inc. according to ASTM E814 and UL 1479, for two hour fire rating for sealing penetrations. When required to attain ratings, use in conjunction with Fire Retardant Foam.

F. Fire Retardant Foam: Dow Corning "Firestop" Foam 3-6548 RTV, GE Silicones Pensil 200, two-part silicone foam, tested and listed by Underwriter's Laboratories, Inc., according to ASTM E814, for two hour fire rating for sealing penetrations, when used in conjunction with Fire Retardant Sealant.
PART 3 - EXECUTION

3.01 INSPECTION: Inspect all surfaces and joints to be caulked and sealed. Report in writing those conditions that prevent correct preparation, priming, and caulking installation.

3.02 PROTECTION: Protect all adjoining surfaces and apply temporary masking tape on both sides of joints where surface staining may occur. Protect joints until sealant is cured.

3.03 JOINT PREPARATION:

A. Rake and thoroughly clean joints of mortar and other foreign materials before applying sealant. Remove coatings from metal surfaces following sealant manufacturer's written instructions, before installing metal where possible, using solvent recommended by manufacturer of metal item.

B. Clean porous surfaces by bead or water blasting as required to provide a clean, sound base surface for sealant adhesion. Remove loose particles present or resulting from blast cleaning by blowing out joints with oil-free compressed air. Wash alkaline seepage from fresh concrete.

C. Clean non-porous surfaces either mechanically or chemically. Clean with solvent and wipe dry immediately. Do not allow solvent film to accumulate on surfaces.

D. Conform to instructions from sealant manufacturer where sealants are required to be applied over painted, lacquered or waterproofed surfaces, or surfaces which have been treated with water-repellant or other coatings.

3.04 INSTALLATION:

A. Comply with sealant manufacturer's written instructions, as approved, for mixing, preparatory work, priming, application life and procedures, and protection of sealant work.

B. Prime joints before insertion of sealant back-up or joint filler material.

C. Roll backing material into joint to avoid lengthwise stretching. Do not twist, braid or puncture.

D. Sealant shall be bonded to the 2 opposite sides of joint only. Apply bond-breaker between sealant and back of joints where space for back-up material does not exist.

E. Joint spaces and surfaces shall be thoroughly dry before installation of sealant materials. Do not install sealant material during or after rain or fog.

F. Provide maximum 3/8" sealant depth unless otherwise shown. Minimum joint width shall be 1/8" for metal to metal joints and maximum 3/4" width elsewhere unless otherwise shown. Apply sealant under sufficient pressure to fill voids. Finish exposed joints smooth and flush with adjoining surface unless recessed joints are shown. Remove temporary masking as soon as joint is completed.

G. Install sealant in manner to provide uniform, continuous ribbons without gaps or air pockets, and with complete wetting of the joint surfaces equally on opposite sides. Fill joints to slightly concave surface just below adjacent surfaces.
H. Tool surfaces to form smooth, uniform surfaces with slightly concave surfaces. Finish joints straight, uniform and neat. Perform tooling before sealant films over.

I. Where horizontal joints occur between horizontal and vertical surfaces, fill joints to form a slight cove to prevent trapping moisture and dirt.

J. Take precautions to prevent leakage or other malfunction at locations where different types of sealants meet.

K. Do not allow sealants or other compounds to overflow, spill or migrate into voids of adjacent construction.

3.05 FIRE RETARDANT SEALS:

A. Fire Retardant Foam and Sealant: Mix and apply each material in accordance with manufacturer's printed instructions, and the applicable details for fire-rated penetrations, as approved. Seal all gaps and cracks, holes, the perimeters of all ducts, pipes, conduits, supports, and other items passing through fire rated floors or walls.

B. Fire Retardant Putty: Apply to voids in accordance with manufacturer's directions, to thickness required to provide fire rated construction.

3.06 CURING: Cure sealants in accordance with sealant manufacturer's printed instructions to obtain high early bond strength, internal cohesive strength and durability.

3.07 CLEANING: Clean material from surfaces not to receive sealant and restore the finish as required. If surfaces adjoining joints are stained and cleaning is not acceptable, remove the affected work and provide new work as directed and approved, at no additional contract cost.

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: [Non-rated] [and] [fire rated], [exterior] [and] [interior], hollow steel doors and frames.

1. Flush doors.
2. Stile and rail glazed doors.
3. Dutch doors.
4. Transom panels.
5. Door frames.
6. Sidelight and transom frames.
7. Fixed window frames.
8. Acoustical door and frame assemblies.
9. Door vision lights.
10. Door louvers.

B. Related sections:

1. Section 08210, “Wood Doors”: Interior wood doors to be installed in hollow steel frames.
2. Section 08710, “Door Hardware”: Hardware for steel doors.
3. Section 08800, “Glazing”: Glazing for steel doors, vision lights, and steel window frames.
4. Section 09900, “Painting”: Field painting of doors and frames.

C. See Door Schedule in Drawings for types, sizes, and fire ratings of steel doors and frames.
1.02 REFERENCES

A. American National Standards Institute (ANSI):

ANSI A250.6 Hardware on Steel Doors (Reinforcement Application).

ANSI A250.8 Specification for Standard Steel Doors and Frames.

ANSI A250.10 Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors.

ANSI A250.11 Recommended Erection Instructions for Steel Frames.

B. American National Standards Institute/Door Hardware Institute (ANSI/DHI):

DHI Handbook Recommended Locations for Architectural Hardware for Standard Steel Door and Frames.


C. American Society of Testing and Materials (ASTM):

ASTM A153 Zinc-Coating (Hot-Dip) on Iron and Steel Hardware

ASTM A366 Steel, Carbon, Cold Rolled Sheet, Commercial Quality.

ASTM A653/A653M Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.


ASTM A924 General Requirements for Sheet Steel, Metallic Coated by the Hot-Dip Process.

ASTM A1008/A1008M Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

ASTM A1011/A1011M Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.


ASTM C665 Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

ASTM E152  Test Methods for Detention Locks for Swinging Doors

ASTM E413  Classification for Rating Sound Insulation.


D. Code of Federal Regulations (CFR):


E. Door Hardware Institute (DHI):

Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames.

F. Factory Mutual (FM):

G. Green Seal (GS):

GC-03  Environmental Criteria for Anti-Corrosive Paints.

H. Military Standardization documents (MIL):

MIL-DTL-P24441/20A  Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type III.

I. National Association of Architectural Metal Manufacturers (NAAMM):

Metal Finishes Manual

J. National Fenestration Rating Council (NFRC):

NFRC 400  Procedure for Determining Fenestration Product Air Leakage.

K. National Fire Protection Association (NFPA):


NFPA 105  Recommended Practice for the Installation of Smoke-Control Door Assemblies.

L. Steel Door Institute (SDI):

SDI 111-C  Steel Doors and Frame Details.

SDI 112  Zinc-Coated (Galvanized/Galvannealed) Standard Steel Doors and Frames
SDI 117 Manufacturing Tolerances Standard Steel Doors and Frames.

SDI 125 High Frequency Hinge Preparation for Frames

M. Steel Structures Painting Council (SSPC):

SSPC SP 1 Solvent Cleaning

SSPC SP 5/NACE No 1 White Metal Blast Cleaning.

SSPC Paint 20 Zinc-Rich Primers (Type I-Inorganic, and Type II-Organic).

N. International Building Code (IBC)

O. Underwriters Laboratories (UL):

1.03 SUBMITTALS

A. Submit in accordance with Section 01330, “Submittal Procedures”:

1. Product data- Detailed technical information for each type of door and frame specified.

2. Shop drawings indicating door and frame elevations, dimensions, frame configurations and profiles, cutouts for hardware, reinforcement, anchors, and details for fabrication, glazing, and installation.

3. Door and Frame schedule: Use same reference numbers as indicated in Contract Documents. Indicate coordination of glazing frames and stops with glass and glazing requirements.

4. Certificates documenting:

   a. Fire testing: Fire-rated units have been successfully tested in accordance with Paragraph 1.4.B.

   b. R-value: Thermal units have been successfully tested in accordance with Paragraph 1.4.C.

   c. Air leakage: Exterior doors and frames have been successfully tested in accordance with Paragraph 1.4.D.

   d. Sound transmission class (STC): Acoustically rated doors have been successfully tested in accordance with Paragraph 1.4.E.

   e. Domestic steel: Steel doors and frames are manufactured from United States produced steel as required by Paragraph 2.2.A and in accordance with Quality Assurance article.
f. Ozone depleting substances (ODS): Core materials do not contain ODS as required by Paragraph 2.2.B.

g. Primer environmental criteria: Primers comply with GS GC-03 as required by Paragraph 2.2.C.

1.04 QUALITY ASSURANCE

A. Conform to the requirements of ANSI A250.8.

B. Fire rated doors and frames: Provide units that comply with NFPA 80, are identical to door and frame assemblies tested for fire-test-response characteristics per ASTM E152, and are labeled and tested by Factory Mutual (FM), Underwriters Laboratories (UL), or other National Recognized testing agency acceptable to SNL Site Fire Marshal. Units shall bear testing agency labels.

1. Oversize door assemblies: Provide certificate that assemblies exceeding fire tested assemblies sizes conform to fabrication of tested and labeled assemblies except for size.

2. Temperature-Rise Rated Doors: Provide certificate that designated assemblies have been tested to withstand 450 degree F (232 degrees C) temperature-rise in 30 minutes of fire exposure.

3. Positive pressure: Provide certificate that fire rated doors have been tested for positive pressure in accordance with IBC or NFPA.

C. Wherever practical, fit and assemble units in manufacturer’s plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at project site.

D. Thermal resistance rating: Provide certificate that flush panel exterior doors have been tested to provide minimum R-value of 3.8 when tested in accordance with ASTM C .

E. Air-leakage: Provide certificate that exterior doors and frames have been tested in accordance with NFRC 400 as door assembly with weather-stripping and gaskets specified in Section 08710, “Door Hardware” to provide maximum air leakage of 0.4 cubic feet per minute per square foot.

F. Sound transmission class: Provide certificate that door assemblies have been tested in accordance with ASTM E413 and ASTM E1408 to achieve minimum sound transmission class (STC).

1. Acoustically rated flush panel doors: STC 43.

2. Flush panel doors with polystyrene core: STC 31.

3. Flush panel doors with honeycomb core: STC 33.
G. Door and window glazing: Comply with CFR 16-CFR 1201 and other applicable safety requirements. Each piece of safety glazing shall be permanently labeled with appropriate marking.

1.05 PRODUCT HANDLING

A. Frame spreaders: Before shipment, install temporary spreaders at bottom of frames; do not remove until frames are in place.

B. Protection: During shipping and storage protect doors with cardboard or other resilient packaging. Immediately remove wrappings that become wet.

C. Inspection: Upon delivery, inspect units. When approved by Contracting Officer, minor damage may be repaired such that repaired item matches undamaged items. Remove and replace all other damaged units.

D. Storage: Store under cover in dry, vented, humidity free, protected space. Place units on 4 inch high blocking with 1/4-inch air circulation spaces between units.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Ceco Door Products; Milan, Tennessee; (www.cecodoor.com).

B. Curries Company; Mason City, Iowa; (www.curries.com).

C. Republic Builders Products; McKenzie, Tennessee; (www.republicdoor.com).

D. Steelcraft; Cincinnati, Ohio; (www.steelcraft.com).

2.02 MATERIALS

A. Steel: Manufactured in United States.

1. Cold-Rolled Steel Sheet: Commercial quality, stretcher level for flatness complying with ASTM A366 and ASTM A1008/A1008M.

2. Galvanized Steel Sheet: Zinc-Coated carbon steel commercial quality, complying with ASTM A924 and ASTM A653/A653M, with A60 or G60 coating designation, mill phosphatized.

3. Hot-Rolled Steel Sheet: Comply with ASTM A1011/A1011M.

B. Door core: Materials not containing ozone-depleting substances (ODS), including CFC (Chlorofluorocarbon) or HCFC (Hydrochlorofluorocarbon) blowing agents. NO CFC or HCFC-based insulating materials shall be furnished and installed under this contract.
1. Honeycomb: Resin-impregnated cardboard honeycomb with 1-inch maximum cells.

2. Fiberglass: Loose batt type complying with ASTM C665 with 1.5 PCF minimum density.

3. Polystyrene: Rigid, expanded, fire retardant, closed cell board complying with ASTM C578.

4. Temperature Rise Rated Door Core: Loose batt type, high-density mineral fiber with adhesive capable of limiting temperature rise in excess of 450 degrees F (232 degrees C) on un-exposed side of door.

5. Acoustically rated door core: Acoustical composite material.

C. Galvanizing Repair Paint: Comply with SSPC - Paint 20.

D. Primers:
   1. Galvanized steel: Zinc-dust, Zinc Oxide, air-dried primer complying with MIL-DTL-P24441/20A and GS GC-03.
   2. Cold rolled steel: Rust-inhibiting primer complying with ANSI A250.10 and GS GC-03 and compatible for field applied finish paint coats. Factory applied and either air-dried or thermo set.

E. Glazing: As specified in Section 08800, “Glazing”.

F. Grout: Perlite gypsum type. Mix with only enough water for stiff workable mixture.

G. Supports and Anchors: Fabricated from not less than 0.0478-inch- (1.2-mm-) thick steel sheet; 0.0516-inch- (1.3-mm-) thick galvanized steel where used with galvanized steel frames.

H. Inserts, Bolts, and Fasteners: Manufacturer’s standard units. Where items are to be built into exterior walls, hot-dip galvanize complying with ASTM A153, Class C or D as applicable.

I. Shop-Applied Paint: Rust-inhibitive primer, either air-drying or baking, suitable as base for specified finish paints on steel surfaces.

2.03 STEEL DOORS

A. Type: Hollow steel construction manufactured in compliance with ANSI A250.8.

C. Fabrication:
   1. Edges: Smooth, seamless, unbroken edges with no visible seams along hinge, lock, and face surfaces. Interlocking joints shall be tack welded, filled, and ground smooth.
   2. Exterior doors: Close top and bottom edges flush as integral part of door. Seal joints against water penetration.
   3. Prepare doors to receive hardware in accordance with ANSI A250.6. Provide hardware reinforcement plates welded in place. Coordinate with hardware supplier to ensure proper preparation of doors for mounting hardware items.
   4. Coordinate cutouts for vision lights and louvers to ensure integrity of fire rated doors.
   5. Manufacturing tolerances: Comply with SDI 117.
   6. Door numbers: Permanently stamp hinge side of door with reference number as designated on Drawings.

D. Exterior Flush Panel Doors:
   1. ANSI A250.8, Grade III, Extra Heavy-Duty, Model 1 (Level A, full flush design).
   2. Face sheet: 16-gauge minimum, galvanized steel sheet.
   3. Core: Polystyrene rigid insulation.
   4. Sound transmission class: STC 31, minimum.

E. Interior Flush Panel Doors:
   1. ANSI A250.8, Grade II, Heavy-Duty, Model 1 (Level B, full flush design).
   2. Face sheet: 18-gauge minimum, cold-rolled steel sheet.
   3. Fabricate according to SDI 112.
   4. Face Sheet: 18-gauge minimum cold rolled steel sheet.
   5. Core: Honeycomb.

F. Interior and Exterior Stile and Rail, Full Glazed Steel Doors:
   1. ANSI A250.8, Grade III, Extra Heavy-Duty, Model 3.
   2. Stiles and rails: Tubular sections fabricated from 16-gauge minimum, galvanized steel sheet.
3. Minimum Dimensions:
   a. Stiles and top and intermediate rails: 5-1/2 inches.
   b. Bottom rails: 12 inches.


5. Stile and rails joints: Stiles shall extend full height of door. Rails shall mechanically join stiles with flush joint filled and ground smooth.

G. Interior Temperature Rise-Rate, Flush Panel Doors:
   1. ANSI A250.8, Grade II, Heavy-Duty, Model 2.
   2. Face sheet: 18-gauge minimum, cold rolled steel sheet.
   3. Core: Mineral fiber capable of limiting temperature rise in excess of 450 degrees F (232 degrees C) on un-exposed side of door.

H. Thermal-Rated (Insulating) Assemblies: Where shown or scheduled, provide doors fabricated as thermal-insulating assemblies and tested in accordance with ASTM C1363 on fully operable door assemblies.
   1. Unless otherwise indicated, provide thermal-rated assemblies U-value rating of 0.41 Btu/square foot x h x degree F (2.33 W/sq. m x K) or better.

   Air leakage for thermal-rated assemblies shall not exceed 0.4 cubic feet per minute per square foot, as determined in accordance with NFRC 400.

I. Exterior Steel Stiffened, Flush Panel Doors:
   1. ANSI A250.8, Grade III, Extra Heavy-Duty, Model 2.
   2. Face sheet: 16-gauge minimum, galvanized steel sheet.
   3. Core: Doors reinforced with 20-gauge hat shaped steel stiffeners at 6 inches maximum welded to inside face sheet. Areas between stiffeners filled with fiberglass insulation.

J. Interior Steel Stiffened, Flush Panel Doors:
   1. ANSI A250.8, Grade II, Heavy-Duty, Model 2.
   2. Face sheet: 18-gauge minimum, cold rolled steel sheet.
   3. Core: Doors reinforced with 20-gauge hat shaped steel stiffeners at 6 inches maximum welded to inside face sheet. Areas between stiffeners filled with fiberglass insulation.

K. Exterior, Acoustically Rated, Flush Panel Doors:
   1. ANSI A250.8, Grade II, Heavy-Duty, Model 2.
2. Face sheet: 16-gauge minimum, galvanized steel sheet.

3. Core: Composite acoustical material placed in all door voids to stiffen, insulate, and sound deaden door panel and provide minimum sound transmission class (STC) of 43.

L. Interior, Acoustically-Rated, Flush Panel Doors:

1. ANSI A250.8, Grade II, Heavy-Duty, Model 2.
2. Face sheet: 16-gauge minimum, cold rolled steel sheet.
3. Core: Composite acoustical material placed in all door voids to stiffen, insulate, and sound deaden door panel and provide minimum sound transmission class (STC) of 43.

M. Fire-Rated Doors: Provide fire-rated units as indicated in Door Schedule on Drawings. Other characteristics of fire-rated door shall be as stated on Door Schedule and specified above. Permanently attach fire-rating label to door edge.

2.04 DUTCH DOOR

A. Type: Door consisting of two leaves, one above, the other, and operated independently or together. Provide lower leaf with service shelf.

B. Construction: Same as interior flush door specified in Paragraph 2.3.E.

C. Service shelf:

1. Shape and size: As indicated on Drawings.
2. Locate top of shelf 34 inches above finish floor.
3. Fabricate from 16-gauge steel with 3/4 inch wide, double hemmed edges with welded corners.

2.05 TRANSOM PANELS

A. Type: Flush panel, 1-3/4 inch thick, fabricated same as adjoining flush door. Size as indicated on Drawings.

B. Attachment:

1. Provide 16-gauge steel reinforcing channels spot-welded to head and jambs of transom panel. Spot-weld second set of channels to doorframe. Field attach transom panels to reinforcing channels with screws.
2. Provide 3/16-inch clip angles welded to jambs of doorframe to receive and support bottom of transom panel.

C. Provide 14-gauge flat astragal spot-welded to bottom of transom panel to receive head of door panel.

D. Prepare and reinforce transom panels to receive door hardware.

2.06 DOOR GLAZING

A. Provide vision lights and glazed openings of dimensions and configurations indicated on Drawings.

B. Equip openings with glazing frames and moldings that are flush with door face. Frames for fire-rated doors shall be of size and type to maintain fire rating.

C. Glazing stops: Rectangular profile. Exterior stop to be non-removable. Interior stop to be removable snap-on type or attached with countersunk screws.

D. Glazing: Factory glaze doors with glazing as specified in Section 08800, “Glazing”:
   1. Fire Rated Interior Doors: 1/4-inch thick, clear wire glass with square mesh.
   3. Exterior doors: 1 inch thick, clear, insulating double pane, tempered safety glass.

2.07 DOOR LOUVERS

A. Door Louvers: Provide louvers according to SDI 111-C for interior doors where indicated, with blades or baffles formed of 24-gauge (0.0239-inch-) (0.6-mm-) thick cold-rolled steel sheet set into minimum 20-gauge (0.0359-inch-) (0.9-mm-) thick steel frame.
   1. Sight-Proof Louvers: Stationary louvers constructed with inverted V-shaped or Y-shaped blades.
   2. Lightproof Louvers: Stationary louvers constructed with baffles to prevent light from passing from one side to the other, any angle.

B. Equip exterior door louvers with insect screens.

C. Finish: Baked enamel factory finish. Color selected by Contracting Officer.
2.08 FRAMES

A. Provide metal frames for doors, transoms, sidelights, borrowed lights, and other openings, according to ANSI A250.8 and SDI 125, and of types and styles as shown on Contract Documents. Conceal fastenings, unless otherwise indicated.

B. Fabrication:
   
   1. Fabricate frames as welded units with mitered corners and reinforced. Welds shall be full length of joint and ground smooth. Face joints shall be seamless.
   
   2. Mortise, reinforce with plates, and drill frames to receive hardware in accordance with ANSI A250.6 and ANSI/DHI A115. Coordinate with hardware supplier to ensure proper preparation of frames for mounting hardware items.
   
   3. Prepare doorframes for 3 silencers.

C. Fire-Rated Frames: Where indicated in Door and Window Schedules on Drawings, provided fire rated frames. Attach fire rated label to each labeled frame.

D. Profile: Combination type with integral stop and trim of size and configuration shown on Drawings. Minor variations to accommodate manufacturer's standard fabrication are acceptable.

E. Sanitary stops: Where indicated in Door Schedule on Drawings, provide door jamb frames with stop cut off at 45 degrees 4 inches above floor surface.

F. Exterior frames:
   
   1. ANSI A250.8, Grade III, Extra Heavy-Duty.
   
   2. Material: 16-gauge minimum, cold-rolled or hot-rolled sheet.

G. Interior frames:
   
   1. ANSI A250.8, Grade II, Heavy-Duty.
   

H. Existing Doors in New Frames: Coordinate frame hinge and strike locations with existing doors.

I. Provide anchors for mechanical attachment of frames to adjacent structure.

   1. Masonry: Install at least three (3) wall anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb. Acceptable anchors include masonry wire anchors and masonry T-shaped anchors.
2. Metal-Stud Partition: Sheet metal Z screw attached to studs, install at least three (3) wall anchors per jamb at hinge and strike levels.

3. Wood Studs: Double flanges with pre-drilled holes for nailing to wood studs.

4. Existing Concrete: Provide pinch and dimple anchor preparation to accommodate 3/4 inch diameter pipe spacer, 3/8 inch countersunk flathead bolt, and expansion shell. Install at least three (3) completed opening anchors per jamb adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb.

5. Floor Anchors: 18-gauge, adjustable base anchor for direct attachment to floor. Attachment with powder-actuated anchors will not be allowed.

6. Anchors for galvanized frames shall have hot dip galvanized finish.

2.09 REMOVABLE MULLIONS

A. Fabricate with same material, construction, and profile as doorframe. Removable mullion shall be same width as doorframe with integral doorstops on both sides.

B. Provide 12-gauge minimum channel shaped anchors for attachment to floor and doorframe head. Removable mullion shall be slotted to fit channels.

C. On secure side, fasteners attaching removable mullion shall be concealed by closed.

2.10 WINDOW GLAZING

A. Glazing stops: Provide sidelight, transom, and window frames with channel shaped glazing stops with mitered corners. Provide permanent frame stop on secure side of glazing. On opposite side, attach stops with countersunk screws.

B. Window Glazing: As specified in Section 08800, “Glazing”:

1. Fire Rated Interior Windows: 1/4-inch thick, clear wire glass with square mesh.


3. Non-Rated Interior Windows required or indicated on Drawings to have safety glass: 1/4-inch thick, clear, fully tempered, safety glass.


5. Exterior windows required or indicated on Drawings to have safety glass: 1-inch thick, clear, insulating double pane, fully tempered safety glass.
2.11 STOPS AND MOLDINGS

A. Provide stops and moldings around solid, glazed, and louvered panels where indicated.

B. Form fixed stops and moldings integral with frame, unless otherwise indicated.

C. Provide removable stops and moldings where indicated or required, formed of not less than 20-gauge (0.0358-inch-) (0.90-mm-) steel sheets matching steel of frames. Secure with countersunk flat or oval head machine screws spaced uniformly not more than 12 inches (304.8-mm-) O.C. Form corners with butted hairline joints.

D. Coordinate width of rabbet between fixed and removable stops with type of glass or panel and type of installation indicated.

E. Glazing Stops: Minimum 0.0359-inch- (0.90-mm-) thick steel or 0.040-inch- (1.0-mm-) thick aluminum.

1. Provide non-removable stops on outside of exterior doors and on secure side of interior doors for glass, louvers, and other panels in doors.

2. Provide screw-applied, removable, glazing beads on inside of glass, louvers, and other panels in doors.

2.12 FACTORY APPLIED FINISHES

A. Cold-Rolled Steel Sheet Finishes:

1. Preparation: In accordance with SSPC-SP 1, clean with non-petroleum solvent to remove oil, dirt, grease, and other contaminants. Remove mill scale and rust to comply with SSPC SP 5/NACE No 1.

2. Pretreatment: Immediately after preparation, apply conversion coating compatible with primer.

3. Primer: Immediately after pretreatment, apply primer that complies with ANSI A250.10 acceptance criteria, GS GC-03 environmental criteria for VOC concentration limit 250 grams per liter of product minus water and chemical component restrictions, is compatible with finish paint systems indicated, and has capability to provide a sound foundation for field-applied topcoats.

B. Galvanized Steel Sheet Finishes:

1. Preparation: Clean with non-petroleum solvent to remove oil, dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas and apply galvanizing repair paint in accordance with ASTM A780, SSPC Paint 20, and GS GC-03.
2. Pretreatment: Immediately after preparation, apply conversion coating compatible with primer.

3. Primer: Zinc-Dust, Zinc-Oxide primer paint complying with performance requirements of MIL-DTL-P24441/20A and environmental criteria of GS GC-03 (VOC concentration limit of 250 grams per liter minus water and chemical component restrictions for Gloss, Semi-Gloss, and Flat).

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with approved shop drawings, manufacturer's instructions, and ANSI A250.11.

B. Install fire-rated frames and door assemblies in accordance with NFPA 80 for class indicated in Door Schedule on Drawings.

C. Placing Frames: Comply with provisions of ANSI A250.11, unless otherwise indicated.
   1. For new construction, place frames before constructing enclosing walls, and ceilings.
   2. Center in opening, plumb, square and level.
   3. Door jamb anchors: Install three (3) minimum at each jamb, at hinge and at strike locations.
   4. Floor anchors: Provide frames with minimum 18-gauge anchors for attachment to floor. For wall conditions that do not allow the use of a floor anchor, provide additional jamb anchors. Attachment with powder-actuated anchors will not be allowed.
   5. Window frame anchors: Provide and place anchors as indicated on approved shop drawings with two (2) minimum per jamb.

D. Fully grout hollow metal frames in masonry construction.

E. Seal joints around frames in accordance with Section 07900, “Joint Sealers”.

F. Glazing: Field glaze hollow steel windows in accordance with Section 08800, “Glazing”.

G. Hardware: Install door hardware in accordance with Section 08710, “Door Hardware”. Ensure gaskets and weather-stripping are provided for all exterior frames. Locate hardware as indicated on approved shop drawings or, if not indicated, in accordance with DHI “Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames”.
H. Door installation: Fit steel doors accurately in frames in accordance with ANSI A250.8 within these clearances:

1. Head and Jamb: 1/8 inch (3.2mm).
2. Bottom: 3/4 inch (19.1mm).
3. Pair of Doors Meeting Edges: 1/8 inch (3.2mm).
4. Door Face and Stop: 1/16 inch (1.6mm).
5. Fire Rated Doors: Clearances specified in NFPA 105 and NFPA 80.

I. New Doors in Existing Frames: Coordinate door hinge/strike locations with existing frames.

3.02 ADJUST AND CLEAN

A. Immediately after erection, sand smooth all rusted and damaged areas of prime coat. Touch-up with compatible, air-drying primer.

B. Check and readjust hardware items, leaving doors and frames in proper operating condition.

END OF SECTION
PART 1  GENERAL

1.01  RELATED WORK SPECIFIED ELSEWHERE

A.  Finish Hardware:  Section 08710.

B.  Glass and Glazing:  Section 08800.

C.  Thresholds:  Section 08721.

1.02  SUBMITTALS

A.  Shop Drawings:  Show details of each frame type, elevation and construction for each door type, conditions at openings, location and installation requirements for finish hardware (including cutouts and reinforcements), details of connections, and anchorage and accessory items.

1.  Include a schedule of doors and frames using the same reference numbers for details and openings as those on the Contract Drawings.

B.  Product Data:  Catalog sheets, specifications, and installation instructions for each type door and frame specified.

C.  Samples:

1.  Frames:  Corner sample of each type, 18 x 18 inches, with mortises, reinforcements, and specified finish.

2.  Doors:  Corner sample of each type showing construction, 18 x 18 inches, with mortises, reinforcements, and specified finish.

3.  Color Samples:  Manufacturer's standard colors showing maximum variation of each color.  Submit actual production sections large enough to establish the allowable color shade range.

PART 2  PRODUCTS

2.01  MATERIALS

A.  Aluminum:

1.  Extruded Shapes:  6063 alloy, T5 temper.

2.  Rolled Shapes:  6061 alloy, T6 temper.


B.  Steel Subframes:  ASTM A 36 plates, shapes and bars.

C.  Reinforcement:  Manufacturer's standard formed or fabricated steel units, of shapes, plates or bars; galvanized after reinforcement fabrication, ASTM A 123.
D. Fasteners: Aluminum, non-magnetic stainless steel, or other non-corrosive metal fasteners compatible with aluminum door components and other items to be fastened; Phillips flat-head screws for exposed fasteners (if any), finished to match fastened item.

1. Do not use exposed fasteners except for necessary application of surface mounted hardware. Use concealed screws when required for application of glazing stops.

E. Inserts: Cast iron, malleable iron, 12 gage galvanized steel, ASTM A 153, for required anchorage to concrete or masonry Work.

F. Expansion Anchor Devices: Stud type expansion shields FS FF-S-325, Group II, Type 4, Class 1.


H. Bituminous Coating: Cold-applied asphalt mastic complying with SSPC-PAINT 12, compounded for 30-mil thickness per coat.

I. Compression Weatherstripping: Replaceable stripping of either molded neoprene gaskets complying with ASTM D 2000, Designation 2BC415 to 3BC620, or molded PVC gaskets complying with ASTM D 2287.

J. Sliding Weatherstripping: Replaceable stripping of wool, polypropylene or nylon woven pile, with nylon fabric and aluminum strip backing, complying with AAMA 701.1.

K. Sealants and Gaskets: Manufacturer's standard for the fabrication, assembly and installation of the Work; guaranteed by the manufacturer to remain permanently elastic, non-shrinking, non-migrating and weatherproof.

L. Glazing Gaskets: Stripping of molded neoprene complying with ASTM D 2000, Designation 2BC415 to 3BC620, or molded PVC complying with ASTM D 2287, or molded closed-cell neoprene complying with ASTM C 509, Type II, for glazing factory-installed glass and panels, and for gaskets which are factory-installed in a "captive" assembly of glazing stops.

2.02 FABRICATION

A. Frames:

1. Fabricate door frames, and frames combining transoms, sidelights, and panel framing of formed or extruded aluminum not less than 0.125 inch thick.

2. Door Stops: Solid aluminum, not less than 1/2 inch thick x 1-3/4 inches wide with integral weatherstripping on door edge. Provide 1-3/4 inches wide continuous 1/4 inch aluminum reinforcing plate located within frame, aligned with door stop.

3. Door Stops: Manufacturer's standard integral extruded shapes.

4. Glazing Beads: Formed or extruded, not less than 0.05 inch wall thickness. Fabricate formed beads of sheet aluminum. Fasten glazing beads to frames with self-tapping screws spaced not more than 12 inches apart.

5. Glazing Beads: Manufacturer's standard integral extruded shapes.

6. Subframes: Fabricate subframe assemblies and accessories, as shown, of materials specified herein.

7. Thermal Break: Manufacturer's standard continuous thermal barrier.
B. Glazed Doors:
1. Fabricate stiles and rails of extruded aluminum tubular shapes, 1/8 inch min wall thickness, not less than 3 inches wide. Attach extrusions together by means of concealed mechanical fasteners and concealed welding.
2. Glazing Beads: Formed or extruded, not less than 0.05 inch wall thickness. Fasten glazing beads to frames with self-tapping screws spaced not more than 12 inches apart.
4. Door Edges: Lock stile edge of single acting doors shall be beveled 1/8 inch in 2 inches. Double acting doors shall have 4 inch radius rounded edges. Meeting stile edges of pairs of single acting doors shall be "V" beveled or rounded, as indicated.

C. Flush Doors: Fabricate doors with continuous, flush, unbroken surfaces without visible seams.
1. Inner Construction: Heavy extruded stiles and rails joined by welding, by steel tie rods, or both.
2. Core: Additional extruded tubing, foamed-in-place urethane foam, or phenolic resin honeycomb.
3. Face Sheets: Minimum .081 inch fastened directly to core, or minimum .040 inch laminated to 1/8 inch tempered hardboard, No. 10 pattern/smooth aluminum sheet.
4. Glass Frames: Manufacturer's standard extruded channel, continuous around opening, with formed or extruded glazing beads.
5. Louvers: Manufacturer's standard extruded and formed assemblies.
6. Door Edges: Lock stile edge of single acting doors shall be beveled 1/8 inch in 2 inches. Double acting doors shall have 4 inch radius rounded edges. Meeting stile edges of pairs of single acting doors shall be "V" bevel.
7. Astragals: Aluminum astragals, where indicated, shall overlap 3/4 inch.

D. Aluminum Tempered Glass Doors: Manufacturer's standard aluminum top and bottom rail or corner assemblies permanently fastened to 1/2 inch or 3/4 inch tempered float glass.

E. Finish Hardware Preparation: Attach concealed reinforcements and cut mortises of sizes required and where located by the approved hardware schedule, for the proper installation of finish hardware.
1. Reinforcements: 1/4 inch thick aluminum.
2. Install reinforcements within mortises at the depths required to bring the hardware surfaces flush with the door and jamb surfaces.
3. Extend reinforcements for hinges, pivots, floor hinges, 4 inches above and below mortises on side jambs and door edges.
4. Reinforce all doors not mortised for concealed door closers on both sides for surface door closer application; and all frames on both sides for closer arm application.

2.03 FINISHES
A. Preparation: After fabrication of doors and frames, but before lamination of panels (if any), prepare the aluminum surfaces for finishing in accordance with the Aluminum Association recommendations and standards. Process all components of each assembly simultaneously to attain complete uniformity of color.

B. Finish exposed aluminum door and frame components as follows:
   1. Natural Anodized Finish: NAAMM AA-M21C22A41, (minimum thickness of 0.7 mils), natural aluminum color.
   2. Colored Anodized Finish: NAAMM AA-M21C22A42 heavy colored, (minimum thickness of 0.7 mils), integral color anodized finish.
   3. Colored Anodized Finish: NAAMM AA-M21C22A32 medium colored, (minimum thickness of 0.4 mils), integral color anodized finish.
   4. Electrolytically Deposited Colored Finish: NAAMM AA-M21C22A44, (minimum thickness of 0.7 mils) electrolytically deposited color anodized finish.
   5. Color:

PART 3 EXECUTION

3.01 INSTALLATION
   A. Securely anchor sub-framing to supporting structures, plumb and level and properly prepared to receive aluminum doors and frames.
   B. Protect areas of frames and panels to be in contact with sealants and surfaces of glazing rebates and glazing beads with protective, strippable tape. Do not apply lacquer to such areas. Remove tape immediately before application of caulking or glazing compound.
   C. Paint aluminum surfaces in contact with masonry and incompatible metals with a bituminous coating.
   D. Door Installation: Fit doors accurately in their frames, with the following clearances:
      3. Bottom; no Threshold or Carpet: 3/8 inch.
      4. Bottom, at Threshold or Carpet: 1/8 inch.

3.02 PROTECTION
   A. Provide protective covering to protect aluminum doors and frames from damage or defacement after erection.

3.03 ADJUSTING AND CLEANING
   A. Final Adjustments: Check and readjust operating finish hardware items just prior to final inspection. Leave Work in complete and proper operating condition.
   B. When directed, or just prior to final inspection remove protective coverings and clean aluminum surfaces with products specifically formulated for aluminum and known to be compatible with finishes specified herein.
END OF SECTION
SECTION 08210
WOOD DOORS

PART 1 – GENERAL

1.01 SUMMARY

A. Section includes: [Non-rated] [and] [fire-rated], interior, solid core, flush doors with [wood veneer] [hardboard] face [including [transom panels] [vision lights] [louvers]].

1. Section 08110, “Steel Doors and Frames”: Hollow steel frames for wood doors.
2. Section 08710, “Door Hardware” Hardware for wood doors.
4. Section 09900, “Painting”: Field finishing of wood doors.

B. See Door Schedule in Drawings for types, sizes, and fire ratings of wood doors.

1.02 REFERENCES

A. American National Standards Institute (ANSI):
   ANSI A208.1   Particleboard, Mat-Formed Wood.

B. American Society of Testing and Materials (ASTM):
   ASTM E413   Classification for Rating Sound Insulation.

C. American Woodwork Institute (AWI):
   AWI Quality Standards.
D. Code of Federal Regulations (CFR):

E. National Fire Protection Association (NFPA):
   NFPA 80 Standard for Fire Doors and Windows.

F. Underwriters Laboratories (UL):
   UL 10B Safety Fire Tests for Door Assemblies - Neutral Pressure.

1.03 DEFINITIONS
   A. Warp: Any distortion in door plane independent of doorframe such as bow, cup, and twist.
   B. Bow: Curvature along length of door measured as deviation from straight line extended from top to bottom of door.
   C. Cup: Curvature along width of door measured as deviation from straight line extending from one door side to opposite side.
   D. Twist: Deviation of one or two door corners being out of plane from other corners.

1.04 SUBMITTALS
   A. Submit in accordance with Section 01330, “Submittal Procedures”:
      1. Product data for wood doors including:
         a. Door core and edge construction.
         b. Veneer species, cut, and matching.
         c. Factory finish materials and application.
            (1) Vision lights.
            (2) Door louvers.
      2. Shop drawings indicating door elevations, dimensions, swings, size and location of blocking for hardware, cutouts for [vision lights] [louvers], and details for fabrication and installation.
      4. Certificates Documenting:
a. Fire-Rated units have been successfully tested in accordance with Paragraph [1.5.B].

b. Acoustically rated doors have been successfully tested in accordance with Paragraph [1.5.C].

c. Recycle content for particleboard cores as required by Paragraph [2.2.C.1].

d. Door adhesives do not contain urea-formaldehyde as required by Paragraph [2.2.C.2].

5. Samples:

a. Factory finishes for selection by Contracting Officer.

b. 8 by 10 inches minimum door panel sample illustrating selected finished face, core, edges, and corner.

6. Manufacturer's instructions for preparing, hanging, installing hardware, and adjusting wood doors. [Include requirements for installing fire rated, positive pressure, and sound control doors.]

7. Copy of warranty required by Paragraph [1.8] for review by Contracting Officer.

1.05 QUALITY ASSURANCE

A. Conform to requirements of AWI Quality Standards, Section 1300, "Architectural Flush Doors".

B. Single Source Responsibility: Obtain doors from 1 (one) source and by a single manufacturer.

C. Fire-rated doors: Provide units complying with NFPA 80, identical to assemblies tested in accordance with ASTM E2074, and listed by Underwriters Laboratories (UL), or other Nationally Recognized testing agency acceptable to SNL Site Fire Marshall. Units shall bear testing agency labels.

1. Oversize Door Assemblies: Provide certificate that assemblies exceeding fire tested assembly sizes conform to fabrication of tested and labeled assemblies except for size.

2. Temperature-Rise Rated Doors: Provide certificate that door type for exit enclosures have been tested to withstand 450 degrees F, (232 degrees C) temperature-rise in 30 minutes fire exposure.

3. Positive Pressure: Provide certificate that fire rated doors have been tested for positive pressure in accordance with IBC or NFPA.

D. Sound Transmission Class: Provide certificate that door assemblies have been tested in accordance with ASTM E413 and ASTM E1408 to achieve minimum sound transmission class of STC 43 [______].
E. Door Glazing: Comply with CFR 16CFR 1201 and other applicable safety requirements. Each piece of safety glazing shall be permanently labeled with appropriate marking.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect doors by packaging and other means during delivery, storage, and handling to prevent damage and warpage.

B. Site storage: Store flat on level surface in clean, dry, well ventilated area. Protect from sunlight. Cover to keep clean, but permit air circulation.

C. Do not drag one door across another.

D. Identify each door with opening number used on shop drawings, using temporary, removable or concealed markings.

1.07 PROJECT CONDITIONS

A. Do not deliver and install wood doors until site conditions have been stabilized and will be maintained at:

1. Temperature: 60 to 90 degrees F, (15 to 32 degrees C).

2. Relative Humidity: 25 to 50 percent.

1.08 WARRANTY

A. Submit in accordance with Section 01770, “Closeout Procedures”:

1. Warranty to cover repair or replacement of defective interior wood doors for life of initial installation including:

   a. Materials and workmanship.

   b. Bowing, cupping, and twisting greater than 1/4 inch for 42 by 84 inches door panel.

   c. Telegraphing of core through veneer exceeding 0.01 inch in 3 inches.

   d. Delamination.

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Algoma Hardwoods, Inc.; Algoma, Wisconsin; (www.algomahardwoods.com).

B. Eggers Industries; Neenah, Wisconsin; (www.eggersindustries.com).

C. Marshfield Door Systems Inc.; Marshfield, Wisconsin; (www.marshfielddoors.com).

E. VT Industries, Inc.; Holstein, Iowa; (www.vtindustries.com).

F. Manufacturers of equivalent products submitted and approved in accordance with Section 01330, “Submittal Procedures”.

2.02 FLUSH DOORS WITH WOOD VENEER FACE

A. Type: Flush interior doors, 1-3/4 inches thick, solid core, 5 ply construction with wood veneer suitable for transparent finish.

B. Construction: 5 plies with stiles and rails bonded to core and assembly sanded prior to gluing crossband and face veneer to each side of core. Comply with AWI Section 1300, PC-5, Premium Grade.

C. Core: Particleboard, ANSI A208.1 1-L-1 Grade.
   1. Minimum recycled content: 50 percent post-industrial wood waste such as sawdust, shavings, and lumber scraps.
   2. Core bonding adhesive: Resins complying with ANSI A208.1 formaldehyde limits. Adhesive shall not contain urea-formaldehyde resin.
   3. Blocking: Provide 5 inches wide minimum wood blocking for installation of locksets, closers, exit devices, kick plates, and other hardware items and eliminate need for through-bolting.
   4. Bonding: Glue stiles and rails to core and sand core assembly prior to applying faces.

D. Stiles: 1-3/8 inches minimum hardwood, same species as face veneer with no visible joints.

E. Top and bottom rails: 1-1/8 inches minimum solid wood.

F. Wood veneer:
   1. Species: Plain sliced red oak, AWI Grade AA, suitable for transparent finish.
   2. Matching:
      a. Center Balance Matching: Provide an even number of equal width veneer leaves from same flitch.
      b. Book Matched: Veneers arranged in sequence with adjacent leaves forming mirror-like image.
      c. Pair Patching: Provide for doors hung in same opening.
      d. Set Matching: Provide for adjacent door pairs in close proximity.
e. Transom Match: Transom panel and adjacent door panel shall have continuous match.

G. Finish: Factory finish wood doors in accordance with AWI Quality Standard Section 1500, System TR-6, Custom Quality.

1. Type: Water-based stain followed by transparent ultraviolet cured, catalyzed polyurethane finish.

2. Color: As selected by Contracting Officer from manufacturer's full range.


5. Seal top door edge with color sealer to match door facing.

2.03 FLUSH DOORS WITH HARDBOARD FACE

A. Type: Flush interior doors, 1-3/4 inches thick, solid core, 3 ply construction with hardboard face suitable for opaque paint finish.

B. Construction: 3 plies with stiles and rails bonded to core and assembly sanded prior to applying hardboard faces. Comply with AWI Section 1300, PC-3, Economy Grade.

C. Core: Particleboard, ANSI A208.1 1-L-1 Grade.

1. Minimum Recycled Content: 50 percent post industrial wood waste such as sawdust, shavings, and lumber scraps.

2. Core Bonding Adhesive: Resins complying with ANSI A208.1 formaldehyde limits. Adhesive shall not contain urea-formaldehyde resin.

3. Blocking: Provide 5 inches wide minimum wood blocking for installation of locksets, closers, exit devices, kick plates, and other hardware items and eliminate need for through-bolting.

4. Bonding: Glue stiles and rails to core and sand core assembly prior to applying faces.


E. Top and bottom rails: 1-1/8 inches minimum solid wood.

F. Face: Hardboard.

G. Factory prime wood doors with one coat wood primer in preparation for site applied opaque paint finish.

2.04 FIRE-RATED WOOD DOORS
A. Types: Provide fire-rated wood doors as indicated on Door Schedule in Drawings. Attach fire rating label to door edge.

1. 20 minutes label: AWI FD 1/3.
   a. Wood Veneer: 5 ply with particleboard core and wood veneer face, AWI PC-5, Premium Grade as specified in Paragraph 2.2.
   b. Hardboard Face: 3 ply with particleboard core and hardboard face, AWI PC-3, Economy Grade as specified in Paragraph 2.3.

2. Mineral Core Fire-Rated Doors: AWI [FD-3/4, 45 minutes label] [FD-1, 60 minutes label] [FD 1-1/2, 90 minutes label] door with non-combustible mineral composition core.
   a. Wood Veneer: 5 ply construction with stiles and rails bonded to mineral core and assembly sanded prior to gluing crossband and face veneer to each side of core. Comply with AWI Section 1300, FD-5, Premium Grade. Wood veneer face as specified in Paragraphs [2.2.F and G].
   b. Hardboard Face: 3 plies with stiles and rails bonded to mineral core and assembly sanded prior to applying hardboard faces. Comply with AWI Section 1300, FD-3, Economy Grade.
   c. Blocking: Provide 5 inches wide minimum composite blocking for installation of locksets, closers, exit devices, kick plates, and other hardware items and eliminate need for through-bolting. Composite blocking to have improved screw-holding capability and be approved for required fire rating.

3. Intumescent hot smoke seals: Conceal in door edges chemically inert, expandable, intumescent seal designed for multi-directional expansion at 400 degrees F, (204 degrees C) filling gap around perimeter of door. [At Contractor's option, surface applied intumescent seals may be provided in lieu of concealed seals as part of Section 08710, "Door Hardware". Seals shall be tested and approved for fire rated door assemblies in accordance with UL Standard 10B.]


5. Temperature-Rise Rated Doors: Provide temperature rise rated doors for [stairwells and other] exit enclosures to withstand 450 degrees F (232 degrees C) minimum temperature-rise in 30 minutes fire exposure.

2.05 SOUND RETARDANT WOOD DOORS

A. Types: Provide sound retardant wood doors as indicated on Door Schedule in Drawings.

B. Provide sound dampening core to achieve sound transmission class of [STC-43] [_____] tested in accordance with ASTM E90 and ASTM E413.
C. Wood Veneer: 5 ply construction with stiles and rails bonded to core and assembly sanded prior to gluing crossband and face veneer to each side of core. Comply with AWI Section 1300, PC-5, Premium Grade. Wood veneer face as specified in Paragraphs [2.2.F and G].

D. Hardboard Face: 3 plies with stiles and rails bonded to core and assembly sanded prior to applying hardboard faces. Comply with AWI Section 1300, PC-3, Economy Grade.

2.06 TRANSOM PANELS
A. Type: Flush panel, 1-3/4 inches thick, fabricated same as flush door specified in Paragraph [2.2]. Size as indicated on Drawings.

B. Veneer of transom panel shall be continuous match with door panel veneer.

C. Attachment: Provide fasteners, clips and brackets as recommended by manufacturer for concealed installation of transom panel to door frame.

2.07 VISION LIGHTS
A. Provide vision lights of dimensions and configurations indicated on Drawings.

B. Type: Metal frame with countersunk mounting holes.

C. Provide fire-rated, labeled vision lights for doors indicated on Door Schedule to be fire-rated.

D. Material: 18-gauge cold-rolled steel hot dipped galvanized.

E. Finish: Factory primed.

F. Glazing as specified in Section 08800, “Glazing”:
   1. Fire rated doors: 1/4 inch clear wire glass with square mesh.
   2. Non-rated doors: 1/4 inch clear tempered safety glass.

G. Glazing stops: Rectangular profile. Exterior stop to be non-removable. Interior stop to be removable snap-on type or attached with countersunk screws.

H. Factory prepare door with cutout to receive vision light. Ship light separately as kit to be field installed in order to prevent damage to door finish.

2.08 DOOR LOUVERS
A. Type: Manufactured, metal-framed louver with fixed blades, perimeter flanges, mitered corners, and countersunk mounting holes for installation in steel doors.
   1. Non-vision inverted Y: Y shaped blades providing 50 percent free area.
   2. Non-vision inverted V: V shaped blades providing 60 percent free area.
3. Lightproof double inverted V: Two sets of V shaped blades preventing light passage with 60 percent free area.

B. Fire-rated louver: Provide fire-rated doors with metal-framed louver of type specified in Paragraph [2.8.A] and equipped with fusible link closing device. Louver shall be labeled for required fire rating.

C. Size: As indicated on Drawings.

D. Material: Cold rolled steel galvanized, 18-gauge for frame and 20-gauge for blades.

E. Finish: Baked enamel factory finish. Color selected by Contracting Officer.

F. Factory prepare door with cutout to receive louver. Ship louver separately as kit to be field installed in order to prevent damage to door finish.

2.09 FACTORY FITTING

A. Factory fit doors to coincide with designated frame opening sizes with these clearances and bevels:

1. Non-Rated Door Clearances:
   a. Head, jamb, and between double doors: 1/8 inch.
   b. Bottom of door to floor finish: 1/8 inch.
   c. Bottom of door to top of threshold: 1/4 inch.

2. Fire-Rated Door Clearances: Comply with NFPA 80.

3. Lock and hinge door edges shall be beveled 1/8 inch in 2 inches. Bevel of fire-rated doors shall not exceed that permitted by labeling agency.

B. Factory machine doors to receive hardware in accordance with AWI requirements, Section 08710, “Door Hardware”, and supplied hardware templates.

1. Machine cut relief for hinges and coring for locksets, cylinders, and other items.

2. Pilot drill screw and bolt holes.

C. Seal cut surfaces after fitting and machining. Ensure that hardware recess edges are sealed with minimum two coats varnish.

PART 3 - EXECUTION

3.01 PREPARATION
A. Inspect door and frames prior to hanging. Reject doors with defects. Verify frames are correct size and type, securely anchored, heads are level, and jambs are plumb.

B. Do not proceed until deficiencies are addressed.

3.02 INSTALLATION

A. Install wood doors in accordance with approved shop drawings, manufacturer's instructions, and AWI Custom Quality Standards.

B. Install fire-rated doors in accordance with NFPA 80 for class indicated in Door Schedule on Drawings.

C. Install sound retardant doors in sound control openings with appropriate hardware as indicated on Drawings.

D. Hang doors and install hardware [and [vision lights] [door louvers]].

E. Fitting: Align and fit doors in frames with uniform clearances and bevels. Do not trim stiles and rails in excess of limits of manufacturer and permitted for fire-rated doors. Ensure that clearances specified in Paragraph [2.9.A] are maintained.

F. Restore factory applied door finish if site fitting and machining is required.

G. Adjust hung doors for smooth and balanced movement. Rehang or replace doors that do not operate freely.

H. Field finish doors with hardboard face with opaque paint finish specified in Section 09900, “Painting”. Do not paint over fire rating labels.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES
A. Ceiling and wall mounted, non-rated access door and frame units.

1.2 SUBMITTALS
A. Submit the following in accordance with the requirements of Section 01300:
   1. Catalog data which includes sizes, types, finishes, scheduled locations, and details of adjoining work.
   2. Manufacturer's Installation Instructions and rough-in dimensions.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS
A. Cesco Products
B. J. L. Industries
C. Milcor

2.2 FABRICATION
A. Fabricate frames and flanges of 16 gauge steel.
B. Fabricate door panels of 20 gauge steel with integral non-combustible insulation filler.
C. Fabricate door panels of 14 gauge steel (non-insulated)
D. Weld, fill, and grind joints to assure flush and square unit.
D. Hardware:
   1. Hinge: 175 degree steel hinges with removable pins.
   2. Lock: Screw driver slot for quarter turn cam lock.

2.3 FINISHES
A. Base Metal Protection: Prime coat units with baked on primer.
B. Finish: Two coats acrylic enamel, white color.
PART 3  EXECUTION

3.1 EXAMINATION
   A. Verify that rough openings are correctly sized and located.

3.2 INSTALLATION
   A. Install units in accordance with manufacturer's instructions.
   B. Install frames plumb and level in openings. Secure rigidly in place.
   C. Position unit to provide convenient access to concealed work requiring access.

END OF SECTION
PART 1   GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Cylinders for Fire Rated Access Doors: Section 08710.

1.02 SUBMITTALS

A. Product Data: Catalog sheets, specifications, and installation instructions.

1.03 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Fire Rated Access Doors For Walls: Complete assemblies complying with Underwriter's Laboratories, Inc (UL) requirements for 1-1/2 hour "B Label" rating. Identify each assembly with UL label.
   2. Fire Rated Access Doors For Ceilings: Complete assemblies complying with Warnock Hersey (WHI) requirements for one-hour rating in wood-framed assemblies and three-hour rating in non-combustible assemblies. Identify each assembly with WHI label and NFPA requirement indicating "For Horizontal Installation".

PART 2   PRODUCTS

2.01 NON-FIRE RATED ACCESS DOORS FOR WALLS AND CEILINGS

A. Frames: Minimum 16 gage steel.
   1. Flange: Integral exposed flange not less than 3/4 inch wide around the perimeter.
   2. Plaster Applications: Expanded metal lath and exposed casing bead welded to perimeter of frame, in place of integral exposed flange.
   1. Acoustical Tile Applications: Frames without exposed flange.
   2. Finish: Match door panel.
   3. Anchorage, Except for New Concrete or Masonry Construction: Predrilled holes in frame for anchoring with fasteners.
   3. Anchorage for New Concrete or Masonry Construction: Adjustable metal masonry anchors.

B. Door Panel: Flush type, minimum 14 gage steel.
   1. Hinges: Concealed type set to open a minimum of 135 degrees; continuous type, or sufficient number to support the door size.
   2. Finish: Factory-applied rust inhibitive baked enamel or primer over phosphate treated steel.
C. Door Panel: Recessed type, minimum 18 gage steel with face of panel formed to provide a 1 inch recessed surface for application of finish material, and reinforced as required to prevent buckling.
   1. Hinge: Continuous type hinge.
   2. Finish: Factory-applied rust-inhibitive baked enamel or primer over phosphate treated steel.
   3. Plaster Applications: Self-furring 3.4 lb. per sq. yd. galvanized expanded metal mesh welded to panel face and casing bead welded to perimeter of panel.

D. Cam Locks: Flush, screwdriver operated; sufficient number to hold door panel in flush, smooth plane when closed.

E. Cam Locks: Flush screwdriver or key operated; sufficient number to hold door panel in flush, smooth plane when closed.
   1. One lock on each door panel shall be key operated, pin tumbler type. The remaining locks, if any, shall be screwdriver operated type.
   2. One lock on each door panel shown or scheduled shall be key operated, pin tumbler type. The remaining locks shall be screwdriver operated type.
   3. Key all locks alike. Furnish ________ keys total.

F. Sleeves (For Recessed Type Door Panels): One for each locking device.
   1. Plaster Ceilings: Integral steel sleeves welded to panel face with plastic grommet on exposed end.
   2. Acoustic Tile or Gypsum Board Ceilings: Plastic grommets for installation in holes cut thru ceiling finish material.

2.02 FIRE RATED ACCESS DOORS FOR WALLS AND CEILINGS

A. Frames: Minimum 16 gage steel, with integral exposed flange not less than one inch wide around the perimeter.
   1. Anchorage, Except for New Concrete or Masonry Construction: Predrilled holes in frame for anchoring with fasteners.
   2. Anchorage for New Concrete or Masonry Construction: Adjustable metal masonry anchors.

B. Door Panel: Flush type, minimum 20 gage steel double wall construction with insulation, equipped with automatic closer and inside release mechanism.
   1. Hinge: Concealed pin hinge or continuous hinge set to open to approximately 100 degrees.

C. Finish: Factory-applied baked enamel or primer over phosphate treated steel.

D. Automatic Latches: Direct action knurled knob or turn ring operated; sufficient number to hold door panel in flush, smooth plane when closed. Equip each latch with inside release device.
Automatic Latches: Direct action knurled knob or turn ring, or key operated; sufficient number to hold door panel in flush, smooth plane when closed. Equip each latch with inside release device.

1. One latch on each door panel shall be operated by a flush key. The remaining latches, if any, shall be knurled knob or turn ring operated type.

2. One latch on each door panel shown or scheduled shall be operated by a flush key. The remaining latches shall be knurled knob or turn ring operated type.
   a. Furnish _____ flush keys total.

3. One latch on each door panel shall have either mortise preparation or rim cylinder latch. Builders Hardware Manufacturers Association, Inc. (BHMA) standard cylinder provided under Section 08710.

4. One latch on each door panel shown or scheduled shall have either mortise preparation or rim cylinder latch. Builders Hardware Manufacturers Association, Inc. (BHMA) standard cylinder provided under Section 08710.

5. Each latch on each door panel shall be operated by a flush key.
   a. Furnish _____ flush keys total.
   b. One latch on each door panel shall have either mortise preparation or rim cylinder latch. Builders Hardware Manufacturers Association, Inc. (BHMA) standard cylinder provided under Section 08710.
   c. One latch on each door panel shown or scheduled shall have either mortise preparation or rim cylinder latch. Builders Hardware Manufacturers Association, Inc. (BHMA) standard cylinder provided under Section 08710.

2.03 FABRICATION

A. Assemble access doors as integral units complete with all parts and ready for installation. Fabricate units of continuous welded steel construction unless otherwise indicated or specified. Grind welds smooth and flush with adjacent surfaces. Anchorage devices shall be of size and type required to secure access doors to types of supports indicated on the Drawings.

1. Allowable Size Variations: Manufacturer's standard size units which vary slightly from the sizes indicated may be acceptable, subject to the approval of the Director.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the access doors in accordance with the manufacturer's printed installation instructions, except as shown or specified otherwise.

B. Coordinate access door installation with installation of supporting construction.

C. Set units accurately in position and securely attach to supports with face panel plumb or level in relation to adjoining finish surface.

3.02 ADJUSTING
A. Adjust hardware and doors for proper operation.

3.03 SCHEDULE

A. Provide non-fire rated access doors in non-fire rated construction and fire rated access doors in fire rated construction.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: [Manually operated,] [Electrically operated,] [non-rated,] [fire rated,] [exterior insulated,] [interior,] overhead coiling steel doors.

B. See Door Schedule in Drawings for types, sizes, and fire ratings of coiling steel door assemblies.

C. Related Sections:
   1. Section 05500, “Metal Fabrications”: Steel angles, supports, and framing of coiling door openings.
   2. Section 09900, “Painting”: Field painting of coiling steel doors.
   3. Section 16720, “Intrusion Alarm System”. Interface of fire-rated coiling door with fire and smoke alarm and detection systems.

D. See Door Schedule in Drawings for types, sizes, and fire ratings of coiling steel door assemblies.

1.2 REFERENCES

A. American Society of Testing and Materials (ASTM):

   ASTM A653/A653M Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

   ASTM A924/A924M General Requirements for Sheet Steel, Metallic-Coated by the Hot-Dip Process.

   ASTM 1008/A1008M Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.

   ASTM C578 Rigid, Cellular Polystyrene Thermal Insulation.

B. Door and Access Systems Manufacturers Association (DASMA):

   DASMA 105 Test Method for Thermal Transmittance and Air Infiltration of Garage Doors.

C. Factory Mutual (FM)
D. Green Seal (GS):

GC-03 Environmental Criteria for Anti-Corrosive Paints.

E. Military Standardization Documents (MIL):

MIL-DTL 24441/20A Paint, Epoxy-Polyamide, Green Primer, Formula 150, Type III.

F. National Electrical Manufacturer’s Association (NEMA)

G. Steel Structures Painting Council (SSPC):

SSPC Paint 20 Zinc-Rich Coating (Type I-Inorganic and Type II-Organic).

SSPC Paint 25 Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II.

H. Underwriters Laboratories (UL)

1.3 SUBMITTALS

A. Submit in accordance with Section 01330, “Submittal Procedures”:

1. Product data for coiling door assemblies and components.

2. Function descriptions for [electric operators] [interface with fire alarm system] [delayed release device].

3. Shop drawings indicating door assembly elevations, dimensions, [wiring diagrams,] and details for fabrication, anchorage, and installation. Reflect actual Project conditions, adjacent components, and required clearances for adjustment.

4. Certificates documenting:

   a. Domestic Steel: Coiling steel doors are manufactured from United States produced steel as required by Paragraph [2.2.A] [_____].

   b. Wind Load Resistance: Exterior units have been successfully tested for performance specified in Paragraph [2.3.C.1] [_____].

   c. Air Infiltration: Exterior units have been successfully tested for performance specified in Paragraph [2.3.C.2] [_____].

   d. R-Value: Exterior thermal units have been successfully tested for performance specified in Paragraph [2.3.F.3] [_____].

   e. Fire Testing: Fire-rated units have been successfully tested in accordance with Paragraph [2.5.C] [_____].

   f. Ozone Depleting Substances (ODS): Door insulation does not contain ODS as required by Paragraph [2.2.B] [_____].
1.4 QUALITY ASSURANCE

A. Manufacturer: Company currently manufacturing overhead coiling doors with 5 years minimum successful experience.

B. Installer: Experienced in the installation of overhead coiling doors and approved by the door manufacturer.

C. Fire-Rated Coiling Door Assemblies:

1. Provide units identical to assemblies tested and listed by Factory Mutual (FM), Underwriters Laboratories (UL), or other nationally recognized testing agency acceptable to SNL Site Fire Marshall. Units shall bear testing agency labels.

2. Oversize Door Assemblies: Provide certificate that assemblies exceeding fire tested assemblies sizes conform to fabrication of tested and labeled assemblies except for size.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inspection: Upon delivery, inspect units. Remove and replace damaged units.

B. Storage: Store components under cover, off ground, and in manner to avoid damage or distortion. Protect from corrosion and deterioration.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS


B. Overhead Door Corporation; Dallas, Texas; (www.overheaddoor.com).

C. Raynor Garage Doors; Dixon, Illinois; (www.raynor.com).

D. The Cookson Company; Phoenix, Arizona; (www.cooksondoor.com).

E. Wayne-Dalton Corporation; Mount Hope, Ohio; (www.wayne-dalton.com).

F. Manufacturers of equivalent products submitted and approved in accordance with Section 01330, “Submittal Procedures”.

2.2 MATERIALS

A. Steel: Manufactured in United States.
1. Cold-Rolled Steel Sheet: Commercial quality, stretcher level for flatness complying with ASTM A1008/A1008M.

2. Galvanized Steel Sheet: Comply with ASTM A924 and coated by Hot-Dip process in accordance with ASTM A653 to G90 coating.

B. Door Slat Insulation: Fire-retardant, closed cell, expanded polystyrene complying with ASTM C578 and not containing ozone depleting substances (ODS).

C. Galvanizing Repair Paint: Comply with SSPC Paint 20, GS GC-03.

D. Primer: Corrosion inhibiting, red oxide primer complying with SSPC Paint 25 and GS GC-03 and performance requirements of MIL-DTL 24441/20A.

1. Lead and cadmium free.

2. VOC Concentration: 250 grams maximum per liter minus water and chemical component restrictions.

2.3 EXTERIOR INSULATED OVERHEAD COILING DOORS

A. Type: [Manually operated,] [Electrically operated,] spring counterbalanced, insulated, weatherproofed, exterior, overhead coiling steel door furnished complete with guides, hardware, fastenings, operating mechanism, and accessories; Model No. [_____] as manufactured by [______].

B. Opening Sizes: As indicated on Drawings.

C. Performance Requirements:

1. Wind loading: Coiling exterior door assemblies shall withstand 25 PSF positive and negative wind loads without damage and permanent deformation.

2. Maximum Air Infiltration: 0.4 cubic feet per minute per square foot tested in accordance with DASMA 105.

Manual Chain Operation: 205 square feet.

Motor Operation: 390 square feet.

D. Operation: [Manual chain operated with endless chain and requiring 25 pounds maximum effort to open and close.] [Electric, motorized operations.]

E. Mounting: Face of wall opening.

F. Curtain:


2. Slats: Interlocking, flat-faced, double wall slat with polystyrene insulation.

   a. Nominal size: 3 inches wide by 7/8 inch deep.
b. Exterior face: 18-gauge minimum.

c. Interior face: 24-gauge minimum.

3. R-Value: 4.1 minimum.

4. Endlocks: Molded high strength nylon riveted to ends of alternate slats to hold curtain in alignment and act as thermal break between curtain and guides.

5. Bottom bar: 2 galvanized steel angles, 1/8 inch minimum thickness mounted back to back with insulated slat between.

6. Weather seals:
   a. Curtain Guides: Seals to wipe against inside and outside faces of door curtain.
   b. Hood: Air baffle and head seal.
   c. Bottom Bar: Vinyl seal.

2.4 INTERIOR OVERHEAD COILING DOORS

A. Type: [Manually operated,] [Electrically operated,] spring counterbalanced, interior, overhead coiling steel door furnished complete with guides, hardware, fastenings, operating mechanism, and accessories; Model No. [_____] as manufactured by [______].

B. Opening sizes: As indicated on Drawings.

Manual push-up operation: 80 square feet.

Manual hand-crank operation: 250 square feet.

Manual chain operation: 340 square feet.

Motor operation: 520 square feet.


D. Mounting: [Face of wall opening.] [Between jambs.]

E. Curtain:


2. Slats: Interlocking flat-faced.
b. Thickness: 24-gauge minimum.

3. Endlocks: Metal endlocks riveted to ends of alternate slats to hold curtain in alignment.

4. Bottom Bar: 2 galvanized steel angles, 1/8 inch minimum thickness mounted back to back with vinyl astragal.

2.5 INTERIOR FIRE-RATED OVERHEAD COILING DOORS

A. Type: [Manually operated,] [Electrically operated,] fire-rated, spring counterbalanced, interior, overhead coiling steel door furnished complete with guides, hardware, fastenings, operating mechanism, and accessories; Model No. [_____] as manufactured by [______].

B. Opening Sizes: As indicated on Drawings.

C. Fire Rating: [[45 minutes] [90 minutes] [3 hours] [4 hours] minimum.] [As indicated on Drawings.] Permanently attach fire-rating label to door edge.

D. Mounting: [Face of wall opening.] [Between jambs.]

E. Curtain:


2. Slats: Interlocking flat-faced.
   b. Thickness: 24-gauge minimum.

3. Endlocks: Metal endlocks riveted to ends of alternate slats to hold curtain in alignment.

4. Bottom Bar: 2 galvanized steel angles, 1/8 inch minimum thickness mounted back to back with vinyl astragal.

Manual push-up operation: 80 square feet.

Manual hand-crank operation: 250 square feet.

Manual chain operation: 340 square feet.

Motor operation: 520 square feet.

F. Operation:

2. Emergency Automatic Operation:
   
a. 160 degrees F (71 degrees C) fusible link causing door to close at speed of not less than 6 inches nor more than 24 inches per second.

b. Delayed Release Device: Provide release device wired to [heat detector] [smoke detector] [fire alarm system] as method of emergency closing.
   
   (1) Mechanism shall hold door in set position. Energizing fire alarm shall release holding mechanism after 10 seconds delay. If fire alarm is canceled within 10 seconds of activation, release device shall reset without closing of door.

   (2) Power outages of less than 10 seconds shall not release door.

c. Closing Method: During emergency, [manually operated doors close by gravity.] [motorized doors close electrically if power is present or by gravity during power failure.]

d. Closing speed: Provide governor to control speed.
   
   (1) Minimum: 6 inches per second.

   (2) Maximum: 24 inches per second.

e. Annunciator: Equip door with visual and audible warning device to provide 40 seconds warning that door is closing. Device to be operable during power failure.

3. Egress During Emergency: [Manually operated doors closed during emergency shall allow manual re-opening.] [Electrically operated doors closed during emergency shall be opened electrically using door operation controls. Door to immediately close if still in alarm.]

4. Flame and Smoke Baffle: Equip hood with 24-gauge galvanized steel baffle activated by fusible link or electromagnetic device.

2.6 ELECTRIC OPERATOR

A. Electric motor operator with pre-wired motor controls, built-in safety system, reversing magnetic controller, overload protection, electric brake, remote control station, and limit switches.
B. Motor: Constant duty, instant reversing, high-starting torque with automatic reset and thermal overload protection, Class A insulated electric motor. Unit shall be self-locking and capable of holding door in any position in case of counterbalance spring failure. Sized motor to move door in either direction from any position at 8 inches minimum per second and 12 inches maximum per second.

C. Limit Switches: Adjustable rotary type synchronized with door.

D. Clutch: Adjustable disc type.

E. Brake: Solenoid actuated drum type.

F. Control Station: Momentary contact, 3-button station with open, close, and stop functions.
   1. Interior Installations: NEMA Type 1 surface mounted enclosure.
   2. Exterior Installation: NEMA Type 4, weatherproof, surface mounted enclosure.

G. Manual Override: In case of power failure, provide auxiliary hand chain operator interlocked to disconnect motor, prevent motor operating, and release break.

H. Safety Device: Provide electric sensing edge on bottom bar to sense object in path of door and activate switch which reverses door's downward travel.

2.7 AUXILIARY COMPONENTS

A. Coiling door assemblies shall be self-supporting. Provide brackets, plates, fasteners, bracing, and other components to securely anchor to adjacent construction. Provide required bracing.

B. Fasteners and Anchors: Heavy-duty, galvanized or stainless steel of type, size, and spacing recommended by door manufacturer for secure, rigid, functional installation.

C. Curtain Guides:
   1. Constructed from 3/16 inch minimum rolled formed steel shapes.
   2. Anchor to jambs with 3/8 inch minimum diameter bolts at 30 inches minimum.

D. Counterbalance Assembly:
   1. Steel pipe barrel capable of carrying curtain load with maximum deflection of 0.03 inch per foot of opening.
   2. Heat treated steel helical torsion springs encased in pipe barrel and designed for counterbalancing curtain. Provide tension wheel for adjustment.
   3. Provide ball bearings at rotating support points.

E. Brackets: 3/16 inch minimum steel plate to support counterbalance assembly and form end closures. Attach with two minimum 1/2 inch diameter bolts.

F. Hood:
1. Rectangular enclosure of 24-gauge minimum galvanized steel sheet.
2. Internally reinforced to maintain rigidity and form and prevent sag.

G. Locking Devices:
1. Push-up and Crank Operated Doors: Interior slide bolts suitable for padlocks.
2. Chain Operated Doors: Chain keepers suitable for padlocks.

2.8 FACTORY APPLIED FINISHES

A. Factory prime galvanized and ferrous metal surfaces:
   1. Preparation: Clean with non-petroleum solvent to remove oil, dirt, grease, and other contaminants. Clean welds, mechanical connections, and abraded areas. Apply galvanizing repair paint to galvanized components.
   2. Pretreat with conversion coating compatible with primer.
   3. Primer: Apply primer to prepare units for site applied paint finish.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examination: Prior to fabrication or submittal of shop drawings, field verify size of openings and clearances. Determine installation conditions and requirements.

B. Furnish built-in anchors and inserts in timely manner to avoid delays.

3.2 INSTALLATION

A. Install overhead door assemblies in prepared openings in accordance with approved shop drawings and manufacturer's instructions.

B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

C. Fit and align door assembly including hardware, level and plumb, to provide smooth operation.

D. Doors shall be lubricated and properly adjusted to manufacturer's specifications to operate freely. Completed doors shall be free from warp, twist, and distortion.

E. Remove labels, visible markings, and clean assemblies.
3.3 FIELD QUALITY CONTROL

A. Testing: After installation, operate doors completely open, closed, and locked a minimum of three times. [Ensure perimeter of exterior doors is weathertight.] Correct deficiencies, adjust, and re-test.


C. Remove labels, visible markings, and clean assemblies.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY
   A. Section includes:
      1. Manually-operated (chain) coiling counter shutters complete with hardware, operators
         and accessories.
      2. Supplementary parts and components, such as inserts, clips, anchors, fasteners and
         other miscellaneous supports and accessories required for a complete installation.
   B. Related work:
      1. Division 5 for miscellaneous steel supports.
      2. Division 8 for overhead coiling doors.
      3. Division 8 for overhead coiling grilles.
      4. Division 9 for finish painting guides.

1.2 SUBMITTALS
   A. Data: Manufacturer's specifications, roughing-in diagrams, and installation instructions.
   B. Shop drawings: For special components and installation conditions not fully dimensioned or
detailed on manufacturer's data sheets. Show attachment details to adjacent construction.
   C. Closeout: Complete data for maintenance and operation of shutters.

1.3 QUALITY ASSURANCE
   A. Uniformity: Furnish all counter shutters made by one manufacturer.
   B. Installer’s qualifications: Shutter manufacturer or authorized distributor of the shutter
      manufacturer.

1.4 HANDLING
   A. Procedure: In accordance with Division One.

1.5 LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN (LEED REQUIREMENTS)
   A. LEED requirements for this section apply to all the construction materials of this project.
   B. The contractor shall comply with the LEED’S credit and/or prescriptive requirements of this
      section and submittal requirements of Section 01351.
C. Local / Regional Materials - The Contractor shall use a minimum of 20% (by cost) of total building materials and products that are manufactured regionally within 500 air miles from the Project site and 50% (by cost) of this regionally manufactured materials shall also be extracted, harvested, or recovered within 500 air miles from the project site. Materials under this section may contribute to the local/regional material content requirements.

1. The requirements of this Paragraph apply only to the materials listed in the Materials and Resources Tracking List to be provided to the Contractor by the Architect. (Division 15 and 16 materials shall not be included in the calculation of this credit.)

2. The Contractor shall also include information for all other materials not included in the Materials and Resources Tracking List for manufacturing locations that are within 500 air miles of the Project site.

3. The Contractor shall provide material manufacturer location information and distance from the project site for all materials identified in the Materials and Resources Tracking List.

4. The contractor shall provide the extraction location information and distance from the project site for all materials identified in the Materials and Resources Tracking List. The tracking location information mentioned above shall be in the form of signed letter from the manufacturer, product literature, and/or cut sheets.

5. Manufacturing refers to the final assembly of the components into the building product that is furnished and installed by the tradesman. An accounting of manufacturer locations for components used in a final assembly is not required.

6. The Contractor shall provide the following Submittals on the Submittal Dates identified:
   a. Local/Regional Materials Summary and Final Cost Report at the end of construction that:
      1) Lists each material separately.
      2) Identifies the name and location of each material manufacturer.
      3) Identifies the distance from the material manufacturer to the site.
      4) Identifies the extraction location of each material.
      5) Identifies the distance from the extraction location to the Project site.
      6) Identifies the cost of each material.
      7) Identifies the total materials cost for the project. (Including recycled content materials). Division 15 and 16 materials shall not be included in this total.
      8) Includes an electronic version of the Environmental Materials Usage Summary Project Form that will be provided by the Architect.

   b. Submittal Date: At the end of construction.

D. Construction Waste Management - The Contractor shall recycle, salvage, reuse, and/or donate a minimum 75% by weight (not volume), of the total construction and demolition waste, less hazardous waste materials, generated during construction of the project. Construction wastes, such as trimmings, that will be produced shall be disposed of consistent with the requirements of Construction Waste Management credit of LEED Rating System version 2.1 and Section 01351.

1. The Contractor shall provide the following Submittals on the Submittal Dates identified:
   b. Construction Waste Monthly Reports.
c. Construction Waste Final Report at the end of construction. The report shall include:
   1) The Contractor's cost of disposing of all construction, waste materials.
   2) A detailed breakdown by weight of each material type disposed of as follows:
      a) Recycling (broken down by material type).
      b) Salvage, including reuse on site.
      c) Hazardous waste disposal.
      d) Landfill.
      e) Provide electronic versions of the Construction / Maintenance / Alteration and Demolition Projects Sample Construction Waste Management Project Forms in Exhibit I and II of Section 01351.

d. Submittal Date: At the end of construction.

E. Low Emitting Materials: Volatile Organic Compounds (VOC) from paints and coatings shall not exceed the VOC and chemical component limits of Green Seal’s Standard GS-11 requirements.

PART 2 - PRODUCTS

2.1 MANUFACTURER
   A. Basis of design is model FD10 by the Cookson Co.
   B. Other acceptable manufacturers, subject to the Architect's approval in each case, include The Lawrence Co., Cornell Iron Works and Pacific Rolling Door Co.

2.2 BASIC MATERIALS
   A. Sheet steel: ASTM A 653 CQ or DQ, with a G90 galvanized coating.
   B. Structural shapes and plates: ASTM A 36.
   C. Iron castings:
      2. Ductile cast iron: ASTM A 536.

2.3 COMPONENT MATERIALS
   A. Endlocks: Heavy malleable iron castings.
   B. Guides and guide supports: Hot-rolled steel sections.
   C. Hood: 24-gage sheet steel.
   D. Barrel: Steel pipe.
   E. Gears: Cast iron.
   F. Brackets: Cold-formed galvanized steel plates or hot-rolled sections.
G. Bottom bar: Tubular steel.

H. Curtain slats: 22-age steel; style equivalent to slat No. 10 by the Cookson Co.

2.4 FINISH MATERIALS

A. Galvanizing: ASTM A 653, coating designation G90.

B. Pretreatment for primer: Phosphate coating in compliance with manufacturer's standard.

C. Primer: Manufacturer's standard rust-inhibitive primer applied to a minimum of one mil DFT.

D. Finish coat: Thermo-setting polyester, each side, 0.6 mil DFT.

2.5 FABRICATION

A. Curtain:
   1. Fabricate with endlocks securely attached to both ends of alternate slats with a minimum of 2 galvanized rivets.
   2. Reinforce top slat.
   3. Provide a tubular bottom rail attached to the lower slat.

B. Guides: Tubular steel profiles forming a groove for the curtain, and extended above counter shutter opening to support coil brackets.

C. Brackets: Manufacturer standard design, with bellmouth guide groove for curtain.

D. Gears:
   1. Cast iron with teeth cast from machine cut patterns.
   2. The pinion gears shall not be less than 3-inch pitch diameter.
   3. Gear ratio shall be designed for a maximum manual effort of 30 lbs.

E. Barrel:
   1. Not less than 4-inch diameter steel tubing designed to limit maximum deflection to 0.03-inch/ft.
   2. Oil-tempered torsion springs shall be capable of correctly counterbalancing weight of curtain and be adjustable by an exterior wheel.

F. Hood: Square steel box attached securely to the brackets.

2.6 OPERATION

A. Normal operation: Push-up type with finger slots in bottom rail, and an interior slide bolt or thumb-turn locks for locking the shutters when closed.

PART 3 - INSTALLATION

3.1 EXAMINATION

A. Examine adjacent construction and supports.
B. Verify that openings are within allowable tolerances, plumb, level, clean, will provide a solid anchoring surface, and that other conditions detrimental to the proper or timely completion of this work are corrected before proceeding with installation.

3.2 INSTALLATION

A. Install shutters and their operating equipment in compliance with the shutter manufacturer's printed instructions, plumb, in true alignment, free of springing, forcing, racking or distortion.

B. Provide necessary hardware, jamb and head mold stops, anchors, inserts, hanger, equipment supports and other accessories required for a complete installation.

C. Attach guide assembly to walls with galvanized bolts (in expansion shields for masonry walls) for a rigid installation. Place anchor bolts to be concealed from security side when shutters are closed.

D. When the installation is complete, lubricate, test and adjust the shutters to operate easily, free from warp, twist or distortion with a tight fit for the entire perimeter.

3.3 TOUCHUP

A. Touchup damaged shop primer by cleaning and sanding the damaged area and applying the same paint as that used for shop painting.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Aluminum doors and frames
B. Vision glass
C. Door hardware
D. Perimeter sealant

1.2 SYSTEM DESCRIPTION

A. Aluminum entrances and storefront system includes tubular aluminum sections [with supplementary internal support framing], shop fabricated, factory finished; vision glass; related flashings, anchorage and attachment devices, and sealant.

1.3 PERFORMANCE REQUIREMENTS

A. Design and size components to withstand dead and live loads caused by positive and negative wind pressure acting normal to plane of wall, to a design pressure of 22 psf measured in accordance with ASTM E330.
B. Limit mullion deflection to flexure limit of specified glass, with full recovery of glazing materials.
C. Accommodate, without damage to components or deterioration of seals, movement between system and peripheral construction, dynamic loading and release of loads, and deflection of structural support framing.
D. Limit air infiltration through assembly to 0.10 cfm, measured at a reference differential pressure across assembly of 6.24 psf as measured in accordance with ASTM 283.
E. Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.
F. Eliminate water leakage when tested in accordance with ASTM E331 with a test pressure of up to 12 psf.
G. Provide for expansion and contraction within system components caused by cycling temperature range of 70 degrees F over a 12 hour period without causing detrimental effect to system components and anchorage.
H. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to the exterior by a weep drainage network.

1.4 SUBMITTALS

A. Submit the following in accordance with requirements of Section 01300.
1. Catalog data indicating component dimensions, describing components within assembly, anchorage and fasteners, glass, door hardware, and internal drainage details.

2. Calculations or load tables indicating framing member structural and physical characteristics and dimensional limitations.

3. Shop drawings indicating system dimensions, framed opening requirements and tolerances, affected related work and expansion and construction joint locations and details.

4. Two samples of at least 6 square inches of aluminum material finish.

5. Manufacturer’s warranty and ensure forms have been completed in Owner’s name and registered with the manufacturer.

1.5 QUALITY ASSURANCE


B. Conform to requirements of ANSI A117.1.

C. Use products of a company specializing in manufacturing aluminum glazing systems with minimum of 10 successfully completed projects of similar size and scope as this project.

D. Use a Professional Structural Engineer to design supplementary framing components.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not install sealants when the temperature is less than the manufacturer’s recommended minimum temperature for installation and curing.

1.7 WARRANTY

A. Provide a manufacturer’s warranty that provides correction of defective Work within a period of 5 years after beneficial occupancy.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Arch Amarlite

B. Kawneer

C. United States Aluminum

2.2 MATERIALS

A. Use extruded aluminum conforming to ASTM B221.

B. Use sheet aluminum conforming to ASTM B209.

C. Use steel sections conforming to ASTM A36, shaped to suit mullion sections.]
D. Use stainless steel or galvanized steel fasteners.

E. Use sealants specified in Section 07900.

2.3 COMPONENTS

A. For exterior applications use frame material with 2 by 4 1/2 inch nominal dimensions; thermally broken, with interior tubular section insulated from exterior; flush glazing stops; drainage holes; internal weep drainage system.

B. For interior applications use frame material 1 3/4 by 4 inch nominal dimension; not thermally broken; flush glazing stops.

C. For exterior applications of reinforced mullions use standard thermally broken frame with internal steel member reinforcement.

D. Use doors 1 7/8 inch thick; 3 3/16 inch top rail; 3 1/2 inch vertical stiles; 7 1/2 inch bottom rail; square glazing stops.

E. Use flashings of aluminum with finish to match mullion sections.

2.4 HARDWARE

A. Use manufacturer’s standard tubular shape pull that coordinates with exit device specified in Section 08710.

B. All other hardware is specified in Section 08710.

2.5 FABRICATION

A. Fabricate components with minimum clearance and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.

B. Accurately fit and secure joints and corners. Make joints flush, hairline and weatherproof.

C. Prepare components to receive anchor devices. Fabricate anchors.

D. Install fasteners and attachments to be concealed from view.

E. Prepare components with internal reinforcement for door hardware.

F. Reinforce framing members for imposed loads.

2.6 FINISHES

A. For exterior exposed aluminum surfaces use dark bronze anodize finish conforming to AA-M12-C22-A44, architectural Class I.

B. Use concealed steel items galvanized in accordance with ASTM A123 to 2.0 oz/sq ft.

C. Apply bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar surfaces.

D. Extent of finish

   1. Apply factory finish to all surfaces exposed at completed assemblies.
2. Apply matching finishes to surfaces cut during fabrication, so that no natural aluminum is visible in completed assemblies, including joint edges.

3. Apply touchup materials recommended by finish manufacturer for field application to cut ends and minor damage to factory applied finish.

PART 3 EXECUTION

3.1 INSPECTION

A. Verify dimensions, tolerances, and methods of attachment with other Work.

B. Verify wall openings and adjoining air and vapor seal materials are ready to receive Work of this Section.

3.2 INSTALLATION


B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges, seal to adjacent Work to form water tight dam.

G. Coordinate attachment and seal of perimeter air and vapor barrier materials.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Set thresholds in bed of mastic and secure.

J. Install hardware using templates provided.

K. Install glass in accordance with Section 08800, using glazing method required to achieve performance criteria.

L. Install perimeter sealant in accordance with Section 07900.

3.3 INSTALLATION TOLERANCES

A. Maximum variation from plumb is 1/16 inch per 10 feet.

B. Maximum misalignment of two adjoining members abutting in a plane is 1/32 inch.
3.4 ADJUSTING
   A. Adjust operating hardware for smooth operation.

3.5 CLEANING
   A. Remove protective material from frame members.
   B. Wash surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean and dry.

3.6 PROTECTION OF FINISHED WORK
   A. Protect finished work from damage.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION:
A. Section Includes:
   1. Steel // single hung // // double hung // windows, type and sizes as shown.
   2. Hardware.
   3. Accessories including, but not limited to, following:
      a. Mullions, closures, trim, weatherstripping, covers, insect screens, anchors, clips, fasteners, and other components necessary for fabrication and installation complete of windows as specified.
      //b. Provide manufacturer’s standard extension pole with hook for opening windows at high window locations. Provide hook receptacle factory attached to ventilators for use with extension poles. //

1.2 RELATED WORK:
A. Sealing Joints: Section 07920, SEALANTS AND CAULKING.
B. Glazing: Section 08810, GLASS AND GLAZING.
C. Finish Color: Section 09050, INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH SCHEDULE.

1.3 QUALITY CONTROL
A. QUALIFICATIONS:
   1. Approval is required of products or service of proposed manufacturer, suppliers and installers, and will be based upon submission by Contractor of certification that:
      a. Manufacturer who regularly and presently, manufactures and installs steel window units and related accessories as one of its principal products.
      b. Accessories required for windows shall be manufacturer’s standard or those of other manufacturers regularly engaged in making window accessories and acceptable to window manufacturer.
         1) Items shall be of materials which shall be compatible with balance of window unit material, and construction shall be that which shall give desired functional service.
   2. Installer: Approved in writing by manufacturer.

1.4 PERFORMANCE REQUIREMENTS:
A. Air Infiltration Test at Weatherstripped Ventilators:
   1. Operable windows: Provided with weatherstripping, such that when tested in closed and locked position in accordance with ASTM E283 before leaving factory, air infiltration shall not exceed 2.06 cubic meter per hour per meter (0.37 cubic foot per minute per foot) of crack length when subjected to a pressure differential across the window of 300 Pa (6.24 psf) equivalent to a wind velocity of 50 miles per hour. Fixed window areas: Maximum air infiltration shall not exceed 0.34 cubic meter per hour per meter (0.06 cubic foot per minute per square foot) of fixed window area.

B. Water Penetration Test at Weatherstripped Ventilators:
1. Operable windows: Provided with weatherstripping, such that when tested in closed and locked position in accordance with ASTM E331 no water penetrates for 15 minutes when a window is subjected to a rate of flow of 5 gal./hr./sq. ft. with a pressure differential across the window at 160 Pa (2.86 psf).

1.5 SUBMITTALS:

A. In accordance with Section 01340, SAMPLES AND SHOP DRAWINGS furnish following:

B. Product Data: Furnish for each type of window required, including:
   1. Construction details and fabrication methods.
   2. Profiles and dimensions of individual components.
   3. Data on hardware, including sweep lock, keeper, lift handles, accessories, and finishes.
   4. Recommendations for maintenance and cleaning of window surfaces.

C. Shop Drawings: Furnish for each type window included in project.
   1. Layout and installation details, including anchors, support framing and sheet metal trim members.
   2. Elevations of continuous work at 1:50 (1/4 inch) scale and typical window unit elevations at 1:20 (3/4 inch) scale.
   3. Full-size section details of typical composite members, including reinforcement.
   4. Hardware.
   5. Accessories.
   7. Color charts for standard finishes and sealants.

SPEC WRITER NOTE: Samples required only if project has more than 20 windows.

D. Samples:
   1. Typical sash corner.
   2. Typical muntin section.
   3. For Initial Color Selection: Submit samples of each specified finish on 300 mm (12 inch) long sections of window members.
   4. Hardware.

E. Quality Control Submittals:
   1. Test Reports: Window manufacturer provide certified test report from a qualified independent testing laboratory engaged in testing windows to verify that his steel window assembly has been tested in accordance with specified test procedures and products comply with these minimum test performance characteristics indicated. Test reports shall have been made within current year.
   2. Manufacturer’s Certificates:
      a. Stating steel members have been given specified thickness of prime coat and/or organic coating finish.
      b. Indicating manufacturer’s and installer’s meet qualifications as specified.

1.6 DELIVERY, STORAGE AND HANDLING:

A. Comply with applicable recommendations of Steel Window Institute.
B. Deliver steel window units and related components in manufacturer’s original, unopened protective packaging labeled for identification with manufacturer’s name and brand and contents. Use padded blankets or other approved protective wrapping for glass, decorative metal work, and other exposed elements.

1. Do not deliver steel window units until work is ready for their installation.

2. Inspect components for damage upon delivery. Do not install steel window units with dimples or dents. Remove and replace damaged components at no additional cost.

C. Storage: Store steel window units and related components, in positions necessary to prevent twisting, in weathertight and dry storage facility in their original shipping containers with protective wrapping or packaging securely in place, in accordance with manufacturers written instructions.

D. Protect finish from damage from handling, weather and construction operations before, during and after installation.

1.7 APPLICABLE PUBLICATIONS:

A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.

B. American National Standards Institute (ANSI):


C. American Society for Testing and Materials (ASTM):

A123-02.....................................Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
B633-98.....................................Electrodeposited Coatings of Zinc on Iron and Steel
C509-00.....................................Elastomeric Cellular Preformed Gasket and Sealing Material.
D2287-96.....................................Non-rigid Vinyl Chloride Polymer and Copolymer Molding and Extrusion Compounds
E283-04.....................................Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors Under Specified Pressure Differences Across Specimen.
E331-00.....................................Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.

D. National Fire Protection Association:


E. Steel Structures Painting Council (SSPC):

SSPC-SP1.................................Solvent Cleaning.
SSPC-SP8.................................Pickling.

1.8 WARRANTY:

A. Warranty: Submit written warranty, in accordance with General Condition requirements except that warranty period shall be extended to include five (5) years.

PART 2 - PRODUCTS

2.1 MATERIALS:

SPEC WRITER NOTE: Delete items in next articles that are not needed for fabrication or installation of selected units.
A. Materials:

1. Frame: Formed from 2.3 mm (12 gauge) galvanized sheet steel.
   a. Sections made from new billet steel with flanges rolled integral at mill.
   b. Ventilator sections shall have glazing rebates providing an unobstructed glazing surface of at least 16 mm (5/8 inch) in height.
   c. Glazing rebate surfaces must be perpendicular to web or stem of section. Applied glazing rebate extensions and tapered rebate surfaces are not acceptable.
3. Mullions and Transom Bars: Mullions and transom bars shall withstand a uniform wind load of 960 Pa (20 psf) of window area without deflecting more than 1/175 of span.

SPEC WRITER NOTE: Select from following hardware finishes. Delete items in next article that are not needed for fabrication of selected units. Items 5.c. and d. may be selected for use in office areas of general maintenance or utility type buildings.

5. Hardware shall be as follows:
   a. Fastener: Standard bronze sweep lock.
   b. Pulls: Standard bronze lift handle.
   c. US 20D: Statuary Bronze.
   e. Balance Arm: Spiral and extension spring sash balance.

SPEC WRITER NOTES:
1. Select from following. Delete items in next article that are not needed for fabrication of selected units.
2. Custom or F. SWI: The Steel Window Institute: Specifiers Guide to Steel special colors available; consult with manufacturer for selection.
3. If windows shall be in a high fume atmosphere similar to Boiler house etc. select Article below.

6. Paint Finishes:
   a. Prime Coat: After fabrication, steel windows, fins, mullions, cover plates and associated parts shall be cleaned, properly treated, prime painted with manufacturer’s standard prime paint.
   b. Factory Finish: After fabrication, for type of factory finish selected, steel windows and associated components shall be cleaned, and given following treatments:
      1) Pretreatment: Zinc phosphate treated.
      2) Primer: Manufacturer’s special epoxy primer and oven cured.
      3) Finish Coat: Manufacturer’s standard color coat finish and oven cured.
4) Color: Refer to Section 09050, INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH SCHEDULE.
   //a) Windows in boiler house shall be given a factory applied finish coat of fume resisting paint. //
   b) Color of finish coat is specified in Section 09050, INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH SCHEDULE.
   c) Touch-up abraded surfaces with enamel as specified for factory finish coat, except that it shall be Class A (Air-Drying), same as original.

c. Zinc Coated Optional Finish: All steel except screens, shall be cleaned and:
   1) Hot dip galvanized (ASTM A123) and/or Electrodeposited (ASTM B633) or equivalent standards.
   2) Zinc coated, phosphate treated and prime painted.
   3) Zinc coated, phosphate treated, prime painted and factory finished in color as selected, from manufacturer's standard colors.
   4) Use galvanize repair compound where galvanized surfaces need field or shop repair. Apply compound in accordance with manufacturer's printed directions.

7. Glass and Glazing: As specified in Section 08810, GLASS AND GLAZING.
   a. Windows shall be factory glazed prior to delivery to project site.
   b. Do not provide weep holes through glazed areas.

8. Accessories:
   a. Insect Screening:
      1) Screen Frame: Formed of electro-galvanized steel having minimum thickness of 0.80 mm (0.032 inch), or of formed or extruded aluminum having a minimum thickness of 1 mm (0.040 inch).

      SPEC WRITER NOTE: Select correct following article if screens are required for windows. Delete items in next article if not needed for selected units.

      //a) Screen frames shall be of same material and finish as specified for windows. //
      //b) Screen frames shall be aluminum with natural finish. //

      2) Screens: Shall be re-wirable with 18 x 16 mesh cloth of aluminum, or fiberglass. Nominal wire diameter of the cloth shall not be less than 0.25 mm (0.011 inch) for aluminum. Wire cloth shall be held taught with removable spline. Screens shall be the removable type. Design screens to be rewirable and removable from inside building.

      SPEC WRITER NOTE: If fiberglass or aluminum screen is required in areas subject to heavy salt spray or fog. Select correct material from Article below.

      //a.) Insect screening shall be aluminum alloy // fiberglass type //.
      b. Fit and install each screen so as to cover windows individually and be free from interference with window hardware without sacrificing protection against insects.
c. Anchor clips and mullions necessary for installation of windows and hardware for operation of ventilators, including fasteners required for attaching such items to window shall be provided by window manufacturer.

d. Screws, shields, plugs or other fastenings into building construction shall be in accordance with manufacturer's recommendations.

e. Window Cleaner’s Bolts: Provide window cleaner’s bolts of standard design, complying with governing regulations and ANSI A39.1. Fabricate bolts of stainless steel or bronze. Reinforce window units or mullions to receive bolts, and provide additional anchorage of units at locations of bolts.

f. Extension Pole Operators: Provide one pole operator and pole hanger for every room that has operable windows more than 1800 mm (6 feet) above floor. Fabricate pole of tubular anodized aluminum with rubber cap at lower end and standard push-pull hook to match hardware design at top end. Provide sufficient length for window operation without reaching more than 1500 mm (5 feet) above floor.

2.2 FABRICATION:

A. General: Fabricate steel windows in accordance with approved shop drawings. Form sections in one piece, straight, true and smooth. Prior to fabrication, all hot rolled steel sections shall be cleaned by shot blasting. Provide drips and weep holes in accordance with manufacturer’s standard practice.

1. Attachment of manufacturer's metal nameplates, shall not be permitted on any window surface.

B. Frame: Members shall be modified channel shapes. Corners of frame and ventilators shall be mitered or coped then solidly welded. Head and jamb members shall have integral screen-stops. Integritily roll continuous flange at jambs and heads to form a caulking stop between facing and backing masonry. Exposed and contact surfaces shall be finished smooth, flush, with adjacent surfaces.

C. Sills: Sills shall have stepped rebates to receive lower sash bottom rail, which shall be kept clear of sill wash. Sills shall not be perforated at any point in their full length. Weld strap anchors to underside of sill, or screw to tapped lugs welded thereto.

D. Sash: Rails shall be tubular. Stiles may be tubular or modified channel shape. Stiles and rails shall be formed in one piece from single strips. Make sash rebates minimum 15 mm (19/32 inch). Make interior horizontal top surfaces of both meeting rails flat and in same plane. Meeting rails shall have tight contact with wedge blocks at jambs when sash is closed. Cope, end-lap and weld all corners of sash.

E. Muntins: Steel tee muntin sections shall be tenoned and welded to perimeter frame. Muntin intersections shall be slotted and cross notched.

F. Glazing: Design windows for interior glazing. Provide continuous removable snap-in metal glazing beads to suit specified glazing.

G. Mullions: Provide manufacturer's standard or a structural shape mullion at multiple unit openings. Make mullions full height of opening and embed them to minimum depth of 125 mm (5 inches) into sill, or securely anchor at head and sill with zinc-coated sheet steel extensions, standard bent-clips or offset shapes of 1.7 mm (14 gauge) zinc-coated steel.

H. If windows and interior metal window trim are installed as complete units, mullions may be anchored at head by means of 5 mm (3/16 inch) steel plate clip bolted to mullion and welded to lintel, and supported at sill with 2.3 mm (12 gauge) zinc-coated steel bent clips welded to mullion.

I. Closures: Miter or cope closure corners and fit with tightly closed joints. Secure closures to window frames with non-corrosive machine screws or expansion rivets, and to masonry with fasteners specified.
J. Reinforcing: Reinforce window frames for attachment of screens, screen hardware or travel-limit lug. Full or limited length reinforcing plates shall be welded to back of frames, and shall be 3 mm (1/8 inch) thick and of sufficient width to securely hold fasteners.

K. Welding: Dress all exposed welds and joints, flush and smooth.

L. Fasteners for Anchoring: Where type, size or spacing of fasteners for securing windows and accessories to building construction is not shown or specified, use expansion or toggle bolts or screws, recommended by manufacturer for construction material adjacent to window units. Bolts or screws: Minimum 6 mm (1/4 inch) diameter and spaced not over 600 mm (24 inches) on centers.
   1. Expansion shield and bolt assemblies shall provide holding power beyond tensile and shearing strength of bolt.
   2. Power actuated drive pins may be used for securing anchors to concrete if recommended by manufacturer.

2.3 INTERIOR METAL WINDOW TRIM:

A. Form window trim of zinc-coated sheet steel. Use 1.2 mm (18 gauge) for heads and jambs, 2.33 mm (12 gauge) for stools and 1.0 mm (20 gauge) for moldings.
   1. Make trim of welded assembly with hairline mitered corners, dressed flush and smooth. Trim to be used for plaster key, shall have flanges expanded or perforated and provided with attachments for anchorage. Slightly round exposed edges. Coat back side of trim to masonry. Make provisions for fastening of metal plastering base.

2.4 BALANCES (SPIRAL AND EXTENSION SPRING BALANCES):

A. Equip // single // double // hung windows with following type balance: Springs shall be oil tempered steel and shall develop full strength of balances.
   1. Balance Arm: Spiral and extension spring sash balance. Encase balances in jambs (two each sash) and attach to sash through slot in inside and outside grooves of jambs. Each balance shall have a rigid, zinc-coated casing assembled within a helically coiled spring with a hanger at one end and slotted ferrule at opposite end, and have a cadmium plated metal spiral rod, equalizing lifting power of spring, operating through ferrule. Attach end of spiral rod at end of casing to head of frame and bottom of sash.

2.5 OPERABLE HARDWARE (SINGLE/DOUBLE HUNG WINDOWS):

A. Ventilators: Shall be hung on one sash balance at each jamb.

B. Provide manufacturer's standard design sweep lock at center of ventilator head rail securely attached to windows with brass or other corrosive-resisting screws. Furnish two (2) sweep locks for ventilators exceeding 950 mm (38 inches) in width.

C. Provide two pulls of manufacturer's standard design at sill rail of ventilator securely attached to windows with brass or other corrosive-resisting screws, and two pull down bars on under side of upper-sash meeting rail except as otherwise specified.
   1. Fit, test and adjust hardware for each window at factory to insure satisfactory operation and security.

D. Hardware:

   SPEC WRITER NOTE: Select and coordinate hardware finish with that indicated in article 2.1 here-in-before. Delete items in next article if not needed for selected units.

   1. Bronze material. // material. //
2. Hop attached.

2.6 WEATHERSTRIPS:

Install weatherstrips, as standard with manufacturer, at head, jambs, sill, and meeting rails of sash and of impost. Weatherstrip shall be applied to both integral weatherstrip grooves of aluminum weatherstrip adapter. Secure weatherstrip adapter to frame surface.

PART 3 - EXECUTION

3.1 INSPECTION:

A. Window openings shall conform with details, dimensions and tolerances shown on window manufacturer’s approved shop drawings.

B. Conditions which may adversely affect window installation shall be brought to Contractors attention, for repair, prior to commencement of window installation. Do not proceed with window installation until unsatisfactory conditions have been corrected.

C. Washdown of adjacent masonry shall be completed prior to erection of windows to prevent damage to window finish by cleaning materials.

3.2 INSTALLATION

A. General:

1. Windows specified under this section shall be installed by experienced personnel as approved by window manufacturer.

B. Install windows in strict accordance with approved shop drawings.

1. Set units plumb, level and true to line, without warp or rack of frames.

2. Anchor units securely to surrounding construction with a minimum of three adjustable, asphalt coated or galvanized steel anchors with approved fasteners in accordance with manufacturer’s recommendations.

3. Exterior joints between sash, trim and mullions shall be properly sealed watertight with an approved sealant as specified in Section 07920, SEALANTS AND CAULKING, and neatly pointed. Finished work shall have weathertight joints.

C. Protect window equipment during construction.

D. Upon complete installation of all windows and accessories, and before acceptance of work, adjust all movable sash and operating mechanism for free and easy operation, and defects of any nature.

E. Furnish certificate, signed by both contractor and window manufacturer, stating that installation of windows was done by installers approved by manufacturer of windows.

3.3 PROTECTION:

A. Protect windows from damage until final inspection and acceptance.

END OF SECTION
SECTION 08520
ALUMINUM WINDOWS

PART 1 - GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE
A. Joint Sealers: Section 07900.
B. Glass and Glazing: Section 08800.

1.02 REFERENCES

1.03 SUBMITTALS
A. Shop Drawings: Show fabrication details and connections to adjacent construction.
B. Product Data: Catalog sheets, specifications, and installation instructions for each type window unit.
C. Samples:
   1. One window unit of each type, with insect screen, and hardware.
   2. Corner section of frame, sash, and insect screen.
   3. Color Samples: Manufacturer's standard color finishes.

1.04 QUALITY ASSURANCE
A. Certification: Each window unit shall bear the AAMA Certification label.

1.05 DELIVERY, STORAGE, AND HANDLING
A. Deliver windows in protective containers, marked with identification for window location.
B. Store and handle windows in a manner that will not cause damage to the finish.

PART 2 - PRODUCTS

2.01 ALUMINUM WINDOW TYPES/GRADE/PERFORMANCE CLASS
A. Comply with the ANSI/AAMA 101 requirements for the following window designation(s):
   1. A-R15 Awning Window, Residential Grade.
   2. A-C20 Awning Window, Commercial Grade.
   3. C-R15 Casement Window, Residential Grade.
   4. C-C20 Casement Window, Commercial Grade.
5. C-HC40 Casement Window, Heavy Commercial Grade.
6. DH-R15 Double Hung Window, Residential Grade.
7. DH-DW-R15 Double Hung Dual Window, Residential Grade.
8. DH-C20 Double Hung Window, Commercial Grade.
9. DH-DW-C20 Double Hung Dual Window, Commercial Grade.
10. DH-HC40 Double Hung Window, Heavy Commercial Grade.
11. HS-R15 Horizontal Sliding Window, Residential Grade.
12. HS-DW-R15 Horizontal Sliding Dual Window, Residential Grade.
13. HS-C20 Horizontal Sliding Window, Commercial Grade.
14. HS-DW-C20 Horizontal Sliding Dual Window, Commercial Grade.
15. HS-HC40 Horizontal Sliding Window, Heavy Commercial Grade.
16. P-R15 Projected Window, Residential Grade.
17. P-C20 Projected Window, Commercial Grade.
18. P-HC40 Projected Window, Heavy Commercial Grade.
19. TH-C20 Top Hinged Window, Commercial Grade.
20. TH-HC40 Top Hinged Window, Heavy Commercial Grade.
21. VP-C20 Vertically Pivoted Window, Commercial Grade.
22. VP-HC40 Vertically Pivoted Window, Heavy Commercial Grade.
23. F-R15 Fixed Window, Residential Grade.
24. F-DW-R15 Fixed Dual Window, Residential Grade.
25. F-C20 Fixed Window, Commercial Grade.
26. F-DW-C20 Fixed Dual Window, Commercial Grade.
27. F-HC40 Fixed Window, Heavy Commercial Grade.

2.02 MATERIALS

A. Frame and Sash Members: Extruded Aluminum, 6063 alloy T5 temper.

B. Fasteners: Aluminum or Stainless steel.
   1. Exposed Fasteners: Phillips flat-head screws. Match the finish of the member being fastened.
   2. Exposed Fasteners: Flat spanner head screws. Match the finish of the member being fastened.

C. Compression Weatherstripping:
   2. PVC Gaskets: ASTM D 2287.

D. Sliding Weatherstripping:
   1. Woven Pile: AAMA 701.2.
E. Thermal Break: Provide manufacturer's standard continuous thermal barrier.

F. Insect Screens: Manufacturer's standard removable unit for each operable sash, designed not to interfere with sash operation.
   1. Frame: Extruded or formed aluminum 0.040 inch min wall thickness, mitred or coped joints, concealed mechanical fasteners.
   2. Retainer Spline: Vinyl.
   3. Screen Mesh:
      a. Aluminum mesh, 18 x 16, .011 inch wire diameter, black or charcoal color finish; FS RR-W-365, Type VII.
      b. Stainless steel mesh, 18 x 18, 0.009 inch wire diameter; AISI Type 316; FS RR-W-365, Type VI.
      c. Glass fiber mesh, plastic coated, 18 x 14, 0.013 inch filament diameter; FS L-S-125, Type II, Class 2.

G. Bituminous Coating: Cold-applied asphalt mastic complying with SSPC-PAINT 12, compounded for 30-mil thickness per coat.

2.03 FINISHES
   A. Prepare the aluminum surfaces for finishing in accordance with the Aluminum Association recommendations and standards.
   B. Finish all exposed aluminum surfaces. Process all components of each assembly simultaneously to attain uniform color.
   C. Finish: Natural Anodized, NAAMM AA-M21C22A41, (minimum thickness 0.7 mils), natural aluminum color.
   D. Finish: Color Anodized, NAAMM AA-M21C22A42, heavy colored, (minimum thickness 0.7 mils), integral color anodized finish.
      1. Color:
   E. Finish: Color Anodized, NAAMM AA-M21C22A32 medium colored, (minimum thickness 0.4 mils) integral color anodized finish.
      1. Color:
   F. Finish: Manufacturer's standard factory applied baked enamel finish.
      1. Color:

2.04 ACCESSORIES
   A. Poles: Manufacturer's standard; one pole for each room or space where a sash locking rail is over 6'-6" above the floor.

PART 3 - EXECUTION

3.01 EXAMINATION

MASTER BUILDING SPECIFICATION
ALUMINUM WINDOWS
08520 - 3
A. Verification of Conditions: Examine surfaces to receive aluminum windows for defects that will adversely affect the execution and quality of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install the Work of this Section in accordance with the manufacturer's printed instructions, except as shown or specified otherwise.

B. Paint aluminum surfaces in contact with masonry or incompatible metals with bituminous coating.

C. Anchor window units securely in place, plumb, level, aligned, without warp of frames or sash.

3.03 ADJUSTING

A. Adjust operating sash and hardware for smooth operation and weathertight closure. Lubricate hardware and other moving parts, except parts in contact with weatherstripping.

3.04 CLEANING

A. Clean aluminum surfaces promptly after installation.

END OF SECTION
SECTION 08586
ALUMINUM SECURITY WINDOWS

PART 1   GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

A. Joint Sealants: Section 07900.
B. Glass and Glazing: Section 08800.
C. Security Glass and Glazing: Section 08811.

1.02 REFERENCES


1.03 DESIGN REQUIREMENTS

A. Pressures and Test Loads:
   1. Design Pressure (DP): 40.0 psf.
      a. Anchors, Fasteners, and Hardware: 60.0 psf.
   2. Structural Test Pressure (STP): 60.0 psf.
   3. Water Test Pressure (WTP): 10.0 psf.

B. Thermal Movement: Provide for material expansion and contraction due to temperature changes from 30 degrees F below zero to 180 degrees F above zero.

C. Maximum Allowable Frame Section Dimensions:
   1. Window Frame Depth: 3-1/2 inches.
   2. Combined Window and Sash Frame Widths:
      a. Exterior: 3-1/2 inches.
      b. Interior: 4-1/2 inches.

1.04 LABORATORY PERFORMANCE TESTS

A. Conduct laboratory performance tests, in accordance with specified standard test methods and procedures, on a test sample unit containing a fixed insulated transom panel above operable dual side-hinged inswinging sash unit unless noted otherwise.
   1. Test sample unit shall be complete with all components indicated for fabrication and installation on approved shop drawings.
   2. Test Sample Unit Type and Size: Window Type 3B, for 3 feet 8 inches wide by 5 feet 6 inches high masonry opening.
B. Air Leakage; ASTM E 283, Test Method for Rate of Air Leakage Through Exterior Windows, Curtain Walls and Doors:
   1. Maximum Allowable Air Infiltration and Exfiltration: 0.10 cfm/lin ft of crack perimeter at 6.24 psf uniform static air pressure difference between opposite sides of the test unit.

C. Structural Performance; ASTM E 330, Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference: Conduct uniform Load Deflection and Structural Tests first to the exterior (positive) side of the window, then to the interior (negative) side.
   1. Uniform Load Deflection Test: No member shall deflect more than 1/175 of its span at 60 psf (STP) uniform static air pressure difference between opposite sides of the window.
   2. Uniform Load Structural Test; at 60 psf (STP) uniform static air pressure difference between opposite sides of the window.
      a. No glass breakage or permanent damage to fasteners, hardware parts, support arms, actuating mechanisms, or other damage which would cause the window unit to be inoperable.
      b. Permanent deformation of individual frame, casement unit, or vent members shall not exceed 0.2 percent of its span.

D. Water Penetration:
   1. ASTM E 331; Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference.
      a. No observable water leakage at 6.0 psf uniform static air pressure difference between opposite sides of the window.
   2. ASTM E 547; Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential.
      a. No observable water leakage after 4 cycles at 6.0 psf uniform static air pressure difference between opposite sides of the window.

E. Vertical Deflection: AAMA GS-001, applied to both interior and exterior glazed casement units individually and in upright vertical positions.
   1. Casement Unit Opening Positions: 45 degrees and 90 degrees (fully open).
   2. Applied Load: 60 lb concentrated load applied downward, located at bottom unrestrained corner, for an undisturbed duration of 5 minutes.
   3. The casement units and vents shall properly close and operate, and show no visible damage upon conclusion of the test.

F. Ventilator (Casement Unit) Torsion: AAMA GS-001, applied to both interior and exterior unglazed casement unit and vent frames supported in horizontal positions.
   1. Horizontal Frame Support: Fulcrum support block and clamp, located at diagonally opposite corners of window frame in a horizontal plane, with one free corner loaded and diagonally opposite free corner securely held in position.
3. Maximum Deflection: 0.1875(A) inches, where (A) equals the inside unglazed surface area, in square feet, of the ventilator being tested.

4. Test each corner of each frame separately.

G. Impact Load: To simulate the impact load of a 200 lb running person, moving at the speed of 25 fps, striking the interior polycarbonate surface with their shoulder.

1. Impact Test Load: 1,800 ft lbs.
   a. Equipment and Method: Standard punching bag filled with lead shot weighing (w) lbs and allowed to free fall vertically downward from a pendulum length (l) feet measured horizontally and vertically away from the point of impact. The pendulum swing shall be in a vertical plane perpendicular to the plane of the window at the point of impact.
   b. Minimum Impact Load Calculation: Pendulum length (l) times weight (w) shall equal 1,800 ft lbs.

2. Securely fasten window in a frame assembly of the same configuration that is used in the actual field condition. Use the same type, number, size and location of frame anchors used in the actual field condition.
   a. The surrounding conditions, framing and window location within the masonry opening are shown schematically on the drawings.
   b. Verify field conditions and develop adequate framing and anchorage methods.

3. Conduct impact load tests sequentially at each of the following locations and include strain gage devices for recording window component deflections as part of the test procedure:
   a. At center of interior surface of inside casement glazing.
   b. Side of interior surface of inside casement glazing, 4 inches from lock side frame member and midway between locks.
   c. Side of interior surface of inside casement glazing, 4 inches from lock side frame member and directly opposite lowest lock.

4. Notify the Director in writing a minimum of 2 weeks prior to performing the impact load test, the date, time and location where the test is to be performed.

5. Impact Load Test Reports; Include the Following:
   a. Detailed description of test with drawings showing construction of window frame structural support and fasteners, fastener types and spacings, test apparatus, and other equipment or devices used.
   b. Before and after photographs, including close-up photographs showing extent of damages, if any.
   c. Strain gage measurement recordings, including drawings showing precise locations of strain gages and component deflections incurred.

6. Window Will Have Passed the Impact Load Test When:
   a. Impact test load has not broken through the polycarbonate and made penetration contact with enclosed air space.
   b. Polycarbonate security glazing, although damaged, remains firmly held in place within perimeter casement frame and glazing stops.
c. Polycarbonate security glazing stops, although bent and deformed, remain firmly held in place within perimeter casement frame.
d. Polycarbonate frame, although bent and deformed, remains firmly attached to window frame by operable hinges and casement security locks
e. Window frame, although bent and deformed, remains firmly attached to test frame enclosure.

   1. Acoustical tests shall be conducted on operable sash unit only, excluding transom panel, and for both indoor and outdoor noise sources.

I. Thermal Performance (U-Valve): AAMA 1503.1, using 15 mph outdoor perpendicular wind speed, U-valve shall not exceed 0.45 Btu/hr/ft²/F.
   1. Test Reports: Include detailed drawings of window and thermocouple locations, test measurements taken at each thermocouple, and copy of computations used to determine U-valve ratings.

1.05 SUBMITTALS

A. Waiver of Submittals: The "Waiver of Certain Submittal Requirements" in Section 01330 does not apply to this Section.

B. Shop Drawings; Include the Following for Each Window Type:
   1. Interior and exterior window elevations, with window opening sizes and locations correlated to floor plans or exterior wall building elevations, using the same Window Schedule and window designations shown on Contract drawings.
   2. Full scale frame section details showing complete assembly of each window and frame component to be provided, exterior wall opening enclosure materials and assembly with frame, installation anchorage details, glass and method of glazing details, weep holes and frame drainage details, location of all hardware and fasteners to be provided.

C. Product Data: Manufacturer's catalog sheets, specifications, and installation instructions.

D. Finish Color Samples: Manufacturer's standard colors and range for each color, for specified finish(es).

E. Samples:
   1. One window unit of each type, complete with hardware.
   2. Complete Type 3B window unit with insulating panel above, fully glazed and all hardware in place, to represent the quality of materials and workmanship to be provided in other windows to be installed.
      a. Deliver sample window to Director's Representative at the Site.
      b. Samples will be returned and, if approved, may be used in the work.
   3. Hardware and Fasteners: Two of each item required.
F. Quality Control Submittals:
   1. Test Reports: Certified laboratory and field performance test reports, bearing independent testing laboratory AAMA seal of approval and certification, for each test conducted.
      a. Test Reports: Include detailed drawings of windows and components tested showing size and location of all test loads and measuring devices used, tabulated record of readings and measurements taken, copies of any computations made using test data, and any other information required by the standard test method or procedure.
   2. Manufacturer's Warranty: Sample copy of window manufacturer's 10 year warranty covering workmanship and materials.

G. Contract Closeout Submittals:
   1. Operation and Maintenance Data: Deliver 2 copies, covering the installed products, to the Director's Representative.
   2. Manufacturer's Warranty: Copy of specified warranty.
   3. Maintenance Training: VHS tape showing how the windows are to be operated and maintained plus eight hours of one or more periods of instruction to Facility maintenance personnel.

1.06 QUALITY ASSURANCE
   A. Testing Agency: Specified laboratory and field performance tests shall be performed by an independent AAMA certified testing laboratory.
   B. Field Example: Prior to installation of windows, install one mock-up window for review and approval of installation method and field impact load test if laboratory impact load test is required.

1.07 DELIVERY, STORAGE, AND HANDLING
   A. Deliver window units assembled in sturdy, protective crates or cartons.
      1. Mark crates or cartons with sufficient identification for proper window location.
   B. Store and handle windows in a manner that will not cause damage to the finish.

1.08 WARRANTY
   A. Special Warranty: The one year period required by Paragraph 9.8 of the General Conditions is extended to 2 years for the work of this Section. Refer to Supplementary Conditions.
   B. Manufacturer's Warranty: In addition to the 2 year period specified above, furnish the window manufacturer's printed 10 year warranty for the Work of this section.
      1. The warranty shall include but not be limited to: infiltration, leakage water penetration, glazing frame deflection or deformation, hardware, fasteners, venetian blinds, weatherstripping, finish durability (surface crazing, peeling, discoloration, blistering, or powdering), and other defects which would impair the aesthetic or performance properties of the window.
A. Spare Parts: Furnish the following items in the manufacturer's original containers properly labeled with the names of the items and locations to be used. Match finishes of installed products. Store spare parts and special keys and tools at the Site where directed.

1. Complete Windows:
   a. Two of Type 2C.
   b. Two of Type 3B.

2. Hardware:
   a. Four pair of sash to frame hinges.
   b. Four pair of sash to sash hinges.
   c. Four pair of interior sash primary locks.
   d. Four pair of interior sash secondary locks.
   e. Four pair of sash latches.
   f. One hundred escutcheon shields.

3. Glass: Four percent of each glass type and size, used in each window type. Minimum of one each. Verify dimensions in the field.
   a. If exterior sash frame is designed in accordance with Subparagraphs 2.02 E.2.a. and 2.02 F.2.a. furnish preglazed sash frame.

4. Venetian Blinds:
   a. One hundred complete replacement units with controls.
   b. One hundred blind control knobs.

5. Keys and Special Tools:
   a. One hundred and fifty primary lock keys.
   b. Fifty secondary lock keys.
   c. All keys shall be keyed as specified.
   d. Oval head manual driver and power tool bit for each type of tamper-resistant screw and bolt size installed.

PART 2 PRODUCTS

2.01 ALUMINUM WINDOW CATEGORY

A. Comply with the AAMA GS-001 requirements for Architectural Windows for the following window types:

1. Side Hinged Inswinging Units: Dual sash unit, double-glazed with Type S-1 Security Glass in the interior sash and Type D Glass in the exterior sash.
   a. Hinge the inswinging dual sash unit to provide independent hinging of the interior sash for maintenance access to air space and venetian blind between the interior and exterior sashes.
2. Fixed Units: Fixed units glazed with Type M insulated glass, and fixed insulated panels where indicated.
3. Projected Units: Top hinged projected out glazed with Type M insulated glass, with fixed units above, and louvers where indicated.

2.02 MATERIALS

A. Aluminum Shapes: ASTM B 221, extruded aluminum, 6063 T5 or T6 temper.
   1. Minimum Wall Thickness: 1/8 inch.
      a. Type S-1 Glazing Stops: 3/16 inch minimum thickness.
   2. Interior Sash Rabbet Depth: Fabricate interior sash extrusion to provide a minimum of 1-1/4 inch rabbet depth for a one inch bite and 1/4 inch setting block required for Type S-1 security glass.

B. Window Frame: Extend above dual sash unit and transom bar to enclose fixed insulating panel where required.
   1. Transom Bar Section: Same width and depth as window frame.
   2. Unsupported Extrusion Legs: Provide increased thickness, or concealed and thermally nonconductive connecting supports, to reduce deflection and deformation of unsupported extrusion legs.
   3. Drainage: Provide frame chambers and transom bars with concealed drainage downward to exterior egress at bottom of sill section.
   4. Anchors: Use concealed clips designed and installed to withstand impact load. Bolt anchors may penetrate jamb and head sections only where adjacent exposed finishes do not allow concealment of clips.
   5. Thermal Barrier: Continuous poured in place and interlocking polyurethane bridge with 3/8 inch minimum separation between exterior and interior aluminum frame contact surfaces.

C. Interior Sash Frame: Extrusion shall include lip projection to cover exposed inner edge of Type S-1 perimeter glazing material.

D. Concealed Security Eyelet: One stainless steel concealed security eyelet for interior window washer at each dual inswinging operable unit.
   1. Location: On lock side of the window between window and operable sash frames.
   2. Applicable Safety Regulations: Comply with ANSI A39.1, New York State Labor Department (NYSDOL), Industrial Code Rule No. 21, and Occupational Safety and Health Act (OSHA) requirements.
      a. Minimum Load Capacity: 5,000 ft lbs.
   4. Structural Anchorage: Stainless steel bolted connection, through window frame and steel backer plate, secured to jamb structural support as required.
E. Glazing Stops:
1. Interior Sash: Extruded 90 degree angular snap-in stop, 3/16 inch thick and located on outer side of sash, secured in place with 3 No. 12 flat head stainless steel screws.
   a. Screws shall be located at center and one-third the distance from each end of the stop to the center screw.
2. Exterior Sash: Either of the Following:
   a. Structural glazing with a disposable sash frame.
   b. Extruded snap-in stop located on inner side of sash.

F. Reglazing Methods: Design and fabricate the window to allow reglazing as indicated.
1. Interior Sash: Remove and reinstall glazing stops on outer side of sash.
2. Exterior Sash: Either of the Following:
   a. Remove and replace entire sash frame, including glazing.
   b. Remove and reinstall glazing stops to reglaze sash.

G. Window Frame Gaskets: Extruded elastomeric neoprene or EPDM, type recommended by window manufacturer, with integral flanges on each side, continuous and without splices except at integrally sealed corners.
1. Gasket Between Casements: Same as window frame gasket material but with minimal compressibility to prevent exterior sash inward deformation during designed wind load and laboratory test conditions.

H. Window Fasteners: Concealed non-magnetic stainless steel with visible heads, exposed within enclosed air space when interior casement is open, finished to match adjacent surfaces.
2. Raised Fastener Heads:
   a. Hexagonal head for attaching window frame and concealed clips to surrounding perimeter enclosure.
   b. Oval head tamper resistant fasteners by Avdel Division of Newman Industries, Inc., 50 Lackawanna Ave., Parsippany, NJ 07054, (201) 263-8100

I. Anchors: Window manufacturer's recommended anchorage devices and methods. Provide brackets or clips with fasteners that do not penetrate the window frame members.

J. Hardware for Inswinging Casements:
1. Hinges: Extruded aluminum and fully concealed, with 1/4 inch diameter stainless steel pin, designed to allow interior sash unit to open not less than 85 degrees.
   a. Number of Hinges per Sash: One pair for sash heights less than 4 feet and 1-1/2 pair for sash heights 4 feet or greater.
2. Interior Sash Primary Locks; Either of the Following:

1) Locate horizontal slide bolts at top and bottom of interior sash (lock side) frame and horizontal slide bolt at center.

2) Escutcheon Shield: 1-1/2 inch diameter stainless steel around exposed keyhole, permanently affixed and unremovable from exposed side of sash frame.

3) Keying: Key primary locks alike, with 36 keys total.

b. Friction Pin Locks: Three concealed cam locks, series 300 stainless steel, friction pin with adjustable strikes and keepers, operable by custodial wrenches that can only be removed when sash is locked.

1) Cam locks shall be hidden behind sash frame opening for custodial wrench.

a) Escutcheon Shield: 1-1/2 inch diameter stainless steel around exposed keyhole, permanently affixed and unremovable from exposed side of sash frame.

2) Locate top and bottom locks one-sixth the sash height maximum below and above horizontal sash members. Locate center lock midway between top and bottom locks.

3) Custodial wrenches shall fit tightly and snugly into escutcheon, frame, and lock openings. Wrenches shall have a 1/4 inch diameter hole in the handle for attachment to metal rings and chains.

4) Install friction pin locks so that cams rotate in an upward direction to open.

5) Filing of friction pin locks is not permitted. Make adjustment for proper fit by changing the thickness of the friction pin lock adjuster.

3. Interior Sash Secondary Lock: Gem 7 pin tumbler, cylinder cam lock, with circular keyway and high security tumbler by Fort Lock Corp., 300 N. River Rd., River Grove, IL 60171-1097, (708) 456-1100. Provide two cylinder locks per window. Key shall be removable from lock only when lock is in locked position.

a. Location: Six inches maximum from head and sill.

b. Center lock upon a 1-1/2 inch diameter stainless steel escutcheon shield, permanently affixed and unremovable from exposed side of sash frame.

c. Keying: Key secondary locks alike, with 36 keys total.

d. Install cam locks so that cams rotate in an upward direction to open.

e. Secure cam locks to the sash with a locking nut or tabs that are mechanically fastened to the sash. Tabs secured to the sash with glue alone are not permitted.

4. Adjustable Limit Devices: Model No. 37-34-00-101 by Truth Hardware, 701 W Bridge Ave., Owatonna, MN 55060, (800) 806-6167, installed at head and sill between interior sash and window frame, to allow and limit sash opening to 6 inches maximum measured from the outer edge of the window sash to the adjacent wall on the strike side.
5. **Sash to Sash Locks**: Two mechanical locking devices per window to keep interior and exterior sash together while window is being opened or closed and in either open or closed positions.
   a. Location: At one-fourth the frame height, below and above the horizontal frame members.

K. **Venetian Blinds**: Manufacturer's product designed for installation and use within window enclosed air space between exterior and interior inswinging casements.

1. **Head Channel**: Extruded Aluminum, 6063-T5 Temper, one inch wide by 7/8 inch high maximum size by 0.050 inch minimum thickness; furnished complete with tilting mechanism, and lifting mechanism, cord lock, stiffeners, ladder drums and cradles, installation brackets, and accessory items required for type of blind and installation indicated.
   a. Concealed head channel between interior and exterior top glazing stops.
   b. Tilting Mechanism: Tilter assembly designed to position tilt of slats at desired angle with smooth operation.
      1) Tilt Mechanism: Manually operated from recessed aluminum control knob, located on interior hinge-side surface of interior inswinging casement frame, connected to head channel tilt mechanism by a concealed neoprene covered woven bronze flexible wire cable with tubular bronze connectors.
         a) Equip tilt mechanism with overload protector to disengage tilter assembly when excessive torque is applied at tilt control knob.
         b) Tilt Control Knob: Aluminum, finished to match adjacent frame surface, with nylon bushings and concealed fasteners.
   c. Lifting Mechanism: Designed to smoothly raise and lower slats to any up or down position while maintaining horizontal angle position of slats.
      1) Equip lifting mechanism with crash-proof cord lock that automatically locks blind into position upon release of lift cord.
         a) Cord Lock: Steel, 0.025 inch minimum thickness, securely attached to head channel.
         b) Cord: Braided polyester, 130 pound minimum tensile strength, located on lock side of interior casement frame, furnished with cord separators and ring at end.
         c) Cord Attachment: Concealed frame mounted hooks, with finish to match adjacent frame surface, for concealed ring attachment of cord when blind is in any up or down position.

2. **Slats**: Aluminum alloy, 1 inch wide and 0.008 inch thick, with rounded end corners and elliptical crown formed after finish coating and curing.
   a. Slat Length: Width of enclosed air space minus 1/2 inch for 1/4 inch maximum end clearance at each casement frame jamb.
   b. Finish: Polyester baked enamel, one mil minimum thickness.
3. Bottom Rail: Aluminum, one inch by 3/8 inch maximum size by 0.050 inch minimum thickness; with molded plastic end caps and hold-down pins, ladder retainers, and metal jamb-type hold down brackets.
   a. Finish: Polyester baked enamel, one mil minimum, over vinyl or epoxy primer.
   b. Hold-down Brackets: Finish color to match adjacent casement frame color.
4. Ladders: Braided polyester yarn, spaced not more than 24 inches apart and not less than 6 inches from slat ends, secured to ladder drum in head channel and bottom rail at sill.
   a. Ladder Length: As required to tautly secure bottom rail to jamb mounted hold-down brackets and within 5/8 inch clearance between bottom rail and casement frame.
5. Ladder Drum and Cradle: One for each ladder.
   a. Ladder Drum and Cradle: Steel, or plastic with a two piece plated steel roller and pin assembly.
      1) Provide ladders with crimped metal ends, to prevent unravelling, before attachment to ladder drum.
6. End Braces: Steel, 0.024 inch (24 gage) minimum thickness, with reinforcing ribs and field adjustable tabs, finished to match head channel.
7. Installation Brackets: Steel, 0.038 inch (20 gage) minimum thickness, with rivet hinged safety locking front cover, finished to match head channel.
   a. Securely mount installation brackets to casement frame using concealed fasteners. Allow for easy removal and replacement of blind by opening and closing installation bracket front covers.
8. Color: Except as otherwise noted, color shall be ivory white throughout including slats, cords, ladders, and other exposed surface accessories.
L. Window Sill Extensions: Extruded aluminum, 6063 T5 or T6 temper. Color to match window finish. Configurations as indicated on the Drawings.
M. Mullion Closure Panels: Extruded aluminum, 6063 T5 or T6 temper. Color to match window finish. Configurations as indicated on the Drawings.
N. Aluminum Joint Sealer: Silicone rubber in color to match exposed adjacent surface.
2.03 FINISHES
A. Prepare surfaces for finishing in accordance with the Aluminum Association recommendations and standards.
B. Unless otherwise specified, finish all exposed aluminum surfaces.
   1. Aluminum finishing and color applications shall be within the range of approved samples. All frame members on the same window shall be of the same color.
C. Aluminum Finish: Color Anodized, NAAMM AA-M21C22A42, heavy colored, (minimum thickness 0.7 mils), medium bronze integral color anodized finish.
2.04 FABRICATION JOINTS AND WIDTHS
A. Miter corner joints and butt joint horizontal transom bar to vertical jamb at window frame.

B. Maximum Miter and Butt Joint Widths:
   1. Exterior: 0.015 inch.
   2. Interior: 0.010 inch.

C. Maximum Change In Plane (Step) Across Joints: 0.012 inch.

D. Maximum Shift In Plane Between Two Members On Opposite Sides of the Same Joint: 0.020 inch.

E. Maximum Shift in Visual Alignment Between Mitered Interior Sash and Window Frame Joints: 0.062 inch.

PART 3  EXECUTION

3.01  EXAMINATION

A. Verification of Conditions: Examine surfaces to receive windows for defects that will adversely affect the execution and quality of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02  PREPARATION

A. Coat aluminum surfaces in contact with masonry or incompatible metals with bituminous coating.

3.03  INSTALLATION

A. Install the Work of this Section in accordance with the manufacturer's printed instructions, except as shown or specified otherwise.

B. Anchor window units securely in place, plumb, level, aligned, without warp of frames or sash.

3.04  FIELD PERFORMANCE TESTS

A. Field performance tests shall be conducted by an independent AAMA approved and certified testing laboratory, employed by the window manufacturer, upon 10 windows selected by the Director's Representative upon completion of window installations.
   1. Field performance tests shall be conducted in presence of the Director's Representative.
   2. Correct test failure deficiencies and retest the window until field performance test is passed.
   3. If two or more windows fail the same test, the test shall be repeated on 10 additional windows, not previously tested, selected by the Director's Representative.
a. For each subsequent set of two or more window test failures, the same procedure shall be repeated until the tests statistically demonstrate that at least 90 percent of the installed windows pass each of the specified field performance tests.

4. Field performance tests shall be for window assembly only and shall not include perimeter crack between window frame and surrounding adjacent wall construction.

B. Air Leakage; ASTM E 783, Field Measurement of Air Leakage Through Installed Exterior Windows and Doors:
   1. Installed windows shall not exceed 0.15 cfm/lin ft of crack perimeter at 6.24 psf uniform static air pressure difference between opposite sides of the window.

C. Water Penetration; AAMA 501.3, Field Check for Water Penetration Through Installed Exterior Windows, Curtain Walls, and Doors by Uniform Static Pressure:
   1. Installed windows shall show no indication of water penetration at 8.0 psf uniform static air pressure difference between opposite sides of the windows.

D. Vertical Deflection; AAMA GS-001, applied to both interior and exterior casement ventilators separately and individually:
   1. Casement Unit Opening Positions: 45 degrees and 90 degrees (fully open).
   2. Applied Load: 60 lb concentrated load applied downward, located at bottom unrestrained corner, for an undisturbed duration of 5 minutes.
   3. The casement units and vents shall properly close and operate, and show no visible damage upon conclusion of the test.

3.05 ADJUSTING

A. Adjust movable components and hardware for smooth operation.

3.06 CLEANING

A. Clean exposed surfaces, including blinds and surfaces within the enclosed air space, without damaging finishes.

END OF SECTION
PART 1  GENERAL

1.01  RELATED WORK SPECIFIED ELSEWHERE

A. Metal Framed Skylights: Section 07820.

1.02  SUBMITTALS

A. Shop Drawings: Show fabrication details and connections to adjacent Work.

B. Product Data: Manufacturer's catalog sheets, specifications, and installation instructions for each item specified.

C. Contract Closeout Submittals:
   1. Maintenance Data: Deliver 2 copies, covering the installed products, to the Director's Representative.

PART 2  PRODUCTS

2.01  MATERIALS

A. Plastic Skylights: Model No. AS-SF acrylic continuous dome skylight as manufactured by Bristolite Skylights, 401 E. Goetz Ave., P.O. Box 2515, Santa Ana, CA 92707, (800) 854-8618.
   1. Acrylic Dome: Clear acrylic, convex shape, fused to fiberglass counter flashing.

B. Domed Unit Skylights: Factory assembled sealed double dome plastic skylight units; complete with extruded aluminum thermally broken frame system with integral drainable condensation gutters and counter flashing to roof curb by Thermo-Vu Skylights, 51 Rodeo Drive, Edgewood, NY 11717, (800) 883-5483, (516) 243-1000; Bristolite Skylights, 401 East Goetz Ave., P.O. Box 2515, Santa Ana, CA 92707, (800) 854-8618, (714) 540-8950; Faulkner Plastics Inc., 4504 E. Hillsborough Ave., Tampa, FL 33610, (800) 488-4703, (813) 621-4703; Naturalite EPI Skylight Systems, 750 Airport Rd., P.O.Box 629, Terrell, TX 75160, (800) 527-4018, (214) 551-6400.
   1. Size: Closest manufacturers standard size to size shown on drawings, compatible with roof curb.
   2. Dome Assembly: Outer and inner domes of clear acrylic, convex shape.

2.02  FABRICATION

A. Fabricate skylights weathertight and free of visual distortion.
PART 3 EXECUTION

3.01 INSTALLATION

A. Install skylights in accordance with the manufacturer's printed instructions. Coordinate with the installation of the roofing system and related flashings. Provide weathertight installation.

END OF SECTION
PART 1 GENERAL

1.01 WORK INCLUDED

A. Product engineering and fabrication techniques, shop drawings, structural calculations and Professional Engineering approval stamps for large missile impact tested skylights designed for a curb mounted application.

B. Fabrication and installation of aluminum and glass skylight system.

C. Finish of skylight assembly and accompanied flashing metals.

D. Gaskets and sealants.

E. Skylight glass and glazing.

F. Skylight flashing.

1.02 RELATED WORK

A. Section 05120 Structural Steel

B. Section 07510 Roofing

C. Section 07600 Flashing and Sheet Metal

D. Section 07900 Joint Sealers

E. Section 08800 Glass and Glazing

1.03 REFERENCES

A. ASCE 7-96

B. ANSI A58.1, Z97.1-1984

C. ASTM E 330, ASTM E 331, ASTM E 283

D. SBCCI Test Standard for determining impact resistance from windborne debris. SSTD 12-97

E. Metropolitan Dade County Protocol PA 201, PA 202, PA 203

F. American Architectural Manufacturers Association (AAMA) 501, 603.8, 605.2, 607.1

G. Flat Glass Marketing Association (FGMA) Glazing Manual

1.04 QUALITY ASSURANCE

A. Provide a skylight and application that is structurally sound, impact resistant and weather tight conforming to applicable testing and performance requirements described herein.

B. Except as otherwise indicated, requirements for aluminum skylights, terminology, tolerances, standards of performance and workmanship are those specified in ANSI/AAMA.

C. Provide certified independent laboratory test reports from an accredited laboratory.
D. Provide Documented Metro Dade Approval Certification for Large Missile Impact in compliance with project requirements.

1.05 TESTING AND PERFORMANCE REQUIREMENTS

A. Test Units All tests, unless otherwise noted, shall conform to the impact, static, cyclic, air and water tests as set by the SBCCI and Miami-Dade Product Approval.

B. Test Procedure and Performance.
   1. Skylights shall conform to criteria for conducting impact, static, cyclic air and water tests set forth by the SBCCI and the Metropolitan Dade County Building Code Compliance Office.
   2. Impact Test - PA 201-94 and 302.1-302.3.2
      a. Missile impact skylight with a solid S4S nominal 2 x 4, #2 surface dry, Southern Pine of not less than 8'-6" in length and 9 lbs in weight at a velocity between 50 and 52 ft/sec. without defined specimen failure.
   3. Cyclic Wind Pressure Loading Test - PA203 -94 and 302.4.-302.7.3.
      a. Apply loads to the specimen using the cycles specified in The South Florida Building Code and as in Table 1 of SSTD 12-97 without failure.
      b. Specified Design Pressure (DP) should not be less than 75 psf.
   4. Uniform Static Pressure Test - PA 202 - 94
      a. Conduct air leakage test at 1.57 psf and 6.24 psf in accordance with ASTM E-283. Air infiltration should not exceed .06 cfm.
      b. Conduct water leakage test in accordance with ASTM E 331 without evidence of any uncontrolled water. Minimum water test pressure should not be less than 10 psf.
      c. Conduct static load test in accordance with ASTM E 330. Deflection should not exceed L /180 when subject to a uniform load.

1.06 SUBMITTALS

A. Shop Drawings
   1. Submit scaled shop drawings including all conditions of construction, location diagrams including identification of and spacing of anchorage, framing members, joinery, glazing materials and sealant details.

B. Structural Calculations.
   1. Provide structural calculations by a licensed structural engineer demonstrating structural compatibility with project requirements.

C. Test Reports
   1. Provide certified independent laboratory test reports verifying compliance with requirements in Section 1.05.

D. Samples
1. Submit ( ) 6" lengths of aluminum extrusions.
2. Submit ( ) color samples of finish to be used.
3. Submit ( ) 12" x 12" glass samples to be used.

E. Warranties
1. Provide manufacturer’s warranty in accordance with the contract documents.
2. Provide glass warranty as furnished by the supplier.
3. Provide installation warranty in accordance with the contract documents.

1.08 WARRANTY

A. Stating that skylight materials for above project will be free from defects and workmanship for a period of five (5) years from date of substantial completion.
B. Stating that glass shall be free from defective materials, delamination and defects in manufacturer for a period of five (1) years from date of manufacturer.
C. The contractor shall assume responsibility for handling, installation and weather seal for a period of one (1) year from date of substantial completion.

PART 2 PRODUCTS

2.01 MATERIALS

A. Acceptable Skylight Manufacturers
1. TriStar Skylights / Savannah Trims, Inc.
   3567 91st Street North
   Lake Park, Florida 33403
   (561) 656-2556 (Fax) 561-656-2599
   SBCCI (Approval #9856A) and Miami-Dade Product Approval No. 01-1114.01
2. Architect Approved Equal
   a. Products of other manufacturers must be pre-qualified to bid not less than 10 days prior to bid date.
   b. Submit written proof of compliance with SBCCI and Miami-Dade Certification criteria for large missile impact test including supporting technical data, engineering calculation, certification of equivalent experience and samples for comparison.

B. Aluminum
1. Extruded aluminum structural members shall be 6063-T6 alloy and temper and not less than nominal .125" wall thickness for master frame and rafters and not less than a nominal .100" on purlins.
2. Aluminum caps and closures shall be 6063-T5 alloy and temper and be not less than nominal 062" wall thickness with cover plates being not less than nominal .050"

C. Finishes (Select Organic or Anodic)
1. Organic. Finish all exposed areas of aluminum framing and components in accordance with AAMA 603.8 or 605.2. *Color to be selected by architect.

<table>
<thead>
<tr>
<th>DESIGNATION</th>
<th>DESCRIPTION</th>
<th>AAMA SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA-M12-C41-R1X</td>
<td>Polyester Based *</td>
<td>603.8</td>
</tr>
<tr>
<td>AA-M12-C41-R1X</td>
<td>Kynar Based *</td>
<td>605.2</td>
</tr>
</tbody>
</table>

2. Anodic. Finish all exposed areas of aluminum framing and components in accordance with:

AAMA 607.1

<table>
<thead>
<tr>
<th>DESIGNATION</th>
<th>DESCRIPTION</th>
<th>AAMA SPECIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>AA-M10-C22-A41</td>
<td>Anodized</td>
<td>607.1</td>
</tr>
</tbody>
</table>

D. Glazing Gaskets and Setting Blocks

1. Glazing gaskets shall be of extruded dense EPDM, 50 durometer per ASTM C-509
2. Setting Blocks are to be neoprene with a 90 durometer and conform to ASTM D2240.

E. Fasteners

1. All fasteners, exterior and framework, are to be 300 series stainless steel.
2. Cadmium, zinc, nickel plated steel and hot dipped galvanized are not allowed.

D. Glass

1. All Glazing shall be a laminated vision glass composition. The use of monolithic polycarbonates, fiberglass translucent panels and applied glass films will not be acceptable.
2. Laminated glass shall be Globe Amerada Glass Company=s P-380 Series Tinted Low E Hurricane Glazing. Minimum overall composition should not be less than 3/8". Contact Savannah Trims, Inc. (561-640-0850) for specifications and glass performance such as reflectivity, colors, tint and Low E performance.

G. Sealants

1. A sealant that is compatible with all substrates and field applied in accordance with the manufacturer’s recommendations.
2. Glass to frame sealant should be GE Sillpruf and field applied in accordance with the manufacturer's recommendations.

2.03 FABRICATION

A. Skylights shall be factory fabricated and assembled at the manufacturer’s factory where feasible. Assemble in the largest possible sections according to job-site conditions.
B. Design rafter bars and cap to accept glazing gaskets.
C. Cover all exposed to view pressure plates with an extruded snap in place cover plate.
D. Use setting blocks to support glass.
E. All welding shall be Tig welding and ground smooth where visible.
F. Locate weep holes to properly drain water to the exterior at each rafter.

PART 3 EXECUTION
3.01 INSTALLATION
   A. After verification of field conditions and properly prepared openings, install skylight system in
      strict accordance with approved submittal drawing.
   B. Skylight system must be installed by a factory authorized and licensed contractor.
   C. Protect all dissimilar metals with a heavy coat of zinc chromate or bituminous paint.
   D. Install true and plumb without warping or racking.
   E. Apply appropriate sealants where indicated on shop drawings and in accordance with
      manufacturers recommendations.

3.02 CLEANING AND PROTECTION
   A. Clean all exposed surfaces and remove labels and excessive silicone from skylight system.
   B. Touch up any finish blemish and replace parts that cannot be successfully cleaned or
      repaired.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Commercial door hardware for the following:
      a. Swinging doors.
      b. Other doors to the extent indicated.
   2. Cylinders for doors specified in other Sections.
   3. Electrified door hardware.

B. Related Sections include the following:
   1. Division 8 Section "Steel Doors and Frames" for astragals provided as part of a fire-rated labeled assembly and for door silencers provided as part of the frame.
   2. Division 8 Section "Flush Wood Doors" for astragals provided as part of a fire-rated labeled assembly.
   3. Division 8 Section "Access Doors" for access door hardware, except cylinders.
   4. Division 8 Section "Aluminum Entrances and Storefronts" for entrance doors, except hardware and cylinders.
   5. Division 13 Sections 13700 "Security" and 13720 "Alarm & Access Control" for interface to security.

C. Products furnished, but not installed, under this Section include the following. Coordinating, purchasing, delivering, and scheduling remain requirements of this Section.
   1. Final replacement cores and keys to be installed by Owner.

1.2 SUBMITTALS

A. Product Data: Include installation details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Details of electrified door hardware, indicating the following:
   1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring. Include the following:
      a. System schematic.
      b. Point-to-point wiring diagram.
      c. Riser diagram.
      d. Elevation of each door.
   2. Detail interface between electrified door hardware and access control system.

C. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of door hardware indicated.

D. Samples: For exposed door hardware of each type indicated below, in specified finish, full size. Tag with full description for coordination with the Door Hardware Schedule. Submit samples before, or concurrent with, submission of the final Door Hardware Schedule.
1. Door Hardware: As follows:
   a. Hinges.
   b. Locks and latches.
   c. Exit devices.
   d. Operating trim.
   e. Closers.
   f. Stops and holders.
   g. Thresholds.

2. Samples will be returned to Contractor. Units that are acceptable and remain undamaged through submittal, review, and field comparison process may, after final check of operation, be incorporated into the Work, within limitations of keying requirements.

E. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening.
   a. Organize door hardware sets in same order as in the Door Hardware Schedule at the end of Part 3.

3. Content: Include the following information:
   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.
   h. Description of each electrified door hardware function, including location, sequence of operation, and interface with other building control systems.
      1) Sequence of Operation: Include description of component functions that occur in the following situations: authorized person wants to enter; authorized person wants to exit; unauthorized person wants to enter; unauthorized person wants to exit.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
5. **Submittal Sequence:** Submit initial draft of final schedule along with essential Product Data to facilitate the fabrication of other work that is critical in the Project construction schedule. Submit the final Door Hardware Schedule after Samples, Product Data, coordination with Shop Drawings of other work, delivery schedules, and similar information has been completed and accepted.

F. **Keying Schedule:** Prepared by or under the supervision of supplier, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

G. **Product Certificates:** Signed by manufacturers of electrified door hardware certifying that products furnished comply with requirements.
   1. Certify that door hardware approved for use on types and sizes of labeled fire doors complies with listed fire door assemblies.

H. **Qualification Data:** For firms and persons specified in "Quality Assurance" Article.
   1. Include lists of completed projects with project names and addresses of architects and owners, and other information specified.

I. **Product Test Reports:** Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, indicating current products comply with requirements.

J. **Certification by manufacturers that products supplied meet or exceed requirements of applicable referenced UBC Standards which may be different from the ASTM or other standard on which they are based.**

K. **Maintenance Data:** For each type of door hardware to include in maintenance manuals specified in Division 1.

L. **Warranties:** Special warranties specified in this Section.

### 1.3 QUALITY ASSURANCE

A. **Installer Qualifications:** An experienced installer who has completed door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

B. **Supplier Qualifications:** Door hardware supplier with warehousing facilities in Project's vicinity and who is or employs a qualified Architectural Hardware Consultant, available during the course of the Work to consult with Contractor, Architect, and Owner about door hardware and keying.

   1. **Electrified Door Hardware Supplier Qualifications:** An experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance, and who is acceptable to manufacturer of primary materials.
   
   a. **Engineering Responsibility:** Prepare data for electrified door hardware, including Shop Drawings, based on testing and engineering analysis of manufacturer's standard units in assemblies similar to those indicated for this Project.

   2. **Scheduling Responsibility:** Preparation of door hardware and keying schedules.

C. **Architectural Hardware Consultant Qualifications:** A person who is currently certified by the Door and Hardware Institute as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.

   1. **Electrified Door Hardware Qualifications:** Experienced in providing consulting services for electrified door hardware installations.
D. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.

1. Provide electrified door hardware from same manufacturer as mechanical door hardware, unless otherwise indicated. Manufacturers that are listed to perform electrical modifications, by a testing and inspecting agency acceptable to authorities having jurisdiction, are acceptable.

E. Regulatory Requirements: Comply with provisions of the following:

1. Where indicated to comply with accessibility requirements, comply with Americans with Disabilities Act (ADA), "Accessibility Guidelines for Buildings and Facilities (ADAAG)," Title 24 of the California Code of Regulations, and ICC/ANSI A117.1 as follows:
   a. Handles, Pulls, Latches, Locks, and other Operating Devices: Shape that is easy to grasp with one hand and does not require tight grasping, tight pinching, or twisting of the wrist.
   b. Door Closers: Comply with the following maximum opening-force requirements indicated:
      1) Interior and Exterior Hinged Doors: 5 lbf applied perpendicular to door.
      2) Sliding or Folding Doors: 5 lbf applied parallel to door at latch.
      3) Fire Doors: 15 lbf applied perpendicular to door.
   c. Thresholds: Top of threshold not more than 1/2 inch above the floor or landing, not more than 1/4 inch maximum vertical edge, and change in level between 1/4 inch and 1/2 inch beveled at a gradient of not more than 1:2

2. In addition to complying with other requirements specified, comply with the following for means of egress doors:
   a. Latches, Locks, and Exit Devices: Not more than 15 lbf to actuate exit devices and latches when applied in the direction of exit travel. Locks shall not require the use of a key, or special knowledge or effort for operation.
   b. Delayed Egress Locks: Lock releases within 15 seconds after applying a force not more than 15 lbf for not more than 2 seconds.

3. Electrified Door Hardware: Listed and labeled as defined in California Electrical Code, Article 100, by a testing agency acceptable to authorities having jurisdiction.

F. Fire-Rated Door Assemblies: Provide door hardware for assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UBC Standard 7-2 (based on UL 10 B-1988) and UL 10 C.

1. Test Pressure (Positive-pressure test): After 5 minutes into the test, the neutral pressure level in furnace shall be established at 40 inches or less above the sill.

G. Keying Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings." Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:

1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
2. Preliminary key system schematic diagram.
3. Requirements for key control system.
4. Address for delivery of keys.
H. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings." Review methods and procedures related to door hardware including, but not limited to, the following:

1. Inspect and discuss electrical roughing-in and other preparatory work performed by other trades.
2. Review sequence of operation for each type of electrified door hardware.
3. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.

1.4 DELIVERY, STORAGE, AND HANDLING
A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
C. Deliver keys to manufacturer of key control system.

1.5 COORDINATION
A. Coordinate layout and installation of recessed pivots and closers with floor construction. Cast anchoring inserts into concrete. Concrete, reinforcement, and formwork requirements are specified in Division 3 Section "Cast-in-Place Concrete."
B. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.
C. Electrical System Roughing-in: Coordinate layout and installation of electrified door hardware with connections to power supplies, fire alarm system and detection devices and access control system.

1.6 WARRANTY
A. General Warranty: Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
B. Special Warranty: Written warranty, executed by manufacturer agreeing to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, the following:
   1. Structural failures including excessive deflection, cracking, or breakage.
   2. Faulty operation of operators and door hardware.
   3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
C. Warranty Period: 2 years from date of Substantial Completion, unless otherwise indicated.
D. Warranty Period for Locksets and Exit Devices: 5 years from date of Substantial Completion.
E. Warranty Period for Manual Closers: 10 years from date of Substantial Completion.
F. Warranty Period for Concealed Closers: 10 years from date of Substantial Completion.
G. Warranty Period for Continuous Hinges: 10 years from date of Substantial Completion.

1.7 MAINTENANCE SERVICE
A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

B. Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies as used in the manufacture and installation of original products.

1.8 EXTRA MATERIALS

A. Furnish full-size units of door hardware described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Door Hardware: One each: Entrance function mortise lock and surface door closer.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in this Section, and the Door Hardware Schedule at the end of Part 3.

1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products.

2. Sequence of Operation: Provide electrified door hardware function, sequence of operation, and interface with other building control systems indicated.

B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Schedule at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

2.2 HINGES AND PIVOTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hinges:
   a. Hager Companies (HAG).
   b. McKinney Products Company; Div. of Assa Abloy. (MCK).
   c. Stanley Commercial Hardware; Div. of The Stanley Works (STN).

2. Pivots and Pivot Hinges:
   b. Stanley Commercial Hardware; Div. of The Stanley Works (STN).

3. Continuous Pin and Barrel Hinges:
   a. Markar Products, Inc. (MP).
   b. Select Hardware (SEL).

B. Standards: Comply with the following:
2. Template Hinge Dimensions: BHMA A156.7.
4. Pivots: BHMA A156.4.

C. Quantity: Provide the following, unless otherwise indicated:
   1. Two Hinges: For doors with heights up to 60 inches.
   2. Three Hinges: For doors with heights 61 to 90 inches.
   3. Four Hinges: For doors with heights 91 to 120 inches.
   4. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.

D. Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

<table>
<thead>
<tr>
<th>Maximum Door Size (inches)</th>
<th>Hinge Height (inches)</th>
<th>Standard Weight</th>
<th>Heavy Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>32 by 84 by 1-3/8</td>
<td>3-1/2</td>
<td>0.123</td>
<td>-</td>
</tr>
<tr>
<td>36 by 84 by 1-3/8</td>
<td>4</td>
<td>0.130</td>
<td>-</td>
</tr>
<tr>
<td>36 by 84 by 1-3/4</td>
<td>4-1/2</td>
<td>0.134</td>
<td>0.180</td>
</tr>
<tr>
<td>42 by 90 by 1-3/4</td>
<td>4-1/2</td>
<td>0.134</td>
<td>0.180</td>
</tr>
<tr>
<td>48 by 120 by 1-3/4</td>
<td>5</td>
<td>0.146</td>
<td>0.190</td>
</tr>
</tbody>
</table>

E. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.

F. Hinge Weight: Unless otherwise indicated, provide the following:
   1. Entrance Doors: Heavy-weight hinges.
   2. Doors with Closers: Antifriction-bearing hinges.

G. Hinge Base Metal: Unless otherwise indicated, provide the following:
   1. Exterior Hinges: Steel, with stainless-steel pin.
   2. Interior Hinges: Steel, with steel pin.
   3. Hinges for Fire-Rated Assemblies: Steel, with steel pin, Stainless steel, with stainless-steel pin.

H. Hinge Options: Comply with the following where indicated in the Door Hardware Schedule or on Drawings:
   1. Hospital Tips: Slope ends of hinge barrel.
   3. Nonremovable Pins: Provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the following applications:
a. Outswinging exterior doors.
b. Outswinging corridor doors with locks.


I. Electrified Functions for Hinges: Comply with the following:
   1. Electrical Contact: Exposed electrical contacts for transfer of power.
   2. Power Transfer: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle.
   3. Power Transfer and Monitoring: Concealed PTFE-jacketed wires, secured at each leaf and continuous through hinge knuckle, and with concealed electrical monitoring switch.

J. Continuous-Pin and Barrel Hinges: Minimum 0.25 diameter stainless steel pin, with 14 gauge stainless steel or steel hinge leaves, carrying doors weighing up to 600 pounds and durability tested minimum of 1,500,000 cycles; fabricated to full height of door and frame. Fabricate hinges to symmetrical template screw locations.

K. Fasteners: Comply with the following:
   2. Wood Screws: For wood doors and frames.
   3. Threaded-to-the-Head Wood Screws: For fire-rated wood doors.

2.3 LOCKS AND LATCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Mechanical Locks and Latches:
      b. Corbin-Russwin Architectural Hardware; Div. of Assa Abloy (C-R).
      c. Schlage Lock Co.; Div. of Ingersol Rand (SCH).

B. Standards: Comply with the following:
   1. Bored Locks and Latches: BHMA A156.2.
   3. Auxiliary Locks: BHMA A156.5.
   4. Exit Locks: BHMA A156.5.

C. Bored Locks: BHMA Grade 1; Series 4000.

D. Mortise Locks: Stamped steel case with steel or brass parts; BHMA Grade 1; Series 1000.

E. Auxiliary Locks: BHMA Grade 1.

F. Certified Products: Provide door hardware listed in the following BHMA directories:

G. Lock Trim: Comply with the following:
   1. Lever: Cast stainless steel.
   2. Escutcheon Rose: Wrought, forged, or cast.
   3. Dummy Trim: Match lever trim and escutcheons.
4. Lockset Designs: Provide the lockset design designated in the hardware sets.. Provide
design indicated or alternate equal design by listed manufacturers.

H. Lock Functions: Function numbers and descriptions indicated in the Door Hardware Schedule
comply with the following:
1. Bored Locks: BHMA A156.2.

I. Lock Throw: Comply with testing requirements for length of bolts to comply with labeled fire
door requirements, and as follows:
1. Bored Locks: Minimum 1/2-inch latchbolt throw.

J. Rabbeted Doors: Provide special rabbeted front and strike on locksets for rabbeted meeting
stiles.

K. Backset: 2-3/4 inches unless otherwise indicated.

2.4 ELECTRIFIED LOCKS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the follow-
ing:
1. Electric Mortise Locksets:
   b. Corbin-Russwin Architectural Hardware; Div. of Assa Abloy (C-R).
   c. Schlage Lock Co.; Div. of Ingersol Rand (SCH).

B. Electric Controlled Mortise Locksets: Solenoid operated, self-contained in mortise lock case,
with internal rectifier. ULC Listed fail-safe or fail-secure locks of types and grades indicated; with
24 volt DC continuous duty solenoid lock mounted inside door and strike plate attached to
frame. Comply with the following:
1. BHMA Grade: Grade 1.

C. Exit Locks: Surface-mounted deadbolts or latchbolts; with battery-powered alarm that sounds
when unauthorized use of door occurs; housed in metal case. Provide red-and-white pressure-
sensitive lettering reading "PUSH TO OPEN--ALARM WILL SOUND."

2.5 DOOR BOLTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the follow-
ing:
1. Surface Bolts:
   a. Door Controls International (DCI).
   b. Don-Jo Manufacturing (DJM).
   c. Hager Companies (HAG).
   d. Ives: H. B. Ives (IVS).
   e. Rockwood Manufacturing Company (RM).

2. Flush Bolts:
   a. Door Controls International (DCI).
b. Don-Jo Manufacturing (DJM).
c. Hager Companies (HAG).
d. Ives: H. B. Ives (IVS).
e. Rockwood Manufacturing Company (RM).

B. Standards: Comply with the following:
1. Surface Bolts: BHMA A156.16.

C. Surface Bolts: BHMA Grade 1.
1. Flush Bolt Heads: Minimum of 1/2-inch-diameter rods of brass, bronze, or stainless steel with minimum 12-inch-long rod for doors up to 84 inches in height. Provide longer rods as necessary for doors exceeding 84 inches.

D. Flush Bolts: BHMA Grade 1, designed for mortising into door edge.

E. Bolt Throw: Comply with testing requirements for length of bolts to comply with labeled fire door requirements, and as follows:
2. Interlocking Surface Bolts: Minimum 15/16-inch throw.
3. Fire-Rated Surface Bolts: Minimum 1-inch throw; listed and labeled for fire-rated doors.

2.6 EXIT DEVICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Adams Rite Manufacturing (ARM).
2. Von Duprin; Div of Ingersol-Rand (VON).
3. Precision Hardware, Inc. (PHI).

B. Standard: BHMA A156.3.
1. BHMA Grade: Grade 1.

C. Certified Products: Provide exit devices listed in BHMA's "Directory of Certified Exit Devices."

D. Panic Exit Devices: Listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for panic protection, based on testing according to UBC Standard 10-4 (based on UL 305-79).

E. Fire Exit Devices: Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UBC Standard 10-4 (based on UL 305-79) and UBC Standard 7-2 (based on UL 10B-1988).

F. Outside Trim: Lever with cylinder, material and finish to match locksets, unless otherwise indicated.
1. Lever trim shall be free-wheeling where indicated in hardware sets.
G. Through Bolts: For exit devices and trim on wood doors

H. Panic Exit Device Construction: Modern push pad type with no more than 3-3/4” projection, reversible device with heavy-duty cold forged steel or bronze chassis, satin stainless steel latch cover, rail, touch bar and end cap.

2.7 CYLINDERS AND KEYING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cylinders:
   a. ASSA, Assa High Security Locks (AHS).
   c. Corbin-Russwin Architectural Hardware; Div. of Assa Abloy (C-R).
   d. Schlage Lock Co.; Div. of Ingersol Rand (SCH).

B. Standards: Comply with the following:

1. Cylinders: BHMA A156.5.
2. Key Control System: BHMA A156.5.

C. Cylinder Grade: BHMA Grade 1.

D. Cylinders: Manufacturer's small format interchangeable core patent protected security type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:

1. Number of Pins: Seven.
2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
3. Rim Type: Cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
4. Bored-Lock Type: Cylinders with tailpieces to suit locks.

E. Construction Keying: Comply with the following:

2. Construction Cylinders: Provide construction cores to be replaced by permanent cores.
   a. Furnish permanent cores and control keys to City Engineer.

F. Keying System: Grand master key as directed by City Engineer.

   a. Permanent keying; pinning cylinders and cutting keys shall be by the Lock Company Factory, where records shall be maintained.

G. Keys: Provide nickel-silver keys complying with the following:

1. Quantity: In addition to one extra blank key for each lock, provide the following:
   a. Cylinder Keys: Two per each lock or cylinder.
   b. Control Keys: Four.
   c. Master Keys: Six per each master set.
   d. Grand Master Keys: Four.
H. Key Control System: BHMA Grade 1 system, including key-holding hooks, labels, two sets of key tags with self-locking key holders, key-gathering envelopes, and temporary and permanent markers. Contain system in metal cabinet with baked-enamel finish.

1. Wall-Mounted Cabinet: Telkee (TEL) Cabinet with hinged-panel door equipped with key-holding panels and pin-tumbler cylinder door lock.
2. Capacity: Able to hold keys for 150 percent of the number of locks.
3. Cross-Index System: Set up by key control manufacturer, complying with the following:
   a. Card Index: Furnish four sets of index cards for recording key information. Include three receipt forms for each key-holding hook.

2.8 ELECTRIC STRIKES AND JAMB LOCKS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Electric Strikes:
   a. Folger Adam Security Inc. (FAS).

B. Standards: Comply with the following:
1. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.5.
4. Dustproof Strikes: BHMA A156.16.
5. Electric Strikes: BHMA A156.5.

C. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:
1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

D. Dustproof Strikes: BHMA Grade 1.
E. Electric Strikes: BHMA Grade 1.

2.9 OPERATING TRIM

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Don-Jo Manufacturing; (DJM).
2. Forms & Surfaces (F&S).

B. Standard: Comply with BHMA A156.6.

C. Materials: Fabricate from satin stainless steel, unless otherwise indicated.

D. Push-Pull Design: As illustrated on Drawings or specified in hardware sets.

2.10 ACCESSORIES FOR PAIRS OF DOORS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Coordinators:
   a. Don-Jo Manufacturing (DJM).
   d. Door Controls International (DCI).

2. Removable Mullions:
   b. Detex (DET).

3. Astragals:
   a. National Guard Products, Inc. (NGP).
   b. Pemko Manufacturing Co., Inc. (PEM).

B. Standards: Comply with the following:

1. Coordinators: BHMA A156.3.
2. Removable Mullions: BHMA A156.3.

C. Carry-Open Bars: Provide carry-open bars for inactive leaves of pairs of doors, unless automatic or self-latching bolts are used.

D. Fire-Exit Removable Mullions: Provide removable mullions for use with fire exit devices complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire and panic protection, based on testing according to UBC Standard 10-4 (based on UL 305-79) and UBC Standard 7-2 (based on UL 10B-1988). Mullions shall be used only with exit devices for which they have been tested.

2.11 CLOSERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Surface-Mounted Closers:
   a. Norton Door Controls; Div. of Yale Security Inc. (NOR).
   b. LCN; Div of Ingersol-Rand (LCN).

2. Concealed Floor Closers:

3. Electromechanical Closers:
   a. Norton Door Controls; Div. of Yale Security Inc. (NOR).
   b. LCN; Div of Ingersol-Rand (LCN).

4. Closer Holder Release Devices:
   a. Norton Door Controls; Div. of Yale Security Inc. (NOR).

B. Standards: Comply with the following:
1. Closers: BHMA A156.4.
2. Closer Holder Release Devices: BHMA A156.15.

C. Surface Closers: BHMA Grade 1, non-handed.

D. Concealed Floor Closers: BHMA Grade 1, with fully adjustable spring power and delayed action closing.

E. Certified Products: Provide door closers listed in BHMA’s "Directory of Certified Door Closers."

F. Hold-Open Closers/Detectors: Coordinate and interface integral smoke detector and closer device with fire alarm system.

G. Flush Floor Plates: Provide finish cover plates for floor closers unless thresholds are indicated. Match door hardware finish, unless otherwise indicated.

H. Recessed Floor Pans: Provide recessed floor pans with insert of floor finish material for floor closer, unless thresholds are indicated. Provide extended closer spindle to accommodate thickness of floor finish.

I. Power-Assist Closers: Norton Door Controls 6900 series or Stanley, as specified in Schedule of Hardware for access doors for the disabled or where listed in the Door Hardware Schedule. Provide electro-hydraulic or electromechanical type units.

J. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Provide factory multi-sized closers, adjustable to meet field conditions and requirements for opening force.

2.12 PROTECTIVE TRIM UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Metal Protective Trim Units:
      a. Don-Jo Manufacturing (DJM).
      b. IPC Door and Wall Protection Systems, Inc. (IPC).

B. Standard: Comply with BHMA A156.6.

C. Materials: Fabricate protection plates from the following:
   1. Stainless Steel: 0.050 inch thick; beveled all sides.

D. Fasteners: Provide manufacturer's standard exposed fasteners for door trim units consisting of either machine or self-tapping screws.

E. Furnish protection plates sized 1-1/2 inches less than door width on push side and 1/2 inch less than door width on pull side, by height specified in Door Hardware Schedule.

2.13 STOPS AND HOLDERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Don-Jo Manufacturing (DJM).
   2. Ives: H. B. Ives (IVS).
B. Standards: Comply with the following:
   1. Stops and Bumpers: BHMA A156.16.
   2. Mechanical Door Holders: BHMA A156.16.
   3. Electromagnetic Door Holders: BHMA A156.15.
   4. Combination Overhead Holders and Stops: BHMA A156.8.
   5. Door Silencers: BHMA A156.16.

C. Stops and Bumpers: BHMA Grade 1.
D. Mechanical Door Holders: BHMA Grade 1.
E. Combination Floor and Wall Stops and Holders: BHMA Grade 1.
F. Combination Overhead Stops and Holders: BHMA Grade 1.
G. Electromagnetic Door Holders for Labeled Fire Door Assemblies: Coordinate with fire detectors and interface with fire alarm system.

H. Floor Stops: For doors, unless wall or other type stops are scheduled or indicated. Do not mount floor stops where they will impede traffic.
   1. Where floor or wall stops are not appropriate, provide overhead holders.

I. Silencers for Wood Door Frames: BHMA Grade 1; neoprene or rubber, minimum 5/8 by 3/4 inch; fabricated for drilled-in application to frame.
J. Silencers for Metal Door Frames: BHMA Grade 1; neoprene or rubber, minimum diameter 1/2 inch; fabricated for drilled-in application to frame.

2.14 DOOR GASKETING

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Door Gasketing:
      a. National Guard Products, Inc. (NGP).
      b. Pemko Manufacturing Co., Inc. (PEM).
   2. Door Bottoms:
      a. National Guard Products, Inc. (NGP).
      b. Pemko Manufacturing Co., Inc. (PEM).

B. General: Provide continuous silicone weather-strip gasketing with anodized retainers on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated or scheduled. Provide stainless steel fasteners for exterior applications and elsewhere as indicated.
   1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
   2. Meeting Stile Gasketing: Fasten to meeting stiles, forming seal when doors are closed.
   3. Door Bottoms: Apply to bottom of door, forming seal with threshold when door is closed.

C. Air Leakage: Not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.

D. Smoke-Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke-control ratings indicated, based on testing according to UBC Standard 7-2 (based on UL 10B-1988) and UL 10 C.
1. Provide smoke-labeled silicone gasketing on 20-minute-rated doors and on smoke-labeled doors.

E. Fire-Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL 10B or NFPA 252.

F. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated, based on testing according to ASTM E 1408.

G. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.


2.15 THRESHOLDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. National Guard Products, Inc. (NGP).
   2. Pemko Manufacturing Co., Inc. (PEM).

B. Standard: Comply with BHMA A156.21.

2.16 MISCELLANEOUS DOOR HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Don-Jo Mfr. (DJM).
   2. Sentrol (SEN).
   3. Tice Industries (TIC).

B. Standard: Comply with the following:
   1. Auxiliary Hardware: BHMA A156.16.
   2. Exit Alarms: BHMA A156.5.

C. Auxiliary Hardware: BHMA Grade 1.

D. Boxed Power Supplies: Modular unit in NEMA ICS 6, Type 4 enclosure; filtered and regulated; voltage rating and type matching requirements of door hardware served; and listed and labeled for use with fire alarm systems.

2.17 FABRICATION

A. Manufacturer's Nameplate: Do not provide manufacturers' products that have manufacturer's name or trade name displayed in a visible location (omit removable nameplates) except in conjunction with required fire-rated labels and as otherwise approved by Architect.
   1. Manufacturer's identification will be permitted on rim of lock cylinders only.

B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18 for finishes. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.
C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.

1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.

2. Steel Machine or Wood Screws: For the following fire-rated applications:
   a. Mortise hinges to doors.
   b. Strike plates to frames.
   c. Closers to doors and frames.

3. Steel Through Bolts: For the following fire-rated applications, unless door blocking is provided:
   a. Surface hinges to doors.
   b. Closers to doors and frames.
   c. Surface-mounted exit devices.

4. Spacers or Sex Bolts: For through bolting of hollow metal doors.

5. Fasteners for Wood Doors: Comply with requirements of DHI WDHS.2, "Recommended Fasteners for Wood Doors."

2.18 FINISHES

A. Standard: Comply with BHMA A156.18.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

D. BHMA Designations: Comply with base material and finish requirements indicated by the following:

1. BHMA 600: Primed for painting, over steel base metal.
2. BHMA 626: Satin chromium plated over nickel, over brass or bronze base metal.
3. BHMA 628: Satin aluminum, clear anodized, over aluminum base metal.
4. BHMA 630: Satin stainless steel, over stainless-steel base metal.
5. BHMA 652: Satin chromium plated over nickel, over steel base metal.
6. BHMA 689: Aluminum painted, over any base metal.
7. BHMA 719: Clear anodized aluminum, uncoated; aluminum base metal.

PART 3 - EXECUTION

3.1 EXAMINATION
A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Steel Doors and Frames: Comply with DHI A115 series.
   1. Surface-Applied Door Hardware: Drill and tap doors and frames according to SDI 107.

B. Wood Doors: Comply with DHI A115-W series.

3.3 INSTALLATION

A. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
   2. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
   4. Opening Hardware: Mount as indicated, or if not indicated, mount in accordance with requirements of applicable publications listed above and between 30 inches and 44 inches above the finish floor.

B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
   1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
   2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.

C. Key Control System: Place keys on markers and hooks in key control system cabinet, as determined by final keying schedule.

D. Boxed Power Supplies: Locate power supplies as indicated or, if not indicated, above accessible ceilings or in equipment room. Verify location with Architect.
   1. Configuration: Provide one power supply for each door opening.
   2. Configuration: Provide the least number of power supplies required to adequately serve doors with electrified door hardware.

E. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

3.4 FIELD QUALITY CONTROL

A. Independent Architectural Hardware Consultant: General Contractor will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.
1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

3.5 ADJUSTING
A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
   1. Spring Hinges: Adjust to achieve positive latching when door is allowed to close freely from an open position of 30 degrees.
   2. Electric Strikes: Adjust horizontal and vertical alignment of keeper to properly engage lock bolt.
   3. Door Closers: Adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches (75 mm) from the latch, measured to the leading edge of the door.
B. Six-Month Adjustment: Approximately six months after date of Substantial Completion, Installer shall perform the following:
   1. Examine and readjust each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.
   2. Consult with and instruct Owner's personnel on recommended maintenance procedures.
   3. Replace door hardware items that have deteriorated or failed due to faulty design, materials, or installation of door hardware units.

3.6 CLEANING AND PROTECTION
A. Clean adjacent surfaces soiled by door hardware installation.
B. Clean operating items as necessary to restore proper function and finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of Substantial Completion.

3.7 DEMONSTRATION
A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

3.8 DOOR HARDWARE SCHEDULE (Specifier to provide all hardware groups relative to the project.)

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Requirements for the fabrication and installation of surface mounted automatic swing -
      door operators, including operator, enclosure cover, safety and actuation controls.

B. Related Sections include the following:
   1. Division 5 Section "Metal Fabrications" for metal guide rails for doors equipped with
      power door operators.
   2. Division 8 Section "Door Hardware".
   3. Division 8 Section "Storefront Entrances".
   4. Division 8, Section 08800 "Glass and Glazing".
   5. Division 16 Sections for electrical connections including conduit and wiring for automatic
      door operators.

1.2 DEFINITIONS

A. Activation Device:  Device that, when actuated, sends electrical signal to automatic door
   operator to open door.

B. Safety Device:  Device that prevents door from opening or closing and protects pedestrians on
   swing side of doors.

1.3 PERFORMANCE REQUIREMENTS

A. Opening and Closing Forces:  Not more than 30 lbf 1 inch from the latch edge of the door.

1.4 SUBMITTALS

A. Product Data:  Include construction details, material descriptions, dimensions of individual
   components and profiles, and finishes for automatic door operators and activation and safety
   devices.

B. Shop Drawings:  Show fabrication and installation details for automatic door operators.  Include
   locations and elevations of entrances showing activation and safety devices.
   1. Include plans, elevations, sections, details, and attachments to other work for guide rails.

C. Samples for Verification:  For exposed components and activation and safety devices with
   factory-applied color finishes.

D. Field quality-control test reports.

E. Product Test Reports:  Based on evaluation of comprehensive tests performed by a qualified
   testing agency, for each product.
F. Operation and Maintenance Data: For automatic door operators to include in emergency, operation, and maintenance manuals.

G. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of units required for this Project and who employs an inspector certified by AAADM.
   1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

B. Manufacturer Qualifications: Company certificate issued by AAADM.

C. Testing Agency Qualifications: An independent agency with inspector certified by AAADM.

D. Source Limitations: Obtain automatic door operators through one source from a single manufacturer.

E. Electrical Components, Devices, and Accessories: Listed and labeled as defined in City of Los Angeles Electrical Code, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.


G. UL Standard: Comply with UL 325.

H. ANSI/BHMA Standard: Comply with A156.10.

I. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Management and Coordination."

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify door openings by field measurements before fabrication of exposed covers for automatic door operators and indicate measurements on Shop Drawings.

1.7 COORDINATION

A. Coordinate size and locations of recesses in concrete floors for recessed control mats that control automatic door operators. Concrete, reinforcement, and formwork requirements are specified in Division 3.

B. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing automatic door operators. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing automatic door operators to comply with indicated requirements.

C. Electrical System Roughing-in: Coordinate layout and installation of automatic door operators with connections to power supplies.
1.8 WARRANTY
A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of automatic door operators that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Faulty or sporadic operation of automatic door operator or activation and safety devices.
      b. Deterioration of metals, metal finishes, and other materials beyond normal weathering or use.
   2. Warranty Period: One year from date of Substantial Completion.

1.9 MAINTENANCE SERVICE
A. Maintenance: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of automatic door operator Installer. Include quarterly planned and preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Provide parts and supplies same as those used in the manufacture and installation of original equipment.
   1. Engage inspector certified by AAADM to perform safety inspection after each adjustment or repair and at end of maintenance period. Submit completed inspection form to Owner.
   2. Perform maintenance, including emergency callback service, during normal working hours.

1.10 EXTRA MATERIALS
A. Furnish extra materials described below, before installation begins, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Activation and Safety Devices: One unit of each type.

PART 2 - PRODUCTS

2.1 PRODUCTS AND MANUFACTURERS
A. Products: Subject to compliance with requirements, provide the product indicated below:
   1. Horton Automatics; Model 4000.
   2. KM Systems; Model 2000.

2.2 MATERIALS
A. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated, complying with standards indicated below:
   2. Extrusions: ASTM B 221.

B. Welding Rods and Bare Electrodes: AWS A5.10/A5.10M.
2.3 AUTOMATIC DOOR OPERATORS, GENERAL

A. General: Provide operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for long-term, maintenance-free operation under normal traffic load for type of occupancy indicated.

B. Electromechanical or electro-hydraulic unit powered by permanent-magnet dc motor; with closing speed controlled mechanically by gear train and dynamically by braking action of electric motor, and with manual operation including spring closing with power off.

C. Hinge and lock operation: Refer to Division 8 Section "Door Hardware" to determine type of hinge and locking hardware for each door that door operator shall accommodate.

D. Housing: Fabricated from 0.125-inch-thick extruded or formed aluminum.

E. Exposed Cover: Fabricated from 0.125-inch-thick extruded aluminum; continuous over full width of door opening; flush with door frame, provision for maintenance access on side, and fasteners concealed when door is in closed position.
   1. Finish and Color: Match door and frame.

2.4 POWER-OPEN DOOR OPERATORS

A. Standard: Comply with BHMA A156.10.

B. Performance Requirements:
   1. Not more than 15 lbf 1 inch from latch edge of door to prevent stopped door from opening or closing.
   2. If power fails, not more than 30 lbf 1 inch from latch edge of door to manually set door in motion.

C. Operation: Power opening and spring closing. When not in automatic mode, door operator shall function as manual door closer, with or without electrical power. Furnish unit with
   1. Control speed of cycle by motor as dynamic brake.
   2. Power-Opening: Upon actuation door operator will automatically open door. The door will remain in the open position until adjustable time-out delay is satisfied.

D. Operating System: Electromechanical or electro-hydraulic.

E. Features:
   1. Adjustable opening and closing speed.
   2. Adjustable opening force.
   3. Adjustable back-check.
   4. Adjustable hold-open time delay 0 – 30 seconds.
   5. Adjustable electrical interface time delay to allow electrified hardware to release, prior to door operator activating.
   6. Three position switch for ON, OFF, HOLD-OPEN.
   7. ON-OFF key switch.
   8. Obstruction re-set.

F. Mounting: Surface mounted on transom panel.
2.5 ACTIVATION AND SAFETY DEVICES

A. Activation Switch: Manufacturer's standard motion sensor activation on both sides of door, installed in compliance with ANSI A156.10 and local codes. Exterior mounted motion sensor shall be capable of deactivation at the door opening by use of local key switch and from remote located push button switch, to enable remote release of doors.

B. Electrical Interlocks: Provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted and for interfacing required electrical hardware and access controls.

C. Safety Devices: Provide swing side safety devices to protect the swing area of the door in compliance with ANSI A156.10., including if required guard rails and safety beams.

2.6 ACCESSORIES

A. High-Energy Automatic Door Operator Signage: Comply with BHMA A156.10.

2.7 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.8 ALUMINUM FINISHES

A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

B. High-Performance Organic Finish (2-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard 2-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pre-treat, and apply coating to exposed metal surfaces to comply with AAMA 2605 and with coating and resin manufacturers' written instructions.

1. Color and Gloss: To match that of storefront door and frame.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances, door and frame supports, and other conditions affecting performance of automatic door operators.
B. Examine roughing-in for electrical systems to verify actual locations of power connections before automatic door operator installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install complete automatic door operator system, including activation and safety devices, control wiring, and remote power units.

B. Full Power Door Operator Installation Standard: Comply with BHMA A156.10 for installation.

C. Automatic Door Operators: Install door operator system, including control wiring, as follows:
   1. Refer to Division 16 Sections for connection to electrical power distribution system.
   2. Refer to Division 13 Security Sections for connection and interface with building security system and electrified access control hardware.

D. Activation and Safety Devices: Install devices and wiring, including connections to automatic door operators, according to BHMA A156.10 and as follows:
   1. Motion Switches: Provide low-profile header mounted motion switches on both sides of each opening indicated to receive automatic door operators.

E. Connect wiring according to Division 16 Section "Conductors and Cables."

3.3 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Testing and Inspecting: After installation has been completed, testing and inspecting of each automatic door operator shall be performed to verify compliance with applicable BHMA standards.
   1. Inspection Report: Submit report in writing to Architect and Contractor within 24 hours after inspection.

C. Remove and replace automatic door operators where test results indicate they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, shall be performed to determine compliance of replaced or additional work with specified requirements.

3.4 ADJUSTING

A. Adjust automatic door operators and activation and safety devices to operate smoothly, easily, and properly, and for safe operation and weather-tight closure.
   1. Adjust doors with low-energy door operators to close according to BHMA A156.10.

B. Lubricate operators, hardware, and other moving parts.

C. After completing installation of exposed, factory-finished automatic door operators, inspect exposed finishes and repair damaged finishes.
D. Readjust automatic door operators and activation and safety devices after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles). Lubricate hardware, operating equipment, and other moving parts.

E. Occupancy Adjustment: When requested within [12] <Insert number> months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to site outside normal occupancy hours for this purpose, without additional cost.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain automatic door operators. Refer to Division 1 Section "Demonstration and Training."

END OF SECTION
PART 1 - GENERAL

1.01 SUMMARY

A. Section includes [clear] [tinted] [low emissivity] [spandrel] [patterned] [wired] [mirror] [heat strengthened] [fully tempered] [laminated] [monolithic] [insulating] glass and glazing accessories for:

1. [Steel] [aluminum] [wood] doors [and] [frames].

2. Manufactured [fixed] [and] [operable] [wood] [aluminum clad wood] [steel] [aluminum] [tubular plastic] windows.

B. Related sections:

1. Section 08110, “Steel Doors and Frames”: Hollow steel doors and frames to be field glazed.

2. Section 08210, “Wood Doors”: Vision lights in wood doors to be factory glazed.

1.02 REFERENCES

A. American Architectural Manufacturers Association (AAMA):

AAMA 800 - Voluntary Specifications and Test Methods for Sealants.

B. American National Standards Institute (ANSI):


C. American Society of Civil Engineers (ASCE):


D. American Society of Testing and Materials (ASTM):

ASTM C509 - Elastomeric Cellular Preformed Gasket and Sealing Material.

ASTM C864 - Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.

ASTM C920 - Elastomeric Joint Sealants.

ASTM C1036 - Flat Glass.
ASTM C1048 - Heat Treated Flat Glass, Kind HS, Kind FT, Coated and Uncoated.
ASTM C1115 - Dense Elastomeric Silicone Rubber Gaskets and Accessories.
ASTM C1172 - Laminated Architectural Flat Glass.
ASTM C1281 - Preformed Tape Sealants for Glazing Applications.
ASTM E546 - Frost Point of Sealed Insulating Glass Units.
ASTM E576 - Frost Point of Sealed Insulating Glass Units in Vertical Position.
ASTM E773 - Accelerated Weathering of Sealed Insulating Glass Units.
ASTM E774 - Classification of the Durability of Sealed Insulating Glass Units.

E. Associated Laboratories, Inc. (ALI):

F. Code of Federal Regulations (CFR):

G. Glass Association of North America (GANA):

H. Insulating Glass Certification Council (ICCC)

I. National Accreditation and Management Institute (NAMI)

J. National Fire Protection Association (NFPA):
   NFPA 80- Standard for Fire Doors and Fire Windows

K. National Fenestration Rating Council (NFRC)
   NFRC 100- Procedure for Determining Fenestration Product U-Factors

L. Underwriters Laboratories, Inc. (UL)
   UL 9- Fire Tests of Window Assemblies
1.03 DEFINITIONS

A. Visible Light Transmittance (T-vis): Percentage of sun's visible energy transmitted through glass.

B. Ultra Violet Transmittance: Percentage of sun's ultra violet or infrared energy transmitted through glass.

C. U-value: Overall indication of heat flow through glass where a lower value indicates less heat flow and hence better thermal performance. Winter nighttime values are calculated using outdoor air temperature of 0 degrees F, indoor temperature of 70 degrees F, and 15 MPH outdoor air velocity. Summer daytime U-values are calculated using outdoor air temperature of 89 degrees F, indoor temperature of 75 degrees F, 7.5 MPH outdoor air velocity, and solar intensity of 248 BTU.

D. Shading Coefficient (SC): Ratio of total solar energy passing through glass relative to amount passing through 1/8 inch thick clear glass under same conditions. A lower coefficient indicates better performance in reducing heat gain.

E. Solar Heat Gain Coefficient (SHGC): Solar heat gain through glass relative to the amount of solar radiation. It is equal to 86 percent of the shading coefficient.

F. Light-to-Solar Gain Ratio (LSG): Ratio of visible light transmittance (T-vis) to solar heat gain coefficient (SHGC), LSG=(T-vis)/(SHGC). The higher the ratio, the better the glass is at reducing unwanted solar heat and maximizing light transmittance.

1.04 SYSTEM DESCRIPTION

A. Provide and install glass in accordance ASTM E1300 to withstand thermal movement and wind and impact loads without breakage, loss, failure of seals, product deterioration, and other defects.

1. Wind and snow design loads: Determined by ASCE 7.

2. Thermal movement design conditions:
   a. Ambient temperature range: 120 degrees F, (48.8 degrees C).
   b. Material surfaces range: 180 degrees F, (82.2 degrees C).

B. Provide and install gaskets, sealants, and other glazing accessories to resist water and air penetration.

C. Center-of-Glass U-Values: NFRC 100 methodology using LBL-35298 WINDOW 4.1 computer program or latest version, expressed as Btu/ sq. ft. x h x deg F (W/sq. m x K).

D. Center-of-Glass Solar Heat Gain Coefficient: NFRC 200 methodology using LBL-35298 WINDOW 4.1 computer program or latest version.

E. Solar and Infrared Optical Properties: NFRC 300.
1.05 SUBMITTALS

A. Provide in accordance with Section 01330, “Submittal Procedures”:

   1. List of proposed products and product data.

   2. Glazing schedule: List glass type, size, and thickness for each opening. Use same designations as Drawings.

   3. Shop drawings detailing glass setting methods and materials.

   4. Samples: 4 by 6 inches minimum size for each type of [tinted] [patterned] [wired] [spandrel] glass.

   5. Glass manufacturer, glass fabricator, and installer qualifications as required by Paragraphs [1.5.A, B, and D.]

   6. Manufacturer's certificates that:

      a. Glazing materials meet or exceed specified requirements.

      b. Sealants have been tested for adhesion to and compatibility with glass and glazing substrates.

   7. Fabricator’s certificates: Certify that safety glass units and sealed insulating glass units meet or exceed specified requirements.

   8. Manufacturer's installation and protection instructions.

   9. Copy of warranties required by Paragraph [1.6] for review by Contracting Officer.

   10. Material Safety Data Sheets (MSDS): Submit MSDS information for glass materials including sealant, tape and gasket.

1.06 QUALITY ASSURANCE

A. Glass manufacturer: Company specializing in manufacture of clear, tinted, coated, and other glass products with 10 years minimum successful experience.

B. Source quality control: To ensure uniformity, all tinted and coated glass used for Project shall be obtained from single manufacturer.

C. Glass fabricator: Company specialized in fabricating insulating, heat strengthened, tempered, laminated, glass units with 5 years minimum successful experience.

D. Glass installer: Company installing glass on site shall specialize in this type of work and have 5 years minimum successful experience.

E. Safety glazing: Comply with CFR 16CFR 1201, ANSI Z97.1, and other applicable safety requirements. Each piece of safety glazing shall be permanently labeled with appropriate marking.
A. Insulating glass units: Permanently labeled with one of the following testing agency certifications.
   1. Insulating Glass Certification Council (IGCC).

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect glass and glazing materials during delivery, storage, and handling in accordance with manufacturer's instructions.

B. Prevent edging chipping and damage from condensation, temperature changes, and exposure to sunlight.

C. Insulating glass units: Comply with fabricator's instructions for venting and sealing when units are exposed to substantial altitude changes.

1.08 WARRANTY

A. Provide under provisions of Section 01770, "Closeout Procedures":
   1. Coated glass units: 10 years manufacturer's warranty to cover replacement in event of peeling, cracking, and deterioration of coating.
   2. Insulating sealed glass units: 10 years fabricator's warranty to cover replacement in event of seal failure and interpane dusting, misting, and filming.
   3. Laminated glass units: 5 years fabricator's warranty to cover replacement in event of delamination, edge separation, and blemishes exceeding referenced standard.
   4. Mirror glass units: 5 years manufacturer's warranty to cover replacement in event of peeling, cracking, and deterioration of coating.

PART 2 - PRODUCTS

2.01 ACCEPTABLE GLASS MANUFACTURERS

A. AFGD Glass, Atlanta, Georgia; www.afg.com.


D. Pilkington; Toledo, Ohio; www.pilkington.com.


G. Manufacturers of equivalent products submitted and approved in accordance with Section 01330, “Submittal Procedures”. Contracting Officer reserves right to reject proposed substitutions on basis of color tint and reflective appearance even though material and performance values are equivalent.

2.02 PRIMARY GLASS PRODUCTS

A. Clear glass:

1. Type: Clear, transparent, flat, annealed, float glass, conforming to ASTM C1036, Type I, Class 1, Quality q3.


3. Performance attributes:
   b. Ultra Violet Transmittance: 65 [_____] percent.
   c. Winter Nighttime U-value: 1.09 [_____].
   d. Summer Daytime U-value: 1.03 [_____].
   e. Shading Coefficient (SC): 0.94 [_____].
   f. Solar Heat Gain Coefficient (SHGC): 0.81.
   g. Light-to-Solar Gain Ratio (LSG): 1.10.

B. Color tinted glass:

1. Type: Blue [Light green] [Dark green] [Light gray] [Medium gray] [Dark gray] [Bronze] tinted glass: Color tinted, annealed, float glass conforming to ASTM C1036, Type I, Class 2, Quality q3; [_____] as manufactured by [_____].


3. Performance attributes:
   b. Ultra Violet Transmittance: [_____] percent.
   c. Winter Nighttime U-value: [_____].
   d. Summer Daytime U-value: [_____].
e. Shading Coefficient (SC): [____].

f. Solar Heat Gain Coefficient (SHGC): [____].

g. Light-to-Solar Gain Ration (LSG): [____].

C. Low emissivity (low-E) glass:

1. Type: Clear glass with neutral coating pyrolytically applied to produce durable surface with unlimited shelf life and product which can be easily cut and tempered and resulting in improved thermal performance and reduced solar heat gain; [____] as manufactured by [____].


3. Performance attributes:
   a. Visible Light Transmittance (T-vis): [0.44 minimum] [____].
   b. Winter Nighttime U-value: [0.35 maximum] [____].
   c. Summer Daytime U-value: [0.36 maximum] [____].
   d. Light-to-Solar Gain Ration (LSG): [1.15 minimum] [____].
   e. Solar Heat Gain Coefficient (SHGC): [____]. As appropriate to comply with above requirements for T-vis and LSG

D. Patterned glass:

1. Type: Clear, annealed, flat glass with distinctive pattern on one side and conforming to ASTM C1036, Type II, Class 1, Form 3, Quality q8, Finish f1; [____] as manufactured by [____].

2. Type: Clear, fully tempered, flat glass with distinctive pattern on one side and conforming to ASTM C1048, Kind FT, Type II, Class 1, Form 3, Quality q8, Finish f1; [____] as manufactured by [____].


4. Pattern: [Linear, p1] [Geometric, p2] [Random, p3] [Special, p4].

E. Wired glass:

1. Type: Clear, annealed, flat glass, conforming to ASTM C1036, Type II, Class 1, Quality q8. Glass for fire-rated doors shall comply with NFPA 80, ASTM 2010 and UL 9, labeled and listed by UL or other testing and inspecting agency.

2. Surface: [Form 1, polished both sides.] [Form 2, patterned.]

4. Mesh: Woven stainless steel wire in [diamond, Mesh m1] [square, Mesh m2] pattern.

2.03 HEAT TREATED GLASS

A. Heat strengthened glass: Provide heat strengthened, annealed glass components where indicated or required to adequately support imposed loads, to allow for large glass size, and resist anticipated thermal stresses in accordance with ASTM C1048, Kind HS.

B. Fully tempered glass:
   1. Provide heat tempered, annealed glass components where indicated or required to adequately resist loading conditions, size of units, and anticipated thermal stresses in accordance with ASTM C1048, Kind FT.
   2. Fully tempered glass shall meet requirements of ANSI Z97.1 and CFR 16CFR 1201 to qualify as safety glass.

2.04 LAMINATED GLASS

A. Laminated glass: Fabricate by bonding two or more glass panes with transparent, flexible interlamintation material in accordance with ASTM C1172.

B. Laminated glass shall meet requirements of ANSI Z97.1 and CFR 16CFR 1201 to qualify as safety glass.

A. Film coated spandrel glass: [Heat strengthened] [Fully tempered] [clear] [tinted] float glass with colored polyester film applied to interior surface to provide opacity for non-vision areas and conforming to ASTM C1036, Type 1, Quality q3 and C1048, Kind [HS] [FT], Condition C.

B. Ceramic coated spandrel glass: [Heat strengthened] [Fully tempered] [clear] [tinted] float glass with colored ceramic frit coating heat fused to interior surface to provide opacity for non-vision areas and conforming to ASTM C1036, Type 1, Quality q3 and C1048, Kind [HS] [FT], Condition B.

2.05 MIRROR GLASS

A. Mirror glass: Mirror glass, clear float tempered safety type with copper and silver coating, organic overcoating, beveled edges 1/4 inch thick, with safety film. Sizes as scheduled on Drawings.

B. Adhesive: Asphalitic bitumen for installation of mirrors on walls.

2.06 FABRICATED GLASS UNITS
A. Fabricate the following glazing units listed below for use on Project using glass products specified in Paragraphs 2.2 through 2.[______]. Refer to Drawings for required sizes and locations.

1. Thickness: Indicated glass thickness are minimums. Provide glass units with thickness as required for glass type, size, and to accommodate performance requirements specified in Paragraph 1.4.

2. Heat treatment: Provide heat strengthened or fully tempered glass units where indicated or as required to accommodate performance requirements specified in Paragraph 1.4.

3. Clean cut glass units to accommodate opening sizes and edge and bite conditions.

B. Monolithic glass units:

1. Type G[______]:
   a. Type: [Annealed] [Heat strengthened] [Fully tempered safety] [Laminated safety] glass.
   b. Thickness: [(1/4) [______] inch].
   c. Color: [Clear] [(______) tinted].


1. Type G[______]: Insulating glass, double pane unit with [1/2] [______] inch air space.
   b. Outside lite:
      (1) Type: [Annealed] [Heat strengthened] [Fully tempered safety] [Laminated safety] glass.
      (2) Thickness: [(1/4) [______] inch].
      (3) Color: [Clear] [(______) tinted].
      (4) Low-E coating on inside face: [______].
   c. Inside lite:
      (1) Type: [Annealed] [Heat strengthened] [Fully tempered safety] [Laminated safety] glass.
      (2) Thickness: [1/4] [______] inch.
(3) Color: [Clear] [_____] tinted.

(4) Low-E coating on inside face: [______].

d. Performance attributes:


(2) Ultra Violet Transmittance: [_____] percent.

(3) Winter Nighttime U-value: [0.35 maximum] [______].

(4) Summer Daytime U-value: [0.36 maximum] [______].

(5) Shading Coefficient (SC): [______].

(6) Light-to-Solar Gain Ratio (LSG): [1.15 minimum] [______].

(7) Solar Heat Gain Coefficient (SHGC): [______]. As appropriate to comply with above requirement for T-vis and LSG.

2.07 ACCESSORIES

A. Provide glazing accessories for specific applications of type recommended by glass manufacturer and glass fabricator and as required for complete, functional, weather tight installation.

B. Cleaners and primers: Compatible with substrate and glazing materials and application condition.

C. Setting blocks: Elastomeric material with Shore A durometer hardness between 80 and 90.

D. Spacer shims: Elastomeric material blocks or extrusions with 50 to 60 Shore A durometer hardness.

E. Edge blocks: Elastomeric material of hardness required to limit lateral movement of glass.

F. Glazing tape: Preformed butyl compound, non-staining, non-migrating in contact with non-porous surfaces, coiled on release paper, [black] [______] and complying with ASTM C1281 and AAMA 800.

G. Glazing gaskets: Provide type, profile, and hardness as required to maintain watertight seal.

1. Dense compression type: Molded or extruded material, [black] [______].

   a. EPDM gasket complying with ASTM C864.

   b. Silicone complying with ASTM C1115.

   c. Thermoplastic polyolefin rubber complying with ASTM C1115.
2. Soft compression type: Molded or extruded, closed-cell, integral-skinned, [black] [_____] gasket complying with ASTM C509, Type II.
   
   a. EPDM.
   
   b. Silicone.
   
   c. Thermoplastic polyolefin rubber.

H. Sealants: Liquid applied, chemically curing type complying with ASTM C920, compatible with materials and conditions, and capable of anticipated joint movement without watertight seal failure.

PART 3 - EXECUTION

3.01 SCHEDULE

A. Provide Type G[_____] glass:
   
   1. Interior hollow [steel] [aluminum] [_____] window framing not required to be safety glass.

B. Provide Type G[_____] safety glass:
   
   1. Interior hollow [steel] [aluminum] [_____] window framing required or indicated on Drawings to be safety glass.
   
   2. Interior [wood] [hollow [steel] [aluminum]] [_____] doors not required to be fire rated.

C. Provide Type G[_____] safety glass:
   
   1. Exterior hollow [steel] [aluminum] glazed doors.
   
   2. Exterior hollow [steel] [aluminum] framed sidelights.
   
   3. Exterior hollow [steel] [aluminum] windows required or indicated on Drawings to be safety glass.

D. Provide Type G[_____] glass:
   
   1. Exterior hollow [steel] [aluminum] windows not required or indicated on Drawings to be safety glass.

E. Provide Type G[_____] glass:

   1. [_____________].
3.02 FACTORY GLAZED PRODUCTS

A. Factory glaze the following products in accordance with product manufacturer’s standard procedures. Coordinate tinted and coated glazing of all factory-glazed products to ensure consistency and compatibility.

1. Wood doors specified in Section 08210, “Wood Doors”.


3.03 FIELD GLAZED PRODUCTS

A. Field glaze the following products in accordance with general requirements of this Section, specific requirements of Section where field glazed product is specified, referenced standards, and written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials. Where requirements conflict, more stringent requirement shall prevail unless otherwise approved by Architect.

1. Hollow steel [interior] [exterior] window frames specified in Section 08110, “Steel Doors and Frames”.

2. Aluminum) [_____] skylight system specified in Section 08630, “Metal-Framed Skylights”.

3. Aluminum) [_____] curtain wall framing system specified in Section 08900, “Glazed Curtain Wall”.

3.04 PREPARATION

A. Verify glass framing is accurately sized, structurally sound, square, and without bow.

B. Verify surfaces of glazing channels and recesses are clean, free of obstructions, and ready to receive glazing.

C. Inspect edges of glass. Install only glass with clean-cut edges. Do not bump, drag, or brush edges against sash or hard objects. Avoid scratching.

D. Immediately prior to glazing, clean contact surfaces with solvent and wipe dry.

E. Prime surfaces as required for adhesion of sealants.

3.05 INSTALLATION
A. Comply with GANA Glazing Manual, approved shop drawings, and manufacturer's instructions.

B. Damaged glass: Do not install glass with edge damage or other imperfections. Remove from site and replace.

C. Install setting blocks and spacers as recommended by referenced glazing standards and glass manufacturer's recommendations. Set blocks in sealant.

D. Provide edge blocking as required to prevent sideways movement of glass in glazing channel.

E. Ensure glazing channels and stops provide required bite on glass, minimum edge and face clearances, and adequate sealant thickness.

F. Tape glazing:
   1. Cut glazing tape to length and set continuously against permanent stops and projecting slightly above sightline.
   3. Rest glass on setting blocks and push against tape for full contact at perimeter of lite.
   4. Remove tape release paper immediately prior to placing glass.
   5. Dry tape glazing: Install dense compressible gasket against glass and secure with removable glazing stop.
   6. Dry/wet tape glazing:
      a. Place spacers below sightline and install removable glazing stop against spacers.
      b. Fill gap between glass and removable glazing stop with sealant to uniform line level with bite of frame.

G. Gasket glazing:
   1. Fabricate two-piece compression gaskets to exactly fit openings.
   2. Install soft compression gasket against permanent stops. Miter cut and bond together corners.
   3. Rest glass on setting blocks. Insert dense compression gasket to press glass against soft gasket and lock in place against removable stop.
   4. Apply sealant to gasket joints.
   5. Install gaskets to protrude slightly beyond glazing stops.
H. Wet sealant glazing:

1. Install spacers and sealant backing between glass and stops. Position to control depth and width of sealant.

2. Apply sealant to glazing channels without voids. Ensure complete bond of sealant to glass and channel surfaces.

3. Tool exposed sealant surfaces to provide wash away from glass.

3.06 MIRROR INSTALLATION

A. Coordinate with other trades to ensure that surfaces to receive mirrors are not painted, coated, or otherwise treated in a manner detrimental to mirror adhesion.

B. Ensure walls are rigid, plumb, smooth, clean, dry, and free of foreign materials.

C. Apply one coat moisture-resistant paint to back of mirror and allow to completely dry.

D. Set mirrors with mechanical fasteners and adhesive applied in accordance with manufacturer's instructions.

   1. Apply adhesive to mirror back with 25 percent coverage. Set mirror in place and hold firmly until adhesive sets.

   2. Support bottom of mirror with L-shaped bar mechanically fastened to wall blocking.

   3. Provide 2 clips minimum at top and each side of mirror. Mirrors greater than 6 square feet shall have 3 clips minimum at top.

E. Place plumb and level without visible distortion.

3.07 CLEANING

A. Clean glass immediately following installation. Remove sealants and other glazing materials from adjacent finished surfaces.

B. Remove labels.

C. Prior to final inspection, clean all glass.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes:
   1. Aluminum curtain wall, store fronts, windows and entrances.
   2. Mockups.
   3. Aluminum copings, column and beam cladding, compensating channels, bracings and closure pieces.
   4. Standoffs for bent glass units.
   5. Glass and glazing for the work of this Section.
   6. Sealants for the work of this Section.
   7. Electrical continuity and grounding of this work.
   8. Supplementary parts and components, such as inserts, clips, fasteners, anchors, bracing and other miscellaneous supports and accessories required for a complete installation.

B. Work installed but furnished in other Sections:
   1. Division 8 for finish hardware.

C. Work furnished but installed in other Sections:
   1. Division 3 for concrete embeds.

D. Related work:
   1. Division 5 for steel supports for curtainwall and storefront framing not specified herein.
   2. Division 7 for sealants and insulation other than required for the work of this Section.
   3. Division 8 for automatic doors and operators.
   4. Division 8 for glass and glazing other than required for the work of this Section.

1.2 STANDARDS

B. AA, Standards and Data.
D. AISI, Cold-Formed Steel Design Manual.
E. ACI 301, Building Code Requirements for Reinforced Concrete.
F. AWS D1.1, Structural Welding Code.

1.3 DESIGN AND PERFORMANCE CRITERIA

A. General: The intent is to provide weathertight, structurally sound assemblies meeting the provisions of this Section.
1. Drawings are schematic and do not identify or solve the issues of thermal or structural movements, anchorage, flatness and stability of facing, or moisture disposal.

2. Drawings do not solve issues in the glass line associated with glass movement, pressure fracture, or thermal shock.

3. Drawings contain details that suggest possible solutions for solving some of the major design requirements. Contractor may use the intent of these details and develop them as Contractor deems best.

4. Specifications are of the performance type and include the minimum requirements of the glazed assemblies without limiting the Contractor to methods of achieving such performance.

5. Unless otherwise defined by Contract Documents, the appearance of exposed elements, including width and depth shall be consistent throughout the project.

6. Unless otherwise defined by Contract Documents, the overall thickness of each glass type, and the component thickness of each multiple layer glass type shall be consistent throughout the Project.

B. Design criteria and performance requirements for glazed assemblies:

1. Design wind pressures, both inward and outward and acting normal to the plane of the wall (including return surfaces) shall be those prescribed by CBC, except that structural tests shall be conducted at 150 percent of loads prescribed by CBC.

2. Dead load shall be the actual weight of materials supported by the glazed assemblies.

3. At the design pressures and loads, limit framing member stresses and deflections as specified below. Measurements shall be taken at the location of maximum deflection.
   a. Normal to the plane of the wall, deflection of framing members, including cantilevers, shall not exceed 1/175 of span length, but in no case more than 3/4 inch, whichever is less. Where a sealant joint occurs between a framing member and a relatively stiff building element, deflection of the framing member shall not exceed 1/2 of the joint width, or less if required by sealant manufacturer.
   b. In the plane of the wall, deflection of framing members shall not reduce the glass bite below 75 percent of the design dimension, and shall not reduce the glass edge clearance below 25 percent of the design dimension. Restrict deflection further if required for assembly and fit of components.
   c. Stresses shall not exceed the allowable values established by the reference standards listed. In no case shall allowable values exceed the yield stress.
   d. NOTE: Structural elements are not designed to resist torsional forces induced by the glazed assemblies. The Contractor shall include in the design of the glazed assemblies sufficient bracing, stiffeners and other reinforcements, as required to ensure the stability of the primary structure under all loads imposed by the glazed assemblies at its support points.

4. Seismic design: Comply with CBC.

5. Thermal movement clearance:
   a. Design glazed assemblies to provide clearance for thermal movement within a surface temperature range of 160 degrees F.
   b. Provide additional clearance as required to accommodate erection tolerance.
   c. Doors and windows shall operate normally and no distortion, damage and failure, including glass breakage, shall occur over this temperature range.
6. Air infiltration: When tested in compliance with ASTM E 283 at a differential static pressure of 1.57 psf, air infiltration at fixed wall shall not exceed 0.06 cubic foot/minute/square foot or less when more restrictive provisions are required by CCR Title 24.

7. Water infiltration: Water infiltration, in this Section, is defined as any leakage which is not controlled and drained to the exterior, or which could cause damage to or impair the function and appearance of the assemblies, and adjacent finishes.
   a. Make provisions in the design to drain to the exterior face of the assemblies any leakage of water occurring at joints and condensation taking place within the construction.
   b. No water infiltration under static pressure shall occur when the assembly is tested in compliance with ASTM E 331 at a differential static pressure of 20 percent of the design wind pressure, but not less than 6.24 psf for 15 minutes.

The exterior glazed assemblies shall perform quietly at all times and without:
   c. Vibration harmonics.
   d. Wind whistles.
   e. Noises caused by thermal movement (including “popping” and “ticking”).
   f. Thermal movement transmitted to other building elements
   g. Loosening, weakening or fracturing of attachments or components or system.

1.4 SUBMITTALS
A. Procedure: In accordance with Division One.
B. Shop drawings:
   1. Detailed, large scale, dimensioned shop drawings of the mockup identifying all materials.
   2. Detailed, large scale, dimensioned shop drawings of the glazed assemblies showing joinery techniques, provision for horizontal and vertical expansion, glass and metal thicknesses, and framing member profiles.
      a. Identify all materials, including metal alloys, glass types, fasteners and glazing materials.
      b. Identify shop and field sealants by product name and located on drawings.
      c. Show relative layout of adjacent walls, beams, columns and slabs, all correctly dimensioned.
      d. Dimension position of glass edge showing "glass bite" and size of structural silicone sealant.
   3. Die drawings for all extrusions, gaskets and weatherstrips.
   4. Method of attachment of insulation. Unless accepted in writing by the glass manufacturer, the thermal insulation shall not be attached directly to the glass, or opacifier applied thereto.
   5. Revise the approved shop and erection drawings to correspond to procedures established by the satisfactory mockup tests (when performed) and field changes. Make no changes in the field without the City Engineer’s prior written approval.
C. Structural calculations:
   1. Submit calculations prepared in compliance with current design rules of the AS, AISI, AISC and ACI. Calculations must be signed and sealed by a California-registered civil or structural engineer.
2. Include analysis for wind and dead load on framing members, structural silicone adhesive and concrete inserts.

3. Show section property computations for framing members and submit full size die drawings.

D. Test reports:
   1. The report for all tests shall include the following information:
      a. Date of test and date of report.
      b. Identification of the specimen (manufacturer, source of supply, dimensions, model, type, materials, and other pertinent information).
      c. Identification of glass thickness and type, and method of glazing.
      d. Type or types of weatherstrip.
   2. For air infiltration under uniform static air pressure: A statement or tabulation of the pressure difference exerted across the specimen during the test and the corresponding rate of air leakage for each specimen tested, calculated in compliance with ASTM E 283.
   3. For water penetration under uniform static air pressure:
      a. A statement or tabulation of pressure difference or differences exerted across the specimen and water application rates during the test.
      b. A record of all points of water penetration on the indoor face of the test specimen, and of water leakage as defined herein.
   4. For structural performance under uniform static air pressure difference:
      a. A tabulation of pressure differences exerted across the specimen during the test and the deflections and permanent deformations at locations specified for each specimen tested.
      b. The duration of test loads.
      c. Record of visual observations of performance.
      d. When the tests are made to check conformity of the specimen to a particular specification, an identification or description of that specification.
      e. Statement that the tests were conducted in compliance with this method, or a full description of deviations from this method.
      f. Statement as to whether or not tape, film, or both, were used to seal against air leakage, and whether in the judgment of the test agency the tape or film influenced the results of the test.
      g. If several essentially identical specimens of a component are tested, results for all specimens shall be reported, each specimen being properly identified, particularly with respect to distinguishing features or differing adjustments. A separate drawing for each specimen will not be required if all differences between them are noted on the drawings provided.

E. Samples: Metal samples with specified finishes. Refer to Section 05080 for painted samples.

F. Manufacturer's approval: Shop drawings of the glazed assemblies to the glass and glazing sealant manufacturers and obtain their approval for these shop drawings before proceeding further. These approvals shall include, but not be limited to the following.
   1. Selection of the glass and glazing materials (glass, sealants, gaskets, setting blocks, jamb shims and similar items).
   2. Size, thickness, design and dimensional limitations of the glass pockets and compatibility of materials.
3. Size and surface preparation relating to structural silicone adhesive. Sealant manufacturer's approval shall be based upon adhesion and compatibility tests performed with specific project substrate materials and shall include sealant manufacturer's recommendations for surface preparation.

4. Insulation attachment method.

G. Closeout: Furnish the City a comprehensive plan for replacement of broken glass. Include a local source.

1.5 QUALITY ASSURANCE

A. Fabricator/Installer's qualifications: Single firm which can show a minimum 5 years experience in fabricating and erecting work similar to that required for this Project.

B. Mockups:
   1. Provide a mockup of each type of glazed assemblies.
      a. Provide a full height x full bay width mockup for curtainwall and storefront.
      b. Provide a test assembly for all trades, whose work is represented by the mockup, to verify their materials and installation methods, and make necessary adjustments before proceeding with the work on the building.
      c. Obtain the City Engineer's approval of the visual quality of the mockup.
      d. Provide a standard of materials, quality and workmanship to be matched for work on the building.
   2. Assemble the mockups using installation methods and materials duplicating, as closely as possible, the glazed assemblies on the building. Construct mockups in compliance with approved shop drawings; deviations from, or additions to details shown on drawings are subject to the City Engineer's approval. Interior finishes are required.
   3. After approval of the visual quality of the mockup by the City Engineer, install sufficient thermal and safetying insulation to demonstrate installation procedures.
   4. Locate the mockups at the job site, or if impractical, at another location acceptable to the City Engineer.
   5. These mockups are not intended to be tested. If testing of a mockup has to be performed to determine compliance with the requirements of this Section, submit shop drawings, testing agency's name and qualifications, test procedures and sequence and other information requested by the City Engineer. Notify the City Engineer before mockup is constructed.

1.6 HANDLING

A. Procedure: In accordance with Division One and "Care and Handling of Architectural Aluminum from Shop to Site" published by AAMA.

1.7 WARRANTIES

A. Warrant work of this Section for satisfactory performance, and against defects in materials and workmanship for 5 years from Substantial Completion, except where longer warranties are specified below.

1. Submit written warranty agreeing to provide all labor and materials required to repair or replace defective materials and workmanship during the warranty period, including damage to the building and furnishings occasioned by defective materials or workmanship or damage as part of repairs to the wall. Defective materials and workmanship include, but are not limited to:
a. Penetration of water into the building.
b. Air infiltration exceeding specified limits.
c. Structural failure of components resulting from forces within specified limits.
d. Cracking, crazing, flaking of coatings and opacifiers on glass.
e. Glass breakage.
f. Secondary glass damage and/or damage due to falling glazed assemblies components.
g. Adhesive or cohesive failure of sealant.
h. Surface crazing of non-structural sealant.
i. Non-structural sealant hardening beyond Shore A durometer 50 or softening below 20.
j. Failure to fulfill other specified performance requirements.
k. Failure of operating parts to function normally.

B. Exposed aluminum finish: As specified in Section 05080.

C. Glass:
   1. Warrant to remove and replace glass light that fails to meet the design and performance requirements.
      a. Warranty shall include labor and materials required to remove and replace the faulty glass and installation for a period of not less than 5 years, except as noted otherwise below.
      b. Warranty period for peeling or deterioration of glass reflective coating shall be 10 years.
   2. Include the following in the warranty:
      a. Glass breakage due to wind pressures up to the specified values or thermal stress; defective glass or damaged glass (prior to or during construction). Secondary glass damage and breakage of tempered glass is regarded in this Specification as being the result of a material defect, and is therefore included in the warranty.
      b. Deterioration of any form, and discoloration of glass reflective coating.

D. Corrections of defective work:
   1. Should any work under this Contract be found defective in materials or workmanship, it shall be corrected in accord with the following provisions.
   2. If, within 5 years after Substantial Completion, any of the work is found to be defective or not in compliance with the Contract Documents, the Contractor shall correct it promptly after receipt of written notice from the City. The City will give such notice promptly after discovery of the condition.
   3. If exploratory work is required to determine the cause of the defects, the cost of this work shall be borne by the Contractor.

E. The warranty does not include damage caused by vandalism, or natural conditions exceeding the performance requirements.

F. This warranty and its enforcement shall not deprive the City of other action, right or remedy available to him.

1.8 LEADERSHIP IN ENERGY AND ENVIRONMENTAL DESIGN (LEED REQUIREMENTS)

A. LEED requirements for this section apply to all the construction materials of this project.
B. The contractor shall comply with the LEED’S credit and/or prescriptive requirements of this section and submittal requirements of Section 01351.

C. Local / Regional Materials - The Contractor shall use a minimum of 20% (by cost) of total building materials and products that are manufactured regionally within 500 air miles from the Project site and 50% (by cost) of this regionally manufactured materials shall also be extracted, harvested, or recovered within 500 air miles from the project site. Materials under this section may contribute to the local/regional material content requirements.

1. The requirements of this Paragraph apply only to the materials listed in the Materials and Resources Tracking List to be provided to the Contractor by the City Engineer. (Division 15 and 16 materials shall not be included in the calculation of this credit.)

2. The Contractor shall also include information for all other materials not included in the Materials and Resources Tracking List for manufacturing locations that are within 500 air miles of the Project site.

3. The Contractor shall provide material manufacturer location information and distance from the project site for all materials identified in the Materials and Resources Tracking List.

4. The contractor shall provide the extraction location information and distance from the project site for all materials identified in the Materials and Resources Tracking list. The tracking location information mentioned above shall be in the form of signed letter from the manufacturer, product literature, and/or cut sheets.

5. Manufacturing refers to the final assembly of the components into the building product that is furnished and installed by the tradesman. An accounting of manufacturer locations for components used in a final assembly is not required.

6. The Contractor shall provide the following Submittals on the Submittal Dates identified:
   a. Local/Regional Materials Summary and Final Cost Report at the end of construction that:
      1) Lists each material separately.
      2) Identifies the name and location of each material manufacturer.
      3) Identifies the distance from the material manufacturer to the site.
      4) Identifies the extraction location of each material.
      5) Identifies the distance from the extraction location to the Project site.
      6) Identifies the cost of each material.
      7) Identifies the total materials cost for the project. (Including recycled content materials). Division 15 and 16 materials shall not be included in this total.
      8) Includes an electronic version of the Environmental Materials Usage Summary Project Form that will be provided by the City Engineer.
   b. Submittal Date: At the end of construction.

D. Construction Waste Management - The Contractor shall recycle, salvage, reuse, and/or donate a minimum 75% by weight (not volume), of the total construction and demolition waste, less hazardous waste materials, generated during construction of the project. Construction wastes, such as trimmings, that will be produced shall be disposed of consistent with the requirements of Construction Waste Management credit of LEED Rating System version 2.1 and Section 01351.

1. The Contractor shall provide the following Submittals on the Submittal Dates identified:
   b. Construction Waste Monthly Reports.
c. Construction Waste Final Report at the end of construction. The report shall include:

1) The Contractor’s cost of disposing of all construction, waste materials.
2) A detailed breakdown by weight of each material type disposed of as follows:
   a) Recycling (broken down by material type).
   b) Salvage, including reuse on site.
   c) Hazardous waste disposal.
   d) Landfill.
   e) Provide electronic versions of the Construction / Maintenance / Alteration and Demolition Projects Sample Construction Waste Management Project Forms in Exhibit I and II of Section 01351.

d. Submittal Date: At the end of construction.

E. Low Emitting Materials: The VOC content of adhesives and sealants used shall be less than the current VOC content limits of South Coast Air Quality Management District (SCAQMD) Rule #1168, and all sealants used as fillers shall meet or exceed the requirements of Bay Area Air Quality Management District Regulation 8, Rule 51.

F. Low Emitting Materials: Volatile Organic Compounds (VOC) from paints and coatings shall not exceed the VOC and chemical component limits of Green Seal’s Standard GS-11 requirements.

G. Recycled Content - The Contractor shall use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the post-industrial content constitutes at least 10% (by cost) of the total value of all the materials used in the project as a minimum. Materials under this section may contribute to the recycled content requirements. The Contractor should request the manufacturer to add recycled content materials to the raw material of the product and documentation per the requirements of section 01351.

1. The Contractor shall provide product specifications or cut sheets indicating the recycled content amount and type (post consumer or post industrial) for all materials containing recycled content.

a. The Contractor shall provide the following Submittals on the Submittal Dates identified:

b. Recycled Content Summary and Final Cost Report at the end of construction that:

1) Lists each material separately.
2) Includes product specification or cut sheets highlighting the recycled content amount and type.
3) Identifies the name and location of each material manufacturer.
4) Identifies the cost of each material.
5) Identifies the total materials cost for the project. (Including recycled content materials). Division 15 and 16 materials shall not be included in this total.
6) Includes an electronic version of the Environmental Materials Usage Summary Sample Project Form that will be provided by the City Engineer.
7) Signed letter of certification with company letter head from the manufacturer certifying the recycled content of the product and tabulating the recycled content composition by percentage composition and by cost, and/or product brochures or cut sheet.

c. Submittal Date: At the end of construction.

H. Select glazing in accordance with LEED credit factors including, but not limited to, ventilation, day lighting, and energy efficiency.
1. General: Material or criterion, specifically required by reference to a published standard, shall be governed by its material and testing requirements.

2. Certification: Furnish certificates or test reports certified by a testing laboratory, attesting compliance with the following performance criteria:
   a. Fixed windows shall meet the minimum requirements of performance of Class F-HC100 and F-AW100 in accordance with ANSI/AAMA 101.
   b. Air infiltration shall be a maximum 0.06 cfm per foot of area at 6.24 lbf/ft² when tested in accordance with ASTM E283.
   c. No water leakage at 12 psf when tested in accordance with ASTM E331 and E 547.
   d. Pivoted windows shall meet the minimum requirements of performance of Class VP-HC65 and VP-AW65 in accordance with ANSI/AAMA 101.
   e. Air infiltration shall be a maximum 0.10 cfm per foot of vent perimeter when tested in accordance with ASTM E283 at a static air pressure differential of 6.24.
   f. No water leakage at 12 psf when tested in accordance with ASTM E331 and E547.

PART 2 - PRODUCTS

2.1 MANUFACTURE
   A. Curtainwall sections: (2-1/2 in. x 7-3/4 in.) Basis of design is for “1600 Wall System” by Kawneer Co., Inc. Other acceptable manufacturers, when approved by the City Engineer, include the following:
      2. Vistawall Architectural Products.
   B. Fixed storefront sections: (2 in. x 4-1/2 in.) Basis of design is for “Tri-Fab VG 451/451T” by Kawneer Co., Inc. Other acceptable manufacturers, when approved by the City Engineer, include the following:
      2. Vistawall Architectural Products.
   C. Fixed window sections (pop-out windows): (1-3/8 in. x 2 in.) Basis of design is for Tri-Fab 450 vent materials, VG Vent by Kawneer Co. Other acceptable manufacturers, when approved by the City Engineer, include the following:
      2. Vistawall Architectural Products.
   D. Aluminum-framed doors: Basis of design is for medium stile doors by Kawneer Co., Inc. Other acceptable manufacturers, when approved by the City Engineer, include the following:
      2. Vistawall Architectural Products.

2.2 MATERIALS/COMPONENTS
   A. Aluminum:
      1. Extrusions: 6063-T5 alloy.
         a. Provide a minimum nominal wall thickness of 1/8 inch for structural members and 1/16 inch for non-structural members. Standard commercial tolerances listed in AA “Aluminum Standards and Data” apply to finished, fabricated and assembled materials.
b. Stricter tolerances shall apply where required to assure proper functioning of glass and glazing materials.

2. Standoffs: 6063-T5 alloy, length as shown on Drawings x ½ in. diameter.


4. Surface flatness and edges: For exposed work, provide materials that have been cold-rolled, cold-finished, cold-drawn, extruded, stretcher-leveled, machine-cut and otherwise produced to the highest commercial standard for flatness with edges and corners sharp and true to angle or curvature as required.

B. Fasteners for aluminum components: 300 Series (18-8) non-magnetic stainless steel for all screws, bolts, nuts, washers and rivets.

C. Steel:
   2. Cold-rolled steel conforming to one of the material specifications listed in AISI Specifications for the Design of Cold-Formed Steel Structural Members.

D. Glass: Refer to the Drawings and Section 08800.

E. Gaskets/weatherstripping:
   1. Gaskets/weatherstripping: Neoprene or EPDM, except where used in contact with a silicone seal. In contact with silicone seal, gaskets and spacers shall be preformed heat-cured silicone rubber, chemically compatible with the silicone sealant and suitable for the specific purpose intended. Gaskets/weatherstripping/ spacers shall have continuous mechanical engagement to framing members; adhesive attachment is not acceptable. Corners of gaskets/ weatherstripping shall be vulcanized.
   2. Sponge gaskets/weatherstripping/spacers: Extruded black neoprene, EPDM or silicone rubber with a hardness of 35 to 45 durometer Shore A and conforming to ASTM C 509 (for neoprene and EPDM). Sponge gaskets shall be compressed 20 percent - 35 percent in the final installed position.
   3. Dense gaskets/weatherstripping: Extruded black neoprene or EPDM conforming to ASTM C 864 or silicone rubber with a hardness of 70 - 80 durometer Shore A for hollow profiles and 55 - 65 for solid profiles.

F. Miscellaneous materials:
   1. Weephole filters: Fully reticulated, vinyl impregnated open cell urethane foam by Scott Paper, or equal.
   2. Slip pads:
      a. Provide eel slip, nylatron, high impact polystyrene or equal slip pads between moving parts at all expansion connections. Provide minimum thickness of 1/16-inch for nylatron and polystyrene, and 1/8 inch for eel slip.
      b. Do not use nylatron or polystyrene in close proximity to field welds, unless installed after welding.
   3. Isolators between dissimilar materials: Rigid, high impact, smooth both sides, high density polyethylene or DuPont Zytel nylon with a minimum thickness of 1/32-inch.
   4. Shims: 300 Series stainless steel or plastic bearing material with a minimum 8,000 psi compressive strength.
   5. Inserts for anchorage in concrete: Steel with integral or welded projections for embedment.
6. Sealants:
   a. Shop sealants: Use GE Silpruf or Dow Corning 795 for joints which are sealed in the manufacturer's plant.
   b. Field sealants and back-up materials: As specified in Section 07920, except that all sealants for the glazed assemblies shall be made by the same manufacturer.

7. Insulation: As specified in Section 07210.

8. Primer:
   a. For aluminum surfaces in contact with masonry, concrete or steel: Rust-inhibitive primer made by one of the manufacturers listed in Section 09900, or bituminous paint.
   b. Steel anchors, anchor inserts, reinforcement and supports: Rust-inhibitive primer made by one of the manufacturers listed in Section 09910.

2.3 FABRICATION AND WORKMANSHIP

A. Maintain the visual design concept shown, including member sizes, profiles and alignment of components. Coordinate work with that of other trades. Promptly furnish items to be placed during the installation of other work.

B. Insofar as practicable, fitting and assembly or the work shall be done in the shop.

C. Exposed work shall be carefully matched to produce continuity of line and design with joints accurately fitted and rigidly secured with flush, hairline contacts.

D. Except where otherwise specified or directed, the method of assembly and joining shall be the Contractor's option provided the results are satisfactory.
   1. The manufacturer's proven methods that will produce the required standards of workmanship shall be used, subject to approval.
   2. Assemble metal work so that it will not be distorted nor the fasteners over-stressed from expansion and contraction.

E. Isolate the glazing perimeter of each opening so that any leakage is confined to and wept from the opening of the leakage origin.

F. Except for spandrel glass and glass glazed with structural silicone, details of installation shall permit replacement of glass from within the building after the construction period with the same size glass without cutting or modification of frames.

G. Welding shall conform to the appropriate recommendation of the AWS and shall be done with electrodes and by methods recommended by the manufacturer of the alloys being welded.
   1. Welds behind finished surfaces shall be so done as to minimize distortion and discoloration on the finished side.
   2. Remove weld spatter and welding oxides on finished surfaces by descaling and/or grinding.

H. Grind exposed welds and finish to match and blend with finish on adjacent parent metal.
   1. Grinding and polishing on non-ferrous metals shall be done only with clean wheels and compounds free from iron and iron compounds.
   2. No soldering or brazing allowed.

I. Do not use exposed fasteners. Provide lock washers or other approved locking device at all bolted connections.

J. Fabricate aluminum and stainless steel components before finishing.

K. Finishing:
1. Aluminum surfaces: Finish exposed surfaces as specified in Section 05080; concealed surfaces may be mill finished, except that when in contact with another material other than stainless steel, prime with rust-inhibitive primer or bituminous paint.

2. Steel surfaces other than galvanized: Prime with rust-inhibitive primer.

3. Primer application:
   a. Remove oil and other deleterious materials in compliance with SSPC SP-1 "Solvent Cleaning" before priming.
   b. Apply specified primer immediately after surface preparation. Apply 2 coats of primer changing color of each coat. Provide minimum DFT of 2 mils for each coat primer and 30 mils for bituminous paint. Allow primer to dry thoroughly before handling.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine adjacent construction and supports.

B. Verify that openings and supporting surfaces are within allowable tolerances, plumb, level, clean, will provide a solid anchoring surface, and that other conditions detrimental to the proper or timely completion of this work are corrected before proceeding with installation.

3.2 ERECTION

A. General:
   1. Installed glazed assemblies shall match the approved mockups.
   2. Erect components in compliance with the approved shop drawings. Provide accurate bench marks for use in erection at all floors. Promptly correct errors and inconsistencies.
   3. Set work plumb and sloped where shown on Drawings, square and level with hairline, flush joints. Fasten securely in correct vertical and horizontal alignment. Seal joints within assemblies, and between assemblies and adjacent construction to make waterproof.
   4. Clean debris, dust and other foreign materials from behind the glazed assemblies as it is erected. Provide temporary closures if necessary to prevent the accumulation of debris, dust and foreign materials in the voids behind the glazed assemblies.

B. Tolerances: Tolerances for the building frame and other work are specified in other Sections of these Specifications and/or in referenced standards of these Sections. Design the glazed assemblies to accommodate these tolerances. All parts of the metal framing shall be within the following tolerances.
   1. Maximum deviation from plumb, level or dimensioned angle: 1/8 inch in a story height and per 10-foot length of any member, or 1/4 inch in any 40-foot run.
   2. Maximum deviations from theoretical position in plan or elevation based on established floor and column lines, including deviation from plumb, level or dimensioned angle:
      a. 3/8 inch total at any location.
      b. Change in deviation shall not exceed 1/8-inch for any 10-foot run in any direction.
   3. Maximum offset from true alignment between 2 consecutive members placed end to end:
      a. 1/16 inch, including members which are designed to be 1/2-inch or less out-of-flush, and members separated 2-inch or less by a reveal or protrusion in the plane of the wall.
      b. 1/8-inch including members which are designed to be out-of-flush by more than 1/2-inch, or separated by a reveal or protrusion more than 2 inches wide.
   4. Maximum offset between glass framing members at corners of glazing pocket: 1/32 inch.
C. Assembly and anchorage:
   1. Anchor components securely in place by bolting, welding other permanent mechanical attachment system, which will comply with performance requirements and permit movements which are intended or necessary. Install slip pads between moving parts.
   2. Provide a separator at contact surface of dissimilar materials wherever there is a possibility of corrosive or electrolytic action.
   3. Remove weld slag and apply primer over welds. Also paint exposed portions of inserts. Clean paint damaged by welding or other causes to bright metal and touchup with primer.

D. Doors: Install doors, and their finish hardware, at indicated locations and adjust the hardware as necessary so the doors operate freely for their full travel, without sticking or binding.

3.3 GLAZING
A. Comply with the requirements of Section 08800 and the following.
B. All surfaces to which the structural silicone or weather seal silicone sealants will adhere shall be warranted by finish and sealant manufacturers as sufficient to provide structural silicone bond surface. Mill finish aluminum is not acceptable in this application.
C. Defer glazing of opening obstructed during construction. Glaze such openings when obstructions are removed.
D. Replace glass which breaks or sustains edge damage, surface damage or damage or reflective coating.

3.4 INSULATION
A. Install as specified in Section 07210.

3.5 PROTECTION/CLEANING
A. Protect this work against damage and contamination during construction. Clean surfaces as required to remove corrosive substances. At the conclusion of construction, clean the work to the City Engineer's satisfaction.
B. Use only cleaning agents compatible with aluminum, glass, glazing materials and sealants.

3.6 FIELD QUALITY CONTROL
A. Refer to Section 08000.
B. Perform field water test in compliance with ASTM E 1105, on completed portions of the glazed assemblies.
C. If testing results in leakage, eliminate the causes of the leakage at no additional cost to the City.
D. Remedial measures must maintain standards of quality and durability and are subject to the City Engineer's approval.
E. Provide powered scaffold, hose and sufficient personnel to operate scaffold and hose.
F. Perform one test each at 10 percent, 50 percent and 80 percent of glazed assemblies completion, with repeat tests of failures occur.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. Section specifies glazed aluminum curtain wall system.
   1. Thermally isolated, pressure equalized on interior.
   2. Type: // Stick // Unit // Unit and Mullion // system to include following:
      a. // Glass // Insulated Metal Panels // Uninsulated Metal Panels // Glass Spandrel Panels //
      b. Integral reinforcing.
      c. Closures, trim, subsills and flashings.
      d. Column covers.
      e. Fasteners, anchors, and related reinforcement.

1.2 RELATED WORK

A. Structural steel: Section 05120, STRUCTURAL STEEL.
B. Miscellaneous metal members: Section 05500, METAL FABRICATIONS.
C. Firestopping between curtain wall and structure: Section 07270, FIRESTOPPING SYSTEMS.
D. Sheet metal flashing and trim: Section 07600, FLASHING AND SHEET METAL.
   a. Joint sealants: Section 07920, SEALANTS AND CAULKING.
   //E. Aluminum and glass hinged entry doors and storefront construction: Section 08410, ALUMINUM
      ENTRANCES AND STOREFRONTS. //
   //F. Revolving entrance doors: Section 08450, REVOLVING ENTRANCE DOORS. //
   //G. Aluminum windows: Section 08520, ALUMINUM WINDOWS. //
   //H. Aluminum windows: Section 08524, SIDE HINGED ALUMINUM WINDOWS. //
   //I. Metal framed skylights: Section 08630, METAL FRAMED SKYLIGHTS. //
      1. Glazing: Section 08810, GLASS AND GLAZING.
      2. Finish Color: Section 09050, INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH
         SCHEDULE.
      3. Louvers and wall vents: Section 10200, LOUVERS AND WALL VENTS.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Approval is required of products or service of proposed manufacturer, suppliers and installers,
      and will be based upon submission by Contractor of certification that:
         a. Manufacturers Qualifications: Manufacturer with five (5) years continuous documented
            experience in // design, // fabrication, // and // installation // of glazed aluminum curtain
            wall systems of type and size required for that project.
b. Installer: Manufacturer approved in writing. Continuously installed glazed aluminum curtain walls systems for previous five (5) years.

c. Manufacturer shall provide technical field representation at project site, as a minimum, at start of project, during middle, towards end of project, and during field testing of field mockup panel.

d. Testing Laboratory: Contractor retained. Engage an AAMA accredited commercial testing laboratory to perform tests specified. Submit information regarding testing laboratory’s facilities and qualifications of technical personnel to perform testing specified in this section.

e. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of glazed aluminum curtain wall system. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, one another, and adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, or in-service performance.

1) Do not modify intended aesthetic effects. If modifications are proposed, submit comprehensive explanatory data for review.

f. Qualification of Welders:

1) Welding shall be performed by certified welders qualified in accordance with AWS D1.2, using procedures, materials, and equipment of the type required for this work.

SPEC WRITER NOTES:

1. Delete requirements for mockup if not warranted by project size or portions of Article not deemed necessary.

2. Indicate location size and configuration of mockup panel on architectural contract drawings.

//B. Mockup //

//1. Construct, at job site, full size typical wall unit which incorporates horizontal and vertical joints, framing, window units, panels, glazing, sealants, and other accessories as detailed and specified. Mock-up wall unit location, size and design shall be as indicated. Orient mockup to be facing full sun when constructed. //

//2. Performance Test //

//a. Conduct performance test after approval of visual aspects has been obtained. Finished work shall match approved mock-up. //

//b. Refer to Performance Requirements and Field Quality Control Articles, included hereinafter, for testing requirements. //

//3. Approved Mock-up //

//a. After completion and approval of test results of job site mockup, as directed, approved mock-up panel shall be used as minimum standard of comparison for entire curtain wall system. //

SPEC WRITER NOTE: Delete this Article if project size does not warrant a pre-installation conference.

//C. Pre-Installation Conference //
1. Prior to starting installation of glazed curtain wall system schedule conference with Contracting Officer to ensure following:
   a. Clear understanding of drawings and specifications.
   b. Onsite inspection and acceptance of structural and pertinent structural details relating to curtain wall system.
   c. Coordination of work of various trades involved in providing system. Conference shall be attended by Contractor; personnel directly responsible for installation of curtain wall system, flashing and sheet metal work, firestopping system and curtain wall manufacturer and their Technical Field Representatives. Conflicts shall be resolved and confirmed in writing.

1.4 SUBMITTALS

SPEC WRITER NOTES:
1. List below items intended for use in project, necessary for review prior to manufacture. Refer to Section 01340, SAMPLES AND SHOP DRAWINGS for submittal requirements. Include additional submittal requirements for items specified.
2. Samples not required for clear anodized finish.

A. In accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.

B. Manufacturer's Literature and Product Data:
   1. Manufacturer's standard details and fabrication methods.
   2. Data on finishing, components, and accessories.
   4. Recommendations for maintenance and cleaning of exterior surfaces.

C. Shop Drawings:
   1. Show elevations of glazed curtain wall system at 1:50 (1/4 inch) scale, metal gages, details of construction, methods of anchorage, glazing details, and details of installation.
   2. Submit for curtain wall system, accessories // , and mock-up // . Tentative approval of drawings shall be received before fabrication of mock-up. Final approval of drawings shall be deferred pending approval of mock-up and accessories. Drawings shall indicate in detail all system parts including elevations, full size sections, framing, jointing, panels, types and thickness of metal anchorage details, flashing and coping details, field connections, weep and drainage system, finishes, sealing methods, glazing, glass sizes and details, firestopping insulation materials, and erection details.

D. Samples:

   //1. Prior to starting installation of glazed curtain wall system schedule conference with Contracting Officer to ensure following:
      a. Clear understanding of drawings and specifications.
      b. Onsite inspection and acceptance of structural and pertinent structural details relating to curtain wall system.
      c. Coordination of work of various trades involved in providing system. Conference shall be attended by Contractor; personnel directly responsible for installation of curtain wall system, flashing and sheet metal work, firestopping system and curtain wall manufacturer and their Technical Field Representatives. Conflicts shall be resolved and confirmed in writing.

   1.4 SUBMITTALS

SPEC WRITER NOTES:
1. List below items intended for use in project, necessary for review prior to manufacture. Refer to Section 01340, SAMPLES AND SHOP DRAWINGS for submittal requirements. Include additional submittal requirements for items specified.
2. Samples not required for clear anodized finish.

A. In accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.

B. Manufacturer's Literature and Product Data:
   1. Manufacturer's standard details and fabrication methods.
   2. Data on finishing, components, and accessories.
   4. Recommendations for maintenance and cleaning of exterior surfaces.

C. Shop Drawings:
   1. Show elevations of glazed curtain wall system at 1:50 (1/4 inch) scale, metal gages, details of construction, methods of anchorage, glazing details, and details of installation.
   2. Submit for curtain wall system, accessories // , and mock-up // . Tentative approval of drawings shall be received before fabrication of mock-up. Final approval of drawings shall be deferred pending approval of mock-up and accessories. Drawings shall indicate in detail all system parts including elevations, full size sections, framing, jointing, panels, types and thickness of metal anchorage details, flashing and coping details, field connections, weep and drainage system, finishes, sealing methods, glazing, glass sizes and details, firestopping insulation materials, and erection details.

   //3. Operating Windows. //

   //a. Specified in Section 08520, ALUMINUM WINDOWS. //
   //b. Side-hinged type specified in Section 08524, SIDE-HINGED ALUMINUM WINDOWS. //

D. Samples:
1. Submit pairs of samples of each specified color and finish on 300 mm (12-inch) long section by width of each tubular, or extruded shape section or 300 mm by 300 mm (12-inch by 12-inch) wide sections of sheet shapes.

2. Submit corner section of framing members showing fasteners, panels, glazing methods, glazing materials, and weather-stripping. Submit one sample minimum 300 mm by 300 mm (12 inches by 12 inches). In lieu of submitting separate samples for corner section, intermediate section, and panel, one composite sample incorporating all components and features listed may be submitted.

3. Where normal color variations are anticipated, include 2 or more units in set indicating extreme limits of color variations.

E. Glass:

1. Specified in Section 08810, GLASS AND GLAZING.

F. Quality Control Submittals:

1. Design Data:
   a. Submit structural and thermal calculations for complete wall assembly. Structural calculations and design shop drawings shall be signed and sealed by a structural engineer registered in state in which project is to be located.

2. Factory Test Reports:
   a. Test Reports: Provide certified test reports, for each of following listed tests, from a qualified independent testing laboratory showing that glazed aluminum curtain wall system assembly has been tested in accordance with specified test procedures and complies with performance characteristics as indicated by manufacturer’s testing procedures. Manufacturer shall submit appropriate testing numbers for specific tests indicated below.
      1) Deflection and structural tests.
      2) Water penetration tests.
      3) Air infiltration tests.
      4) Delamination tests.
      5) Thermal conductance tests.
      //6) Sound transmission loss test. //
      7) Submit factory tests required except that where a curtain wall system or component of similar type, size, and design as specified for this project has been previously tested within last year, under conditions specified herein, resulting test reports may be submitted in lieu of listed testing.

G. Manufacturer’s Certificates:

1. Submit Certificates of Compliance, with specification requirements, for the following:
   a. Metal extrusions.
   b. Metal accessories.
   c. Stating that aluminum has been given specified thickness of anodizing or organic coating finish.
   d. Indicating manufacturer’s and installer’s meet qualifications as specified.
   e. Submit list of equivalent size installations, for both manufacturer and installer, which have had satisfactory and efficient operation.
H. Manufacturer’s Field Reports:
   1. Submit field reports of manufacturer’s field representative observations of curtain wall installation indicating observations made during inspection at beginning of project, during middle of installation and at conclusion of project. Indicate results of field testing of mockup field panel, and any directions given Contractor for corrective action.

1.5 DELIVERY, STORAGE AND HANDLING

A. Refer to AAMA CW 10 for care and handling of architectural aluminum from shop to site.

B. Prior to packaging for shipment from factory, mark wall components to correspond with shop and erection drawings and their placement location and erection.

C. Prior to shipment from factory, place knocked-down lineal members in cardboard containers and cover finished surfaces of members with protective covering of adhesive paper, waterproof tape, or strippable plastic. Do not cover metal surfaces that will be in contact with sealants after installation.

D. Inspect materials delivered to site for damage; unload and store with ventilation, free from heavy dust, not subject to combustion products or sources of water, and shall permit easy access for inspection and handling. Sealing and caulking compounds, including handling, shall be in accordance with requirements of Section 07920 SEALANTS AND CAULKING.

1.6 PROJECT CONDITIONS

Field Measurements: Where glazed aluminum curtain wall systems are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying Work.

1.7 APPLICABLE PUBLICATIONS

A. Publications listed below form a part of this specification to extent referenced. Publications are referred to in text by basic designation only.

B. American Architectural Manufacturers Association (AAMA):
   MCWM-1-89...............................Metal Curtain Wall Manual
   CW 10-97)...............................Care and Handling of Architectural Aluminum from Shop to Site
   CW 11-85 ..................................Design Windloads for Buildings and Boundary Layer Wind Tunnel Testing
   CWG 1-89 ..................................Installation of Aluminum Curtain Walls
   TIR A1-75...............................Sound Control for Aluminum Curtain Walls and Windows
   TIR A4-97...............................Recommended Guide Lines for Reflective Insulating Glass
   TIR A8-90...............................Structural Performance of Poured and Debridged Framing Systems
   TIR A9-91...............................Metal Curtain Wall Fasteners
   TIR A11-96.............................Maximum Allowable Deflection of Framing Systems for Building Cladding Components of Design Wind Loads
   101-I.S.2-97 ............................Aluminum, Vinyl (PVC) and Wood Windows and Glass Doors
   501-94 .................................Methods of Test for Exterior Walls
503-92 ........................................Field Testing of Metal Storefronts, Curtain walls and Sloped Glazing Systems

605-98 ........................................High Performance Organic Coatings on Architectural Extrusions and Panels

1503-88 ........................................Thermal Transmission and Condensation Resistance of Windows, Doors and Glazed Wall Sections

C. American National Standards Institute (ANSI):

Z97.1-84(R94) ..................................Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test

D. American Society of Civil Engineers (ASCE):

7-98 ............................................Minimum Design Loads for Buildings and Other Structures

E. American Society for Testing and Materials (ASTM):

A36/A36M-00 ...............................Structural Steel

A123-00......................................Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products

A193-01......................................Alloy-Steel and Stainless Steel Bolting Materials for High Temperature Service

A307-00......................................Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength

B209-01......................................Aluminum and Aluminum Alloy Sheet and Plate

B211-00......................................Aluminum and Aluminum Alloy Bar, Rod, Wire

B221/B221M-00 .........................Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes

B316/B316M-00 .........................Aluminum and Aluminum Alloy Rivet and Cold-Heading, Wire, and Rods

C236-89(1993)...........................Steady State Thermal Performance of Building Assemblies by Means of a Guarded Hot Box

C578-95 .....................................Rigid Cellular Polystyrene Thermal Insulation

C612-00 ..................................Mineral Fiber Block and Board Thermal Insulation

C920-01 .................................Elastomeric Joint Sealants

C794-93 .....................................Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants.

D1037-99 ....................................Evaluating the Properties of Wood-Base Fibers and Particle Panel Materials

E84-00 .........................................Surface Burning Characteristics of Building Materials

E90-99 .........................................Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements

E283-91 ......................................Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Difference Across this Specification

E330-98 ......................................Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

E331-00 ......................................Water Penetration of Exterior Windows, Curtain Walls, and Doors By Uniform Static Air Pressure Difference
1.8 WARRANTY

A. Warranty: Submit manufacturer’s written warranty for materials, installation and weather tightness, and subject to terms of “Warranty of Construction” Article specified in Section 01001 GENERAL CONDITIONS, except that warranty period shall be extended to five (5) years from date of final acceptance of project by Government.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

A. Design Requirements:


2. System Assembly: // Site assembled. // Shop unitized assembly. //

3. No curtain wall framing member shall deflect, in a direction normal to plane of wall, more than 1/175 of its clear span or 20 mm (3/4 inch), whichever is less, when designed in accordance with requirements of TIR A11 and tested in accordance with ASTM E330, except that when a
// plastered // gypsum wallboard // surface will be affected, deflection shall not exceed 1/360 of span. No framing member shall have a permanent deformation in excess of 0.2 percent of its clear span when tested in accordance with ASTM E330 for a minimum test period of 10 seconds at 1.5 times design wind pressures indicated as part of structural drawing wind load requirements. No glass breakage, damage to fasteners, hardware or accessories shall be permitted due to deformation stated above.

a. Provide system complete with framing, mullions, trim, fasteners, anchors, accessories, concealed auxiliary members, and attachment devices for securing wall to structure as specified or indicated. Unless noted otherwise, comply with MCWM-1.

b. Curtain wall system components // and integral door and/or window units // shall be furnished by one manufacturer or fabricator; however, all components need not be products of same manufacturer.

c. Fully coordinate system accessories directly incorporated, and adjacent to contiguous related work and insure materials compatibility, deflection limitations, thermal movements, and clearances and tolerances as indicated or specified.

d. Provide system with adequate allowances for expansion and contraction of components and fastenings to prevent buckling damage, joint seal failure, glass breakage, undue stress on fastenings or other detrimental effects. For design purposes, base provisions for thermal movement on assumed ambient temperature range of from -18 degrees C to 49 degrees C (0 degrees F to 120 degrees F).

e. Provide wall system to accommodate tolerances in building frame and other contiguous work as indicated or specified.

//B. Manufacturer’s Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of kind indicated. Engineering services are defined as those performed for installations of curtain walls that are similar to those indicated for this Project in material, design, and extent. //

C. Performance Requirements:

1. System shall meet or exceed all performance requirements specified.

2. Curtain wall components shall have been tested in accordance with requirements below and shall meet performance requirements specified:

3. System Design: Design and size components to withstand dead loads and live loads caused by positive and negative wind loads acting normal to plane of wall // as calculated in accordance with // ______ // code. // as calculated in accordance with ASCE 7-Minimum Design Loads for Buildings and Other Structures. // to a design pressure of // _____ kPa, // (_______ lb/sq ft) // . // as measured in accordance with ASTM E330. //

4. Seismic Loads: Design and size components to withstand seismic loads and sway displacement as calculated in accordance with // _______ // code.

5. Water Penetration:

a. No water penetration shall occur when wall is tested in accordance with ASTM E331 at a differential static test pressure of 20 percent of inward acting design wind pressure as indicated on structural drawings, but not less than 479 Pa (10 psf).

b. Make provision in wall construction for adequate drainage to outside of water leakage or condensation that occurs within outer face of wall. Leave drainage and weep openings in members and wall open during test.

6. Air Infiltration: Test glazed aluminum curtain wall system according to AAMA 503, which requires testing according to ASTM E783
a. Static-Air-Differential: 75 Pa (1.57 lbf/sq. ft.) minimum.
b. Air Leakage: 0.03 L/s per sq. m (0.06 cfm/sq ft) of surface maximum.

SPEC WRITER NOTE: Indicate design of entire system to withstand wind and concentrated loads as indicated on structural Contract Drawings.

7. Deflections Test: ASTM E330, Procedure B.
   a. No member shall deflect in a direction parallel to plane of wall, when carrying its full design load, more than an amount which will reduce edge cover or glass bite below 75 percent of design dimension. No member after deflection under full design load, shall have a clearance between itself and top of panel, glass, sash, or other part immediately below it less than 3 mm (1/8 inch); clearance between member and an operable window or door shall be minimum 1.5 mm (1/16 inch).

8. Delamination Test:
   a. Adhesively bonded metal-faced panels shall show no evidence of delamination, warpage or other deterioration or damage when subjected to the six "Accelerated Aging Cycles" specified in ASTM D1037.

   a. The thermal transmittance of opaque panels shall not exceed a U-value, Btu/hr/sq ft/degree F, as required and indicated on contract drawings for exterior wall system, when tested in accordance with ASTM C236. Average calculated thermal transmittance of complete wall assembly including panels, windows, and all other components shall not exceed a U-value of

10. Window Tests:
    a. Windows shall meet the requirements specified in Section or , except where requirements of this section differ, this section shall govern. Windows shall meet same requirements for deflection and structural adequacy as specified for framing members when tested in accordance with ASTM E330 except permanent deformation shall not exceed 0.4 percent; there shall be no glass breakage, and no permanent damage to fasteners, anchors, hardware, or operating devices. Windows shall have no water penetration when tested in accordance with requirements of ASTM E331.

11. Sound Attenuation Through Wall System (Exterior to Interior):
    a. STC , measured in accordance with ASTM E413.

2.2 MATERIALS

A. Extruded Aluminum Framing Members: ASTM B221M; 6063-T5 extruded aluminum for non-structural components or 6063-T6 extruded aluminum for structural members; temper and alloy as recommended by manufacturer.

B. Sheet Aluminum: ASTM B209M; 6065-T5 temper and alloy as recommended by manufacturer.
   1. Formed flashing and closures: Minimum 1.58 mm (0.062 inch) thick aluminum, in finish as selected.
   2. Extruded sill members: Minimum 1.58 mm (0.062 inch) thick aluminum, in finish as selected.

C. Steel Sections: ASTM A36M.

D. Primer: TS TT-P-645; red, for shop application and field touch-up.

E. Fasteners:
1. For Exterior Cap Retainers: ASTM A193 B8 300 series, stainless steel screws.

F. Shims: Metal or plastic.

G. Joint Sealants and Accessories
   1. In accordance with requirements specified in Section 07920, SEALANTS AND CAULKING.
   2. Structural Flush Glazed Joints: High performance silicone sealant applied in accordance with manufacturer's recommendations.
      a. Hardness: Type A, 30 durometer
      b. Ultimate Tensile Strength: 1172 kPa (170 psi)
      c. Tensile at 150% Elongation: 55 kPa (80 psi)
      d. Joint Movement Capability after 14 Day Cure: +/- 50%
      e. Peel Strength aluminum, after 21 Day Cure: 599 g/mm (34 pounds per inch).
   5. Structural silicone shall not be used to support dead weight of vertical glass or panels.
   6. Comply with recommendations of sealant manufacturer for specific sealant selections.
   7. Provide only sealants that have been tested per ASTM C794 to exhibit adequate adhesion to samples of glass and metal equivalent to those required for project.
   8. Exposed metal to metal joints: Silicone sealant selected from manufacturer's standard colors.

H. Glazing Materials:
   1. As specified under Section 08810, GLASS AND GLAZING.
   2. Glazing Gaskets:
      a. Exterior: Continuous EPDM gaskets at each glass and spandrel panel.
      b. Interior: Continuous, closed cell PVC foam sealant tape, sealed at corners.
   3. Glass Sizes and Clearances:
      a. Accommodate up to 25 mm (1 inch) glazing.
      b. Sizes indicated are nominal. Verify actual sizes required by measuring frames. Coordinate dimensions for glass and glass holding members to meet applicable minimum clearances as recommended by glass manufacturer. Do not nip glass to remove flares or to reduce oversized dimensions. All cutting shall occur in factory.
   4. Glass Setting Materials:
      a. Provide head bead and drive wedge required for glass installation to suit curtain wall system in accordance with manufacturer's recommendations.
      b. If used in psychiatric facilities, the glass shall be retained in the framing system in such a manner that it can withstand lateral forces in excess of force required to break the glass. Plastic clips for holding glass are not permitted.

I. Louvers:
1. As specified under Section 10200, LOUVERS AND WALL VENTS.

//J. Louver Screening:
1. As specified under Section 10200, LOUVERS AND WALL VENTS.

//K. Column Covers Exterior and Interior Surfaces: // _____ // mm // _____ // inch // thick prefinished aluminum, // _____ // full contact pressure bonded to // _______ // ensuring flat surface, // ______ // finish as selected. // to match curtain wall mullion sections. //

L. Firestopping: Refer to Section 07270, FIRESTOPPING SYSTEMS for requirements.

2.3 FABRICATION

A. Curtain wall components shall be of materials and thickness indicated or specified. Details indicated are representative of required design and profiles. Maintain sightlines indicated on drawings. Unless specifically indicated or specified otherwise, methods of fabrication and assembly shall be at discretion of curtain wall manufacturer. Perform fitting and assembling of components in shop to maximum extent practicable. Anchorage devices shall permit adjustment in three directions. There shall be no exposed fasteners.

B. Joints:
1. Joints exceeding +1.5 mm (+1/16") shall be mechanically fastened.

C. Ventilation and Drainage:
1. Direct water leakage to exterior by means of concealed drainage system and weeps. Flashings and other materials used internally shall be nonstaining, noncorrosive, and nonbleeding.

D. Protection and Treatment of Metals:
1. Remove from metal surfaces lubricants used in fabrication and clean off other extraneous material before leaving shop.
2. Provide protection against galvanic action wherever dissimilar metals are in contact, except in case of aluminum in permanent contact with galvanized steel, zinc, stainless steel, or relatively small areas of white bronze. Paint contact surfaces with one coat bituminous paint conforming to MIL-C-18480 or apply appropriate caulking material or nonabsorptive, noncorrosive, and nonstaining tape or gasket between contact surfaces.

E. Metal sills and Closures: Fabricate accessories, spandrel panels, trim closures of sizes and shapes indicated from similar materials and finish as specified for wall system.

//F. Concealed Interior Mullion Reinforcing: ASTM A36M steel shapes as required for strength and mullion size limitations, hot dip galvanized after fabrication in accordance with ASTM A123. //

//G. Metal Spandrel Panels: Manufacturer's standard laminated aluminum-faced panels of thickness indicated, flat with no deviations in plane exceeding 1.5 mm in 600 mm (1/16 inch in 24 inches) or 3 mm (1/8 inch) over entire panel. Provide with edge flanges.
1. Face Sheets: 0.6 mm (0.024-inch) minimum thickness finished to match system framing.
2. Concealed Back Sheets: Aluminum or galvanized steel in manufacturer's standard thickness.

SPEC WRITER NOTE: Select proper stabilizer-sheet type if required for project. Cement board stabilizer sheets in 3 mm (0.125 inch) and 4 mm (0.157) inch thicknesses also available. Cement board not susceptible to moisture but is very brittle and possibly more expensive. Contact panel manufacturer for design assistance before inserting cement board requirements.
Delete items not applicable for use and renumber paragraphs.

//H.  Stabilizer Sheets:
//1.  3 mm (1/8 inch) thick tempered hardboard. //
//2.  13 mm (1/2 inch) thick gypsum board. //

SPEC WRITER NOTE: Select stabilizer-sheet type below if fire resistant panels are required for project. Verify requirements of Authorities having jurisdiction. Delete items not applicable for use and renumber paragraphs.

//3.  Gypsum board at inner face and hardboard at outer face as required to provide surface burning characteristics when tested according to ASTM E84 as follows:

SPEC WRITER NOTE: Provide actual values required for panel ratings required for project. Verify requirements with Authorities having jurisdiction. Delete items not applicable for use and renumber paragraphs.

//a.  Flame Spread: ____. //
//b.  Smoke Developed: ____. //

SPEC WRITER NOTE: Select proper core type required for project based on R-Value required for wall system or design type requirements. R-Values indicated are examples only. Authorities having jurisdiction may restrict insulation materials based on fire performance characteristics. Verify requirements with Authorities having jurisdiction.

Delete items not applicable for use and renumber paragraphs.

//I.  Panel Core Material:
//4.  Edge Configuration: // Sealed. // Vented to the exterior. //

2.4 PROTECTION

A.  Provide protection for aluminum against galvanic action, wherever dissimilar materials are in contact, by painting contact surfaces of dissimilar material with a heavy coat of bituminous paint (complete coverage), or by separating contact surfaces with a preformed neoprene tape having pressure sensitive adhesive coating on one side.
2.5 METAL FINISHES

A. In accordance with NAAMM AMP500 series.

//B. Anodized Aluminum: //

//1. AA-C22A41 Chemically etched medium matte, with clear anodic coating, Class 1 Architectural, 0.7-mil thick. //

//2. AA-C22A44 Chemically etched medium matte with electrolytically deposited metallic compound, integrally colored coating Class 1 Architectural, 0.7-mil thick finish. Dyes will not be accepted. //

a. // Light // Medium // Dark // bronze.

b. // Black. //

//C. Fluorocarbon Finish: AAMA 605.2.

1. Color as selected. //

SPEC WRITER NOTE: Select one of following paragraphs for primer type required. Select a primer compatible with finish material. For high performance finish, careful selection of primer is required. Consult with manufacturer for recommendation of proper primer to be used.

D. Shop and Touch-Up Primer for Steel Components: SSPC Paint 25 red oxide. // ______. //

E. Touch-Up Primer for galvanized Steel Surfaces: SSPC Paint 20 zinc rich. // ______. //

F. Concealed Steel Items: Galvanized in accordance with ASTM A123 to 610 // ____ // gm/sq m // 2.0 // _____ // oz/sq ft // . // Primed with iron oxide paint. //

G. Apply one coat // _____ coats // of bituminous paint to concealed aluminum // and steel // surfaces in contact with cementitious or dissimilar materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation of glazed curtain wall system, arrange for representative(s) of manufacturer to examine structure and substrate to determine that they are properly prepared, and ready to receive glazed curtain wall work included herein.

B. Verifying Conditions and Adjacent Surfaces

1. After establishment of lines and grades and prior to system installation examine supporting structural elements. Verify governing dimensions, including floor elevations, floor to floor heights, minimum clearances between curtain wall and structural frames, and other permissible dimensional tolerances in building frame.

3.2 PREPARATION

A. Take field dimensions and examine condition of substrates, supports, and other conditions under which work of this section is to be performed to verify that work may properly commence. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Contact between aluminum and dissimilar metals shall receive a protective coating of asphaltic paint for prevention of electrolytic action and corrosion.
3.3 INSTALLATION

A. Installation and erection of glazed curtain wall system and all components shall be in accordance with written directions of curtain wall manufacturer. Match profiles, sizes, and spacing indicated on approved shop drawings.

B. Bench Marks and Reference Points

1. Establish and permanently mark bench marks for elevations and building line offsets for alignment at convenient points on each floor level. Should any error or discrepancy be discovered in location of marks, stop erection work in that area until discrepancies have been corrected.

C. Ensure that drainage system operates properly in accord with AAMA 501 procedures.

D. Do not proceed with structural silicone work when metal temperature is below 0 degrees C (32 degrees F).

E. Isolate between aluminum and dissimilar metals with protective coating or plastic strip to prevent electrolytic corrosion.

F. Install glazed aluminum curtain wall system so as to maintain a virtually flat face cap, with no visible bowing.

G. Install entire system so that fasteners are not visible.

H. Tolerances:

1. Maximum variation from plane or location shown on approved shop drawings: 3 mm per 3600 mm (1/8 inch per 12 feet) of length up to not more than 13 mm (1/2 inch) in any total length.

2. Maximum offset from true alignment between two identical members abutting end to end in line: 0.8 mm (1/32 inch).

3. Sealant Space Between Curtain Wall Mullion and Adjacent Construction: Maximum of 19 mm (3/4 inch) and minimum of 6 mm (1/4 inch).

SPEC WRITER NOTE: Delete following paragraph on windows if not part of curtain wall system.

//I. Windows: //

1. Refer to // Section 08520, ALUMINUM WINDOWS // and/or // Section 08524, SIDE HINGED ALUMINUM WINDOWS // for window requirements.

2. Install windows in accordance with details indicated and approved shop drawing detail drawings. //

3. Seal exterior metal to metal joints between members of windows, frames, mullions, and mullion covers in accordance with requirements of Section 07920, SEALANTS AND CAULKING. Remove excess sealant. //

4. After installing and glazing windows, adjust ventilators and hardware to operate smoothly and to be weathertight when ventilators are closed and locked. Lubricate hardware and moving parts. //

5. Install to make weathertight contact with frames when ventilators are closed and locked. Do not cause binding of sash or prevent closing and locking of ventilator. //

   a. Provide for ventilating sections of all windows to insure a weather-tight seal meeting infiltration tests specified. Use easily replaceable factory-applied weather-stripping of manufacturer's stock type. //

//J. Joint Sealants. //
1. Joint Sealants: Shall be in accordance with requirements of Section 07920, SEALANTS AND CAULKING.

2. Surfaces to be primed and sealed shall be clean, dry to touch, free from frost, moisture, grease, oil, wax, lacquer, paint, or other foreign matter. Enclose joints on three sides. Clean out grooves to proper depth. Joint dimensions shall conform to approved detail drawings with a tolerance of plus 3 mm (1/8 inch). Do not apply compound unless ambient temperature is between 5 and 35 degrees C (40 and 90 degrees F). Clean out loose particles and mortar just before sealing. Remove protective coatings or coverings from surfaces in contact with sealants before applying sealants or tapes. Solvents used to remove coatings shall be of type that leave no residue on metals.

3. Match approved sample. Force compound into grooves with sufficient pressure to fill grooves solidly. Sealing compound shall be uniformly smooth and free of wrinkles and, unless indicated otherwise, shall be tooled and left sufficiently convex to result in a flush joint when dry. Do not trim edges of sealing material after joints are tooled. Mix only amount of multi-component sealant which can be installed within four hours, but at no time shall this amount exceed 19 liters (5 gallons).

4. Apply primer to masonry, concrete, wood, and other surfaces as recommended by sealant manufacturer. Do not apply primer to surfaces which will be exposed after caulking is completed.

5. Tightly pack backing in bottom of joints which are over 13 mm (1/2 inch) in depth with specified backing material to depth indicated or specified. Roll backing material of hose or rod stock into joints to prevent lengthwise stretching.

6. Install bond preventive material at back or bottom of joint cavities in which no backstop material is required, covering full width and length of joint cavities.

7. Remove compound smears from surfaces of materials adjacent to sealed joints as work progresses. Use masking tape on each side of joint where texture of adjacent material will be difficult to clean. Remove masking tape immediately after filling joint. Scrape off fresh compound from adjacent surfaces immediately and rub clean with approved solvent. Upon completion of caulking and sealing, remove remaining smears, stains, and other soiling, and leave work in clean neat condition.

K. Glass:

1. Refer to Section 08810, GLASS AND GLAZING, and drawing for glass types. Install in accordance with manufacturer's recommendations as modified herein.

2. Before installing glass, inspect sash and frames to receive glass for defects such as dimensional variations, glass clearances, open joints, or other conditions that will prevent satisfactory glass installation. Do not proceed with installation until defects have been corrected.

3. Clean sealing surfaces at perimeter of glass and sealing surfaces of rebates and stop beads before applying glazing compound, sealing compound, glazing tape, or gaskets. Use only approved solvents and cleaning agents recommended by compound or gasket manufacturer. All sashes shall be designed for outside glazing. Provide continuous snap in glazing beads to suit glass as specified.

4. Insulating and tempered glass, and glass of other types that exceed 100 united inches in size. Provide void space at head and jamb to allow glass to expand or move without exuding sealant. Perimeter frames and ventilator sections shall have glazing rebates providing an
unobstructed glazing surface 19 mm (3/4 inch) in height. Glazing rebate surfaces must be sloped to shed water.

5. Provide adequate means to weep incidental water and condensation away from sealed edges of insulated glass units and out of wall system. Weeping of lock-strip gaskets should be in accordance with recommendation of glass manufacturer.

L. Metal Copings:
   1. Refer to Section 07600, FLASHING AND SHEET METAL for requirements of metal copings when they are not a part of glazed curtain wall system work.
   2. Coordinate curtain wall installation with metal coping detail on contract drawings. Provide watertight seal to meet criteria set forth in this section regarding air and water penetration.

SPEC WRITER NOTE: Delete the following article if no operating components such as windows and doors are part of curtain wall assembly.

3.4 ADJUSTING

//A. Adjust // windows // doors // revolving doors // to provide a tight fit at contact points and operate easily. //

//B. Adjust weather-stripping to make even contact with surfaces. //

//C. Adjust operating hardware and moving parts. //

3.5 CLEANING

A. Install curtain wall frame and associated metal to avoid soiling or smudging finish.
B. Clean metal surfaces promptly after installation, exercising care to avoid damage to coatings.
C. Remove excess glazing and sealant compounds, dirt, and other substances.
D. Follow recommendations of manufacturer in selection of cleaning agents. Do not use cleaning agents containing ammonia or other compounds that might damage finished metal surfaces.
E. Replace cracked, broken, and defective glass with new glass at no additional cost to Government. Just prior to final acceptance of curtain wall system clean glass surfaces on both sides, remove labels, paint spots, compounds, and other defacements, and clean metal fixed panels. Remove and replace components that cannot be cleaned successfully.

3.6 FIELD QUALITY CONTROL

A. Testing Agency: Engage an AAMA accredited commercial qualified independent testing and inspecting agency to perform field quality-control tests specified, and to prepare test reports.
   1. Submit information regarding testing laboratory's facilities and qualifications of technical personnel to Contracting Officer for approval.

B. Conduct field check test for water leakage on designated wall areas after erection to comply with MCWM-1. Conduct test on two wall areas, two bays wide by two stories high where directed. Conduct test and take necessary remedial action as directed by Contracting Officer.

C. Test Specimen:
   1. Test specimen shall include curtain wall assembly and construction. Test chamber shall be affixed to exterior side of test specimen and test shall be conducted using positive static air pressure.
   2. Test specimens shall be selected by Contracting Officer after curtain wall system has been installed in accordance with contract drawings and specification.
D. Sealant Adhesion Tests: Test installed sealant, in presence of sealant manufacturer’s field representative, in a minimum of two areas and as follows:

//1. Test structural silicone sealant according to field adhesion test method described in AAMA CW 13, "Structural Sealant Glazing Systems (A Design Guide)."

2. Test weatherseal sealant as recommended in writing by sealant manufacturer.

E. Air Infiltration: Test glazed aluminum curtain wall system according to AAMA 503, which requires testing according to ASTM E783.

1. Static-Air-Pressure Differential: 75 Pa (1.57 lbf/sq. ft.) minimum.

2. Air Leakage: 0.03 L/s per sq. m (0.06 cfm/sq. ft.) of surface maximum.

F. Water Penetration: Test glazed aluminum curtain wall system for compliance with requirements according to AAMA 503, which requires testing according to ASTM E1105.

1. Uniform Static-Air-Pressure Difference: 20 percent of positive design wind load, but not less than 479 Pa (10 psf). No uncontrolled water shall be present.

G. Retesting:

1. Should system fail field test, system may be modified or repaired, and retested.

2. Should system fail second field test, system may be additionally modified or repaired, and retested.

3. All modifications and repairs made to tested areas shall be recorded, and same modifications and repairs made to all system and adjacent construction on project.

4. Should second test fail, Contracting Officer may require testing of additional areas of the curtain wall.

H. Rejection:

1. Failure of any of specimens to meet test requirements of third test shall be cause for rejection of wall system and adjacent construction on project.

SPEC WRITER NOTE:
The following Article may not be required if no operating components such as window and door units are included in curtain wall system.

//3.7 DEMONSTRATION, TESTING, AND ACCEPTANCE

//A. Instruct Owner's personnel in proper operation and maintenance of // windows // revolving entrance door equipment // or // horizontal sliding entrance door equipment // . Train personnel in procedures to follow in event of operational failures or malfunctions. //

//B. Acceptance: At completion of project, and as a condition of acceptance, // revolving entrance door equipment // or // horizontal sliding entrance door equipment // and systems shall be operated for a period of fifteen (15) consecutive calendar days without breakdown. //

3.8 PROTECTION

A. After installation, protect windows, and other exposed surfaces from disfiguration, contamination, contact with harmful materials, and from other construction hazards that will interfere with their operation, or damage their appearance or finish. Protection methods shall be in accordance with recommendations of product manufacturers or of respective trade association. Remove paper or tape factory applied protection immediately after installation. Clean surfaces of mortar, plaster, paint, smears of sealants, and other foreign matter to present neat appearance and prevent
fouling of operation. In addition, wash with a stiff fiber brush, soap and water, and thoroughly rinse. Where surfaces become stained or discolored, clean or restore finish in accordance with recommendations of product manufacturer or respective trade association.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install interior light gauge metal framing as indicated on the drawings.

1.2 SUBMITTALS

A. Shop Drawings: Submit plans, elevations and details indicating extent of Work and connection details.

B. Product Data: Submit manufacturer's catalog data for each item proposed for installation.

C. Certificates: Furnish manufacturer's certification that materials meet or exceed Specification requirements.

1.3 QUALITY ASSURANCE

A. Comply with the Building Code of the City of Los Angeles and the following as a minimum requirement:

1. ANSI A 42.3 Lathing and Furring for Portland Cement Based Plaster, Exterior and Interior.


3. American Welding Society (AWS): Structural Welding Code (D1.1); Specification for Welding Sheet Steel in Structures (D1.3).

B. Tolerances: Install walls and partitions on straight lines, plumb, free of twists or other defects, and contacting a 10 foot straightedge for its entire length at any location within a 1/8 inch tolerance. Install horizontal framing level within a tolerance of 1/8 inch in 12 feet in any direction.

PART 2 PRODUCTS

2.1 MATERIALS

A. Wall Framing and Furring for Gypsum Wallboard:

1. Load bearing: Studs for load-bearing walls shall conform to ASTM C 955. Studs shall be C-shaped, roll-formed steel fabricated from minimum gage as indicated on the drawings, and G60 hot-dip galvanized coated sheet. Stud sizes shall be as indicated. Floor and ceiling runner tracks shall conform to ASTM C 955. Tracks shall be prefabricated, U-shaped with minimum 3/4 inch flanges, unpunched web, fabricated from G60 hot-dip galvanized coated sheet. Bridging in load bearing walls shall conform to ASTM C 955. Bridging shall be minimum 3/4 inch wide x 7/16 inch deep cold-rolled steel channel with weld attachment clips at each stud location or V-bar type weld or screw attached to each stud flange. Bridging shall provide lateral support for the stud.
2. Non-load bearing: Studs for non-load bearing walls shall conform to ASTM C 645. Studs shall be C-shaped, roll-formed steel with minimum uncoated design thickness of the gage indicated on the drawings, fabricated from G40 hot-dip galvanized coated sheet. Floor and ceiling runner tracks shall conform to ASTM C 645. Tracks shall be U-shaped, unpunched web, thickness to match studs, fabricated from G40 hot-dip galvanized coated sheet.

3. Portions supporting a mortar bed: Studs that receive mortar bed set ceramic tile, brick, or mini-brick finish shall be minimum thickness 16 gage and otherwise conform to requirements for load bearing partitions.

4. Studs at wall mounted items: Provide 16 gage studs at wall-hung lavatories, urinals, grab bars, wall-hung casework, fixtures, equipment, and where similar items are indicated on Drawings.

B. Stud gages indicated on Drawings or specified are minimum. Where required stud height and/or loads exceed code requirements or manufacturer's recommendations, provide heavier gage studs and/or decrease stud spacing as necessary to conform to code requirements.

C. Shaft Wall Framing Members: CH studs, 22 gage for 2-1/2 inch studs, 20 gage for 4 inch studs, conforming to ASTM 645, fabricated of steel conforming to ASTM A 653, Grade A, yield point 40 ksi, hot-dip galvanized.

D. Framing Accessories: Provide all standard related accessories including floor and ceiling tracks, clips, web stiffeners, anchors, and similar items, of the same manufacture as each type of stud specified, and as required for a complete installation.

1. Fire Rated Top Tracks: Approved assemblies bearing UL or ITS rating, required fire ratings and code requirements. Tracks shall be "Sliptrack," manufactured by Sliptrack Systems, Inc., Anaheim, CA, or "Fire-Trak," manufactured by Fire-Trak Corporation, Kimball, MN.

E. Fasteners: Wafer-head screws, self-drilling type for 20 gage metal and heavier.

F. Steel Backing Plates: Provide a minimum 4 inch wide by l6 gage steel, or sections of studs and stud track welded to web of studs, except as otherwise indicated. Apply shop coat of metal primer.

PART 3   EXECUTION

3.1 INSTALLATION

A. Walls and Partitions: Install products as recommended by their manufacturer, and as follows:

1. Fasten floor runners for exterior walls and interior partitions to concrete slab with required power driven fasteners. Spacing of fasteners not to exceed 24 inches on center. Fasten ceiling runners to structure.

2. Sound insulated walls and partitions: Embed floor runner tracks in two beads of acoustical sealant or two runs of compressible tape seal unless otherwise indicated on Drawings. Install the top track nested into slotted track system, in same manner for full height insulated walls. Where wall ends abutting concrete, masonry, or steel set end studs in two beads of acoustical sealant or two tape seals and secure at 4-foot centers vertically.
3. Space studs not over 16 inch on center unless indicated otherwise. Studs shall be located approximately 2 inches from door frame jambs, abutting partitions and partition corners, except those providing support for door and window openings.

4. Furnish and install manufacturer's standard floor track and shoes. Securely wire studs to shoes. Studs may be tack-welded to floor track instead of providing wired shoes. Fasten track to floor by means of 1/4 inch x 1-1/4 inch Star "Dryvin" hammer drive anchors or 3/16 inch x 1 inch round head, "Rawl-Drives" one-piece expansion bolts spaced not to exceed 3 feet, and installed in drilled holes in slab, or to wood joist with nails as indicated. Track may be fastened to concrete floor slabs with 1/4 inch x 7/8 inch low-velocity, power-driven fasteners.

5. Studs shall be seated squarely in track with stud web and flanges abutting track web, plumbed and securely fastened with sheet metal screws, to flanges or web of both floor and top tracks. Provide 4 screws per stud.

6. Where there is no suspended ceiling, tops of stud walls shall be provided with track and shoes and be fastened as specified for floors. Welding of studs to ceiling track will not be permitted except where bearing studs are installed.

7. Over metal doorframes, install a cut-to-length section of runner track, with flanges slit and web-bent to allow flanges to overlap adjacent vertical studs, and securely fasten to studs. At doorjambs, extend studs continuous to structure above.

8. Bridging, or horizontal bracing of 1-1/2 inch, cold-rolled channels shall be fastened in a manner to prevent stud rotation. Bridging shall be furnished as follows: walls up to 10 feet high, one row at mid-height; walls exceeding 10 feet high, bridging or bracing rows spaced not to exceed 5 feet on center.

END OF SECTION
PART 1   GENERAL

1.1    SUMMARY
A. Provide aluminum moldings (plaster joints) shall be as indicated on the drawings and specified.

1.2    SUBMITTALS
A. Submit manufacturer's catalog data to illustrate the profiles and dimensions of the moldings.

PART 2   PRODUCTS

2.1    MATERIALS
A. Aluminum moldings shall be by Fry Reglet Corporation, or equal.
B. Aluminum alloy and temper shall be that recommended by the aluminum producer for the specified anodic coating and shall have mechanical properties equal to or exceeding those of 6063-T5. Connector clips shall be aluminum or polyvinylchloride.
C. Fasteners shall be aluminum, galvanized steel, or stainless steel.
D. Profiles shall be the manufacturer's standard shapes and sizes, conforming to the configurations shown on the drawings.

2.2    FINISHES
A. Finish shall be Silicone Polyester Enamel melamine resin (50% silicone in resin solids), applied over chromate conversion coating and primer. All surfaces to receive silicone polyester enamel shall be pro-treated and primed in strict accordance with paint manufacturer's instructions.
B. Finish shall meet or exceed AAMA 605.2 specification "Voluntary Specification for High Performance Organic Coatings of Architectural Extrusions and Panels." Nominal dry film thickness shall be 0.30 mil for primer and 1.0 mil for finish coat(s).
C. Color shall be as selected by the Architect from the Manufacturers standard products.

PART 3   EXECUTION

3.1    INSTALLATION
Aluminum moldings shall be installed securely fastened to the structure, and in accordance with the manufacturer's descriptive data.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install grey acrylic finish steel trowel plaster as indicated on the drawings and specified.

1.2 QUALITY ASSURANCE

A. The distributor should be capable of providing a local architectural representative to provide consultation.

1. A technical consultant supplied by the local distributor should be contacted to consult the installer for the application of finish on all samples, mockups and during the actual system application.

B. Engage an experienced installer, who is certified, in writing by the product manufacturer, as being qualified to install the 3 coat plaster systems. The installer shall have 1 year’s experience with the products to be used on this project and have successfully completed the installation of a minimum of 50,000 square feet of the specified product.

C. Plan and conduct a pre-installation meeting at the project site prior to the installation of any wall materials (including mock-ups). This meeting is to be attended by the Architect, Contractor, Applicator of the system and the Technical Consultant.

D. Mock-Up Installation: Prior to the installation of the 3 coat plaster system work, provide a 4’-0” wide x 4’-0” tall sample mock-up panel using materials specified for final work. The panel must be constructed as per the Architects size and dimension requirements. Demonstrate the proposed range of color, texture and workmanship to be expected in the completed work. Show a cut-away in the panel exposing the weather barrier, metal lath and drainage weep of the system on a perimeter edge of the panel. Obtain Architect’s acceptance of visual qualities of the sample panel. Maintain sample panel throughout the construction process and dispose of when project is completed.

1.3 REFERENCE STANDARDS

A. The work of this section shall comply with the latest edition of the following. When conflicts arise between references, the more stringent shall apply.


2. ICBO Evaluation Service, Inc. - Evaluation Report Number ER-4617

3. American Society for Testing and Materials, related specifications. ASTM.


1.4 SUBMITALS

A. Product data for each component of the 3 coat plaster system.
1. Provide the following submittals for acceptance. First submittals and re-
submittals shall be complete and in the required form. Re-submittals shall include
requested corrections and shall respond to previous comments. Each sheet that
is revised shall bear a revision date, number and revised detail included. Failure
of a submittal to be complete, in the proper form, responsive to comments and
identifying revisions shall, at the reviewer's discretion, be cause for disapproval
and return of document without review, with the Contractor bearing full
responsibility for any resultant delay. Failure to review comments or to note a
noncompliance with plans and specifications shall not relieve the Contractor from
his obligation to comply. Allow sufficient time for preparation and processing of
submittals and re-submittals to avoid conflicts with schedule.

2. Submit product data and specifications for any materials, or fabrication
techniques used in the 3 coat plaster system work. Include instructions and or
recommendations for installation and maintenance. Include certified test reports
showing compliance with requirements where test methods are indicated.

B. Samples for verification in form of 1-foot-square panels for each finish, color and texture
specified. Prepare samples using same tools and techniques intended for actual work.

C. Qualification data for firms and persons specified in “Quality Assurance” Section to
demonstrate their capabilities and experience. Include a list of completed projects with
project names, addresses and any other information specified.

D. Installer certificates signed by the manufacturer's representative certifying that installers
comply with requirements under “Quality Assurance” Section.

1.5 GUARANTY-WARRANTY

A. In accordance with Section 01611, the Contractor shall and does hereby warrant and
guaranty that all work executed under this Contract be free from defects of materials and
workmanship for a period of five (5) years from the date of final acceptance of the project
by the Board of Public Works, except certain specific items of work, materials and
equipment requiring a guaranty or warranty for a greater period of time is specified.

1.6 DELIVERY, STORAGE AND HANDLING

A. Delivery and Storage of Material: Except for sand and water, deliver materials to the site
in sealed containers or bags fully identified with the manufacturer's name, brand and
type. Store materials in a dry, well-ventilated space, under cover and of the ground. Do
not allow liquids to freeze.

1.7 PROJECT CONDITIONS

A. Installer must examine surfaces to receive the plaster system and shall notify the
contractor in writing of conditions detrimental to the proper and timely completion of the
work. Do not proceed with the work until unsatisfactory conditions have been corrected in
a manner acceptable to the installer.

B. Protect adjacent surfaces from damage during installation of the plaster system.

C. The plaster system must be applied at an ambient air temperature from 40 degrees F to
110 degrees.

D. Maintain temperature for a minimum of 24 hours after application to allow proper curing.
E. Do not apply to frozen surfaces or surfaces containing frost.

1.8 REGULATORY REQUIREMENTS

A. Provide a system that conforms to the fire code as well as California Building Code (CBC) requirements.

PART 2 PRODUCTS

2.1 GREY ACRYLIC FINISH STEEL TROWEL PLASTER

A. Subject to compliance with specified requirements grey acrylic finish steel trowel plaster shall be by the following manufacturer (or equal).

1. PAREX Inc.
   Po Box 189
   Redan, GA 30074
   Ph. 714-396-3774 Fax 714-771-1821

B. Provide Liquid Polymers, Base Coats, finish coat materials, and accessories that are compatible with one another and approved for use by PAREX INC, or equal.

C. Comply with the following requirements:

   1. All materials must be mixed and applied as per manufacturers recommendations. PAREX Inc. (or equal), provides an “Application Guide” that must be reviewed and followed through the installation of its materials.

   2. Match finishes indicated by referencing manufacturer’s standard designations for these characteristics.

D. Gypsum Sheathing: ½” thick Georgia Pacific “Dens-Glass Gold” Sheathing Board: Gypsum sheathing manufactured in accordance with ASTM C 1177 with glass mats both sides and long edges, water-resistant treated core.


F. Reinforcing Lath: Expanded self-furring metal lath fabricated from copper bearing steel, painted, or zinc alloy and weighing 3.4 pounds per square yard.

G. Plaster Accessories: Coordinate depth of accessories with the thickness and number of coats required. All trims must be either from aluminum and or galvanized metal:

   1. Corner Reinforcement; galvanized corner reinforcement/corner aid, containing pre-formed corners to be set for (3/4” grounds).

   2. Casing beads; aluminum or galvanized metal pre-formed “J” mold, for plaster terminations to be set for (3/4” grounds).

   3. Foundation sill weep screed; galvanized perforated weep screed with expanded flanges. Designed for use at sill plate line to form plaster stop and prevent PM System from contacting damp earth and to be set for (3/4” grounds).
4. Control joints; Stockton metal NVS galvanized metal pre-formed channel screed to be set for (3/4" grounds). Contact: Stockton Products of Orange, CA at 877.862.5866.

H. The 3 Coat PAREX Fiber 47 Plaster System to be set from face of lath: 7/8 inch total minimum:
   1. PAREX Fiber 47 3/8 inch scratch coat and 3/8 inch brown coat.
   2. Sand: to meet ASTM C 897-96.
   3. Water: Potable and free from substances harmful to plaster.

I. Acrylic Skim Coat with Smooth Finish:
   1. PAREX 121, or equal, Dry Base Coat with Skim Coat - Grey Smooth Finish.

J. Flexi-Rock Sandcoat (sandable non-aggregated smooth coating and patching compound for Flexi-Rock Prepcoat Skim Coat), or equal.
   1. When using Sandcoat; FR100, or equal, admix is required.
   2. After Sandcoat has been applied and sanded the particles sitting on the surface of the finish need to be sealed and stabilized, before Flexi-Rock Tintable Primer, or equal, is applied. A mixture of FR100 and water (50/50) must be rolled and or sprayed to act as a surface stabilizer/sealer.

2.3 SEALANTS
A. Provide system manufacturer’s recommended low modulus silicone sealant elastomeric sealant that is compatible with joint fillers, joint substrates, and other related materials.

B. Sealant color shall be custom Color to match the plaster System finish coating on the adjacent surfaces, and to be approved by Architect.

PART 3 EXECUTION

3.1 EXAMINATION
A. All work shall be performed by skilled workmen, especially trained and experienced in this type of work. If the Contractor chooses to sub-contract the installation of work, the proposed sub-contractors qualifications shall be approved in advance by the Architect and Contractor.

B. Bench marks for elevation and building line-offset marks for alignment shall be established on each floor level by the Contractor, who shall be responsible for their accuracy. Should any error be found in their location, the Contractor shall so notify the Contractor in writing, and installation work shall not proceed in the affected area until the errors have been corrected.

C. After lines and grades have been established, and before beginning installation in any area, the Contractor shall examine all parts of the structure on which the wall is to be placed in that area. Should any conditions be found which, in his opinion will prevent the proper execution of his work, he shall report such condition in writing to the Architect and the Contractor.
D. Installation work shall not proceed in that area until such conditions are corrected or adjusted to the satisfaction of the Architect and the Contractor. Commencement of work shall constitute acceptance of surrounding conditions.

3.2 PREPARATION

A. Protect contiguous work from moisture deterioration and soiling resulting from application of systems. Provide temporary covering and other protection needed to prevent spattering of exterior finish coatings on other work.

B. Protect system, substrates, and wall construction behind them from inclement weather during installation. Prevent infiltration of moisture behind system and deterioration of substrates.

C. Gypsum sheathing:
   1. All sheathing used beneath the, smooth plaster system work shall be a minimum 5/8” Exterior Gypsum Sheathing Board: containing a water-resistant core and complying with UBC Section 2511, Table 25-G and ASTM MC79.
   2. Panels shall be tightly butted together and screws shall not be spaced less than 3/8” from edges and ends of sheathing.

3.3 INSTALLATION

A. Comply with the plaster system manufacturer’s current published instructions for installation of system as applicable to each type of substrate.

B. Exterior Gypsum Sheathing (Dens-Glass Gold):
   1. All edges and ends of the exterior gypsum sheathing shall occur on the framing members, except those edges and ends which are perpendicular to the framing members. All edges and ends of gypsum wallboard shall be in moderate contact.
   2. Fasteners shall be spaced not less than 3/8 inch from edges and ends of gypsum wallboard. Fasteners shall be applied in such a manner as not to fracture the face paper with the fastener head.
   3. Fasteners shall be long enough to penetrate through metal framing no less than a 1/2 inch.
   4. Comply with manufacturer’s recommendations for all accessories and installation procedures.

C. Underlayment: (over open framing) at all vertical and horizontal surfaces shall be covered with 2 sheets of type D building paper free from holes and breaks other than those created by fasteners and construction system due to attaching of the building paper. The building paper shall be applied horizontally, with the upper layer lapped over the lower layer not less than 2 inches. Where vertical joints occur, building paper shall be lapped not less than 6 inches. The installation of the building paper must be applied separate to that of the metal lath.

D. Plaster trims: must be installed prior to the application of the metal lath.
   1. Install casing beads where plaster stops and at all plaster terminations.
2. Install weep screed at base.
3. Install control joints and expansion joints.

E. Metal Lath: when fastening the 3.4 self-furring metal lath use No. 7, Type S Wafer Head Screws that are installed minimum 6 inches on center. Metal lath shall be applied horizontally and be lapped not less than ¼ inch at sides and 1 inch at ends. Cornerite shall be installed in all internal corners to retain position during plastering. Cornerite may be omitted when lath is continuous or when plaster is not continuous from one plane to an adjacent plane.

1. After the metal lath has been applied install corner reinforcement/corner aid at all exterior corners.

F. 3/8 inch Scratch Coat:

1. Apply scratch coat with sufficient material to embed and fill spaces of lath and to form keys through metal lath.
2. Allow scratch to set slightly, then score surface using a metal scratching tool with teeth 1 inch apart.
3. Score scratch coat surface in direction perpendicular to direction of supporting framing.
4. Curing scratch coat. Allow a 2 day curing time, and maintain moist conditions by a fine fog spray applied in the morning and evening to the surface of the scratch coat for the entirety of the cure time


1. Apply brown coat over scratch coat, bring out to grounds using a metal rod to a flat and true surface free of imperfections, which would reflect in the finish coat.
2. Reconsolidate brown coat by only lightly floating after hydration of the cement has commenced and sufficient moisture has evaporated, so that surface sheen has disappeared, but before the base/brown coat has become to rigid to be moved under float. Then immediately take a steel trowel cut back around trim edges approximately 1/16th of an inch, this will allow the finish to level off flush to the trim edges.
3. Leave the face of the base coat only slightly rough using a steel trowel to receive finish.
4. Curing brown coat: Allow a 7 day curing time, maintain moist conditions by a fine fog spray applied in the morning and evening to the surface of the brown coat for the first 72 hours.

H. Application of 1/8th inch Skim Coat: Apply a skim coat approximately 1/16th of an inch with a steel trowel to a smooth and uniform consistency.

I. Application of Smooth Finish.

1. Apply first coat of smooth finish approximately 1/16th of an inch over entire skim coated panel using a steel trowel, allow for the first coat to begin its set, then
double back with a second coat using a chrome trowel. Apply the second coat approximately 1/16th of an inch and allow for the material to achieve a slight set, then trowel smooth without leaving directional lines and or burnish marks to a flat/smooth and uniform surface.

2. When applying smooth finish plan to work so that the entire wall can be completed at one time so as to eliminate joining lines and overlaps.

3. Overlaps and cold joints are unacceptable.

J. When using smooth finish: An architectural review will be performed upon completion of prepcoat skim with leveling coat application (before Skim Coat is primed). Sand coat shall be applied to obtain acceptable corners, trim edges and to remove any unacceptable blemishes (such as chatter marks or undulations). Once finish is approved any areas where Sand Coat has been applied will be sealed.

3.4 INSTALLATION OF JOINT SEALANTS

A. Prepare joints and apply sealant, of type and at locations indicated, to provide weather tight joints.

3.5 PROTECTION AND CLEANING

A. Remove temporary covering and protection of other work. Promptly remove protective coatings from window and door frames and any other surfaces outside areas indicated to receive protective coating.

B. Provide final protection and maintain conditions in a manner acceptable to installer and system manufacturer that ensures system’s being without damage or deterioration at time of Substantial Completion.

3.6 ACCEPTANCE

A. Installed materials which are damaged, or which in the opinion of the Architect do not conform to the specification requirements, shall be removed and replaced with acceptable material at no additional cost to the Owner.

B. Demonstrate proper cleaning methods and materials to Owner's maintenance personnel.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install expanded metal mesh behind drywall as indicated on the drawings and as specified.

1.2 SUBMITTALS

A. Submit shop drawings of the security mesh prior to fabrication and delivery to the job-site. Indicate dimensions, materials, finishes and fastening details, and the Owner's access for maintenance.

B. Submit manufacturer's detailed installation instructions and descriptive recommendations.

C. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:

   1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials. Provide separate data for each different manufacturer used:

      a. Expanded Metal Mesh (steel)

   2. LEED Credit MRc5.1: Provide manufacturer name and location data for the following materials. Provide separate data for each different manufacturer used:

      a. Expanded Metal Mesh (steel)

PART 2 PRODUCTS

2.1 EXPANDED METAL MESH BEHIND DRYWALL

A. Expanded metal mesh shall be fabricated from not lighter than 16 gage steel sheets to form a short way dimension of not less than one inch and long way not greater than 2” and shall be flattened (Type F).

B. Secure the expanded mesh to the framing with vandal resistant fastenings.

C. Finish: Expanded metal mesh shall be supplied with the manufacturer's standard rust inhibiting mill applied finish.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install the expanded metal mesh behind drywall in accordance with manufacturer's instructions, specifications, and approved shop drawings.
B. The mesh shall be affixed in a manner that will deter disassembled with common hand tools such as hammers, pliers, or screw drivers. Make the assembly difficult, if not impossible, to penetrate the drywall by head butting, kicking or punching. All fasteners, screws, and nuts shall be so set that they cannot be accessed from the room side of the wall.

END OF SECTION
PART 1  GENERAL

1.1  SUMMARY

A. Furnish and install cementitious tile backerboard as indicated on the drawings and specified.

PART 2  PRODUCTS

2.1  COMPONENTS

A. Cementitious Backer Board: High density, cementitious, glass fiber reinforced, 1/2 inch thick.
   1. Acceptable Manufacturers (or equal) are as follows:
      b. USG, Durock.
      c. Georgia-Pacific, Dens-Shield.

B. Joint Reinforcing Tape: Coated glass fiber mesh tape; minimum 2 inch width.

C. Fasteners:
   1. Drywall screws, with rust resistant finish "Climaseal," or hot dip galvanized finish.

D. Washers: Stainless steel; 3/4 inch round, countersunk.

E. Dry-Set Grout: ANSI A118.6; commercial or latex portland cement.

PART 3  EXECUTION

3.1  INSPECTION

A. Verify existing conditions are satisfactory for installation.

3.2  INSTALLATION

A. Install building paper over studs before installing backerboards.

B. Install boards as recommended by the product manufacturer, horizontally, with end joints over framing members. Fasten panels to studs, maximum 8 inch fastener spacing. Install screw heads flush with the surface of the board.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. All labor, materials and equipment necessary for gypsum board systems (Drywall Construction) as indicated on the Contract Drawings and in these Specifications, including:

1. Taping, spackling and sanding of wallboard surfaces.
2. Metal framing for ceiling access panel furnished under DIVISIONS 15 and 16.

B. Related Sections:

2. Building Insulation in DIVISION 7.
3. Sealants in Section 07920.
4. Metal Doors and Frames in Section 08110.
5. Metal Framing in Section 09200.

C. Regulatory Agency: Los Angeles City Building Code, DIVISION 47.

D. References Standards:

1. GA216-85 Recommended Specifications for the Application and Finishing of Gypsum Board.
2. ASTM C-630.

1.2 SUBMITTALS

A. Conform to conditions of SUBMITTALS SECTION of DIVISION 1-GENERAL REQUIREMENTS of these Specifications.

B. Product Data:

1. Materials list of items proposed to be provided under this Section.
2. Manufacturer's specifications and other data needed to prove compliance with specified requirements.
3. Manufacturer's recommended installation procedures, when approved by the City Engineer, will become the basis of accepting or rejecting actual installation procedures used on the work.

C. Samples: Submit samples of all types of gypsum board to receive a painted finish. Submit sample with a completed finish to confirm that all types take the finish similarly.
D. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:

1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials:
   a. Steel Framing Components
   b. Gypsum Wallboard (for each different product type and manufacturer used)

2. LEED Credit MRC4: Provide recycled content data for each different product type, size and manufacturer used for the following materials:
   a. Gypsum Wallboard (for each different product type and manufacturer used)
   b. Recycled content materials claims shall meet the following requirements:
      2) The recycled content of each material shall be provided for the percentage by weight of post-consumer and post-industrial content, as defined in the document referenced above, used in each product type used.

3. LEED Credit MRC5.1: Provide manufacturer name and location data for the following materials. Provide separate data for each different manufacturer used:
   a. Steel Framing Components
   b. Gypsum Wallboard (for each different product type and manufacturer used)

4. LEED Credit EQc4.1: Provide adhesive and sealant VOC Emissions Data for the following materials. This information should be available on Material Safety Data Sheets (MSDS) or other product manufacturer’s literature. Provide the product manufacturer’s most current VOC emissions data:
   a. Sealant (per 3.2.K)

1.3 QUALITY ASSURANCE

A. Labor: Use adequate number of skilled laborers who are thoroughly trained and experienced in the necessary crafts and completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

1.4 PROJECT CONDITIONS

A. Environmental Requirements: During work operations of this Section maintain temperatures within the building within the range of 55 to 70 degrees F. Provide adequate ventilation in the work areas to carry off excess moisture.

1.5 GENERAL REQUIREMENTS

A. Product Handling:
1. To be arranged for delivery and storage of adequate supplies of drywall materials to the job-site to permit uninterrupted progress of the work.

2. Deliver materials and accessories to the job-site in their original containers or bundles properly identified with manufacturer's name and brand name. Store as directed by the City Engineer and protect against damage during the extent of the Contract.

3. Store drywall finish materials in flat area, protected from moisture, on flat and solid supports off the floor surface.

B. Scaffolding: In accordance with Federal, State, County, and City of Los Angeles Safety Rules and Regulations and CAL/OSHA. Avoid interference with work of other trades.

C. Protection:
   1. Adequately protect all existing and/or new work in place against damage.
   2. Keep floor surfaces covered to prevent staining by spackling materials.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements provide products of one of the following:

   1. Steel Framing and Furring:
      a. Bostwick Steel Framing Co.
      c. United States Gypsum Co.

   2. Grid Suspension Systems: Provide Drywall Suspension System-Flat Ceiling by USG, or equal. Comply with ASTM C645 to form a system that conforms to the requirements of UBC.

   3. Gypsum Boards and Related Products:
      a. Lousiana Pacific Corp.
      b. Georgia-Pacific Corp.
      d. United States Gypsum Co.

2.2 STEEL FRAMING COMPONENTS FOR SUSPENDED AND FURRED CEILINGS

A. General: Provide components which comply with ASTM C 754 for materials and sizes, unless otherwise indicated.

B. Wire for Hangers and Ties: ASTM A 641, Class 1 zinc coating soft temper.
C. Channels: Cold-rolled steel, 0.0598 inch (16 gage) minimum thickness of base (uncoated) metal and 7/16 inch wide flanges, protected with rust-inhibitive paint.

D. Steel Studs for Furring Channels: ASTM C 645, with flange edges bent back 90 deg and doubles over to form 3/16 inch minimum lip (return), minimum thickness of base (uncoated) metal and minimum depth as indicated on the drawings.

E. Steel Rigid Furring Channels: ASTM C 645, hat-shaped, depth of 7/8 inch, and minimum thickness of base (uncoated) metal as indicated on the drawings.

F. Grid Suspension System: ASTM C 645, manufacturer's standard grid suspension system composed of main beams and cross furring members which interlock to form a modular supporting network.

2.3 GYPSUM WALLBOARD

A. Recycled panels shall be "Fiberbond" by Louisiana-Pacific, or equal. Install these panels throughout the project, except where other panels are specifically called for. The unit shall be comprised of 3 layers in the form of a sandwich panel with wood fiber and gypsum throughout each layer. The outer layers shall be made of gypsum and recycled newspaper (without perlite), and the inner core shall be of gypsum, recycled newspaper, and perlite.

1. Acoustical panels shall be formed in a continuous process under heat and pressure.

2. Flame spread shall not exceed 6 per ASTM E84.

B. Other than recycled panel shall be used where fire rating is required, or elsewhere indicated on the drawings. Wallboard shall conform to Fed. Spec. SS-L-30D, in 48" widths by lengths as will minimize cross joints, and as follows:

1. Regular wallboard, type III grade R, Class I, 5/8" thick except as otherwise noted on the Drawings.

2. Fire-retardant wallboard, type III, grade X, class 1, 5/8" thick and shall bear label (U.L.) for 1-hour fire rating.

3. Water-resistant wallboard shall conform to ASTM C-630, type "X" conforming to L.A. City Building Code and 5/8" thick except as otherwise noted on the Contract Drawings.

4. Where gyp board is called for at the exterior roof level, provide cement-coated portland cement panels, high-density portland cement surface coating on both faces and lightweight concrete core composed of portland cement and expanded ceramic aggregate; fabricated in panels 7/16-inch thick by 36 inches wide by 36, 48, 60, 64, or 72 inches long and weighing 3.2 to 3.8 psf, by one of the following:

   a. "Wonder-Board"; Modulars Inc.


5. Shaft walls wallboard designed for encasing shafts of required fire-resistivity, conform to Fed. Spec. SS-L-30D, type IV, grade "R" or "X", in dimensions shown on the Drawings.
C. Abuse and impact resistant system, abrasion resistance, conforming to ASTM D 4977, impact resistance, conforming to ASTM E 695, fire endurance, conforming to ASTM E 84, and as follows:

<table>
<thead>
<tr>
<th>Panel</th>
<th>Fasteners</th>
<th>Jt. Tape</th>
<th>Jt. Treat.</th>
<th>Panel Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/8” FIBEROCK VHI Gypsum fiber panels</td>
<td>Steel: 1 ¼” Type S-12 drywall screw.</td>
<td>SHEETROCK paper tape</td>
<td>SHEETROCK Setting compound</td>
<td>United States Gyp. Co. 125 So. Franklin St. Chicago, Il 60606 1-800-289-4874</td>
</tr>
<tr>
<td>5/8” LexCore ARR 5810 (FIRECODE C w/.010 LEXAN)</td>
<td>Steel: 1 ¼” Type S-12 drywall screw.</td>
<td>SHEETROCK paper tape</td>
<td>SHEETROCK Setting compound</td>
<td>Contemporary Storage Systems, CSS. 892 Route 11 – P.O.Box 29 Kirkwood, NY 13795 1-888-673-8540</td>
</tr>
<tr>
<td>5/8” Hi-Impact 1000 gypsum wallboard</td>
<td>Wood: 1 ¾” Type W drywall screws. Steel: 1 ¼” Type S-12 drywall screws.</td>
<td>ProForm paper tape</td>
<td>Sta-Smooth Setting joint compound</td>
<td>Gold Bond National Gypsum Co. 2001 Rexford Rd Charlotte, NC 28211</td>
</tr>
<tr>
<td>5/8” Dens Armor Abuse Guard</td>
<td>Steel 1 ¼” Type S-12 drywall screws</td>
<td>SHEETROCK paper type</td>
<td>SHEETROCK setting compound</td>
<td>Nation Gypsum</td>
</tr>
</tbody>
</table>

D. Screws: Type "W" bugle head drywall screws, conforming to ASTM C664, 1 1/4-inch long, except where longer length is required by Code.


F. Taping Compound: As recommended by the wallboard manufacturer.

2.4 ACCESSORIES

A. Metal Trim: Form from zinc-coated steel not lighter than 26 gage, conforming to Fed. Spec. QQ-S-775, type I, class "d" or "e".

B. Casings (for all free edges of exposed gypsum wallboard): U.S. Gypsum No. 200-4 metal trim, U-shaped and of 1/2-inch size.


D. All other accessories, as necessary for a complete installation.

E. Access Panels: Inryco/Milcor Style DW; 24-inch x 24-inch. Flush hinges and screwdriver operated cam latch.

F. Sound Deadening Board: Fiber or gypsum sound deadening board 1/2-inch thick as supplied by Georgia-Pacific Corporation, or equal.
G. Edge Beads at Perimeter of Ceilings: Angle shapes with wings not less than 3/4" wide, with concealed wing perforated for nailing and exposed wing edge folded flat and factory finished white.

H. Adhesives and Sealants (LEED Credit EQc4.1): Only use adhesives and sealants in the interior of the building that meet or do not exceed the VOC limits of the CURRENT requirements of South Coast Air Quality Management District (SCAQMD) Rule No. 1168 on the interior of the building.

1. Current requirements refers to the date on which the materials are installed in the building.
2. Rule No. 1168: Refer to http://www.aqmd.gov/rules for the actual current version of the rule that will be applicable at the date of installation during construction.
3. Interior refers to all building construction that is inside of the exterior weatherproofing material.

2.5 JOINTING SYSTEM

A. Materials: Reinforcing tape and compound, designed to be used together as recommended by the wallboard manufacturer.

B. Jointing compound may be used for finishing if so recommended by its manufacturer.

2.6 ACCESS DOORS

A. In Partitions and Ceilings: Provide for access to mechanical and/or electrical installations.

B. Types:
1. 24" x 24" metal access doors with concealed hinges to metal frame and with Allen key lock.
2. Where to be located in fire-rated partitions, access doors to have the same fire-rating.
3. For tile surfaces and toilet room access doors and frames to be stainless steel with satin finish.
4. Other access doors of steel, prime coated to be finish painted as specified in Section 09900-PAINTING of these Specifications.

PART 3 EXECUTION

3.1 INSTALLATION OF STEEL FRAMING

A. Steel Framing Installation Standard: Install steel framing to comply with ASTM C 754 and with ASTM C 840 requirements that apply to framing installation.

B. Install supplementary framing, blocking and bracing at terminations in the work and for support of fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, and similar construction to comply with details indicated and with
recommendations of gypsum board manufacturer, or if none available, with "Gypsum Construction Handbook" published by United States Gypsum Co.

C. Isolate steel framing from building structure to prevent transfer of loading imposed by structural movement, at locations indicated below to comply with details shown on Drawings:

1. Where edges of suspended ceilings abut building structure horizontally at ceiling perimeters or penetration of structural elements.

2. Where partitions and wall framing abuts overhead structure.

D. Do not bridge building expansion and control joints with steel framing or furring members; independently frame both sides of joints with framing or furring members or as indicated.

3.2 INSTALLATION OF WALLBOARD

A. Project Conditions: Examine all parts of the work for any conditions which would affect the soundness or correctness of drywall work. Verify all corrective work to be done before proceeding with drywall construction operations.

B. Cooperation: Required, with all other trades involved in the work of placing of work, building-in, and embedding into drywall construction of all fixtures, anchors, backing, sleeves, inserts; providing of openings, chases to the extent necessary for proper and secure installation, attachments, and passing of other work.

C. All new piping, conduit, and fixtures to be concealed by wallboard or to penetrate drywall finish to be in place, tested, and approved before start of application of wallboard.

D. Install sound deadening board at locations indicated on the Drawings. Secure to framing with drywall screws as specified for wallboard in Subsections 2.2B of this Section.

E. General:

1. In accordance with Contract Drawings and with the separate boards in moderate contact but not forced in place.

2. At internal and external corners, conceal the cut edges by overlapping covered edges of abutting boards.

3. Stagger the boards so that corners of any four boards will not meet at a common point except in vertical corners.

F. Cutting: By scoring and breaking, or by sawing. Do all cutting from the face side. Sandpaper cut edges for neat jointing in finished work. Cutouts for pipes, fixtures, or other small openings to be scored before knocking out or cut out with saw.

1. Openings are not to be punched out. Scribe gypsum wallboard finish to intersecting or abutting surfaces.

G. Ceilings: Secure boards along perimeters of ceilings, around edges of openings to all furring channels. Place boards with long dimensions perpendicular to supports, screw in place at 12-inches on center in the field and 8-inches on center along board edges. Locate screws not less than 1/8-inch from board edges.
H. Walls and/or Vertical Planes: Place wallboard horizontally or vertically in accordance with manufacturer's recommendations for the particular situation for minimum taping. Secure wallboard to structural supports with drywall screws spaced 12-inches on center in the field and 8-inches on center staggered along each board edge. Use 1-1/4-inch long screws for fastening single layer of wallboards.

I. Fasteners: Firmly fasten boards to supporting framing member with fasteners not cutting surface paper or fracturing the gypsum core. Where a fastener has cut surface paper, provide another screw fastener approximately 1-1/2-inches from the defective fastener and remove the defective fastener. Butt join vertical joints of wallboard at supports and stagger on opposite faces of partitions.

J. Casings or Trim: Provide at all exposed edges and/or ends of wallboard and where intersecting with other materials. At exterior corners of wallboard joints secure in place specified corner reinforcements ready for taping compound.

K. Sealants: Where indicated on the Contract Drawings, provide a bead of sealant where trim or casings abut adjacent construction.

L. Access Doors:
   1. By careful coordination with the Drawings and with the trades involved, install the specified access doors where required.
   2. Anchor firmly into position, and align properly to achieve an installation flush with the finished surface.

3.3 JOINT TREATMENT AND FINISHING

A. General:
   1. Inspect areas to be joint treated, verifying that the gypsum wallboard fits snugly against supporting framework.
   2. In areas where joint treatment and compound finishing will be performed, maintain a temperature of not less than 55 degrees for 24 hours prior to commencing the treatment, and until joint and finishing compounds have dried.
   3. Apply the joint treatment and finishing compound by machine or hand tool.
   4. Provide a minimum drying time of 24 hours between coats, with additional drying time in poorly ventilated areas.

B. Embedding compounds:
   1. Apply to gypsum wallboard joints and depressed fastener heads in a thin uniform layer.
   2. Spread the compound not less than 3" wide at joints, center the reinforcing tape in the joint, and embed the tape in the compound. Then spread a thin layer of compound over the tape.
   3. After this treatment has dried, apply a second coat of embedding compound to joints and fastener heads, spreading in a thin uniform coat to not less than 6" wide at joints, and feather edged.
4. Sandpaper between coats as required.
5. When thoroughly dry, sandpaper to eliminate ridges and high points.

C. Finishing Compounds:
1. After embedding compound is thoroughly dry and has been completely sanded, apply a coat of finishing compound to joints and depressed fastener heads.
2. Feather the finishing compound to not less than 12" wide.
3. When thoroughly dry, sandpaper to obtain a uniformly smooth surface, taking care to not scuff the paper surface of the wallboard.

D. Screw Heads: To be depressed slightly and to have at least 3 coats of spackle, each coat applied at same time as the spackling of joint and to be thoroughly dry before application of succeeding coats.

E. Where Gypsum Board to Receive Vinyl or Other Coverings: Leave all surfaces clean and in acceptable conditions to receive subsequent finish work of other trades.

3.4 CORNER TREATMENT
A. Internal Corners: Treat as specified for joints, except fold the reinforcing tape lengthwise through the middle and fit neatly into the corner.

B. External Corners:
1. Install the specified corner bead, fitting neatly over the corner and securing with the same type fasteners used for installing the wallboard.
2. Space the fasteners approximately 6" on centers, and drive through the wallboard into the framing or furring member.
3. After the corner bead has been secured into position, treat the corner with joint compound and reinforcing tape as specified for joints, feathering the joint compound out from 8" to 10" on each side of the corner.

3.5 OTHER METAL TRIM
A. General: The Drawings do not purport to show all locations and requirements for metal trim.

1. Carefully study the Drawings and the installation, and provide all metal trim normally recommended by the manufacturer of the gypsum wallboard approved for use in this work.

3.6 CLEANING UP
A. In addition to other requirements for cleaning, use necessary care to prevent scattering gypsum wallboard scraps and dust, and to prevent tracking gypsum and joint finishing compound onto floor surfaces.

B. At completion of each segment of installation in a room or space, promptly pick up and remove from the working area all scrap, debris, and surplus material of this Section.
C. Provide final protection and maintain conditions, in a manner suitable to Installer, which ensures gypsum drywall construction being without damage or deterioration at time of Completion.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY
A. Furnish all tools, equipment, materials, supplies, accessories and perform all labor to install ceramic tile work indicated on the Contract Drawings and as hereinafter specified.

B. Related Sections:
1. Documents affecting work of this Section include, but are not necessarily limited to the GENERAL CONDITIONS, SUPPLEMENTARY CONDITIONS and Sections in DIVISION 1 of these Specifications.
2. Concrete work in Division 3.
3. Caulking in Section 07900.

1.2 QUALITY ASSURANCE
A. Referenced Specifications and Standards:
1. Material, installation and workmanship shall conform to the Tile Council of America Specifications and as follows:
   a. Glazed Ceramic Tile: A137.1
   b. Ceramic Mosaic Floor Tile: A137.1

B. Grade Certificate and Labeling: With each delivery of tile, furnish manufacturer's "Master Grade Certificate" to the City Engineer.

1.3 SUBMITTALS
A. General: Comply with the pertinent provisions of SUBMITTALS SECTION 01330 of DIVISION 1 - GENERAL REQUIREMENTS of these Specifications.

B. Provide submittals to document material selection as follows:
2. Data from manufacturer to certify recycled content, manufacture location and harvest location (i.e. cut sheets and/or manufacturer certification letters)

C. Product Data: Within 45 calendar days after the Contractor has received the City Engineer's "Notice to Proceed" submit the following:
1. Manufacturer's list of items proposed to be used or provided under this Section.
2. Manufacturer's standard palette showing the various tile colors and textures available.
3. Manufacturer's data, specifications and installation instructions for all products of this Section.

D. Certificates:

1. Furnish a Master Grade Certificate signed by this tile manufacturer at time of shipping stating type and quantities and by the Contractor who has installed the tile.

2. Furnish certification by the grout manufacturer that the products used meet or exceed the standards of the American National Standards Institute.


E. Samples:

1. Required: Two pieces of each type, size and color of tile, to be submitted to the Architect for approval.

2. Ceramic Tile: Wall, and floor tile and trimmer.

3. Mosaic Floor Tile: 12" x 12" sample in non-slip texture.

4. Provide samples of standard grout colors by manufacturer. Each sample shall bear the manufacturer's name and color designation.

1.4 PRODUCT HANDLING

A. Deliver materials in manufacturer's original unbroken containers with legible labels identifying brand name and contents.

1. Tile cartons shall be grade-sealed by manufacturer in accordance with ANSI A137 with grade-seals unbroken.

2. Grout shall contain hallmarks certifying compliance with referenced standards.

B. Deliver mastic grout in containers ready for use.

C. Store all materials in a dry location under cover in a manner to prevent damage or contamination.

D. All tile materials shall be free from chips, cracks, scratches, pits, discoloration or other defects. Damaged or defective materials will be rejected.

E. Deliver ceramic tile as customary for this product.

1.5 JOB CONDITIONS

A. Install mortar and set and grout the tile, only when the temperature is at least 50°F and rising.

B. Protection: Protect adjacent surfaces against damage during progress of the work of this Section.
C. Coordination and Cooperation: Coordinate work of this Section with work of other trades. Perform work without delay to the work in progress.

PART 2 PRODUCTS

2.1 CERAMIC TILE

A. General: Provide ceramic tile and accessories complying with Tile Council of America Specification 137.1, and by the manufacturers, and in colors and patterns as noted on the contract drawings.

B. Floor Tile: Natural clay or porcelain ceramic, dust pressed, machine made, with all purpose edge. Colors, patterns and sizes as selected from highest price range.

C. Glazed Wall Tile: Standard grade, square edge, dust pressed, machine made, bright or matt glazed, field tile and matching base with integral corners and terminals.

D. Tile for Base and Wall Surfaces: Tile for base and wall surfaces shall be as indicated on the drawings.

2.2 SETTING AND POINTING MATERIALS

A. Portland Cement: ASTM C150, type I or II.

B. White Portland Cement: Trinity, Medusa or Riverside.

C. Hydrated Lime: ASTM C207, type S, high-calcium type.

D. Sand: ASTM C144, clean, washed, sharp and fine aggregates. Sand for mortar setting beds shall be well graded to pass a No. 8 sieve with not more than 5 percent passing a No. 100 medi-screen.

E. Water: Clean potable water from a supply distributed for domestic use.

F. Grout Materials:
   1. For Ceramic Wall Tile: Hydroment Dry Tile Grout by Bostik Construction Products, Sno-Brite Grout by Technical Adhesives, Inc., or approved equal.
   2. For Unglazed Ceramic Floor Tile: Hydroment Dry Tile Grout by Bostik Construction Products, or equal.
   3. For Ceramic Mosaic Floor and Wall Tile: Portland Cement Grout.
   4. Colors shall be as selected by the Architect. (See Finish Schedule)

G. Reinforcing Fabric: Welded wire 2-inch x 2-inch, 16/16 wire or 3-inch x 3-inch mesh, 13/13 wire or 1 1/2-inch x 2-inch mesh, 16/13 wire conforming to ASTM A82 and ASTM A185, galvanized finish.

H. Divider Strips: White metal alloy, 5/16-inch thick, with provisions for keying to mortar setting bed.

2.3 MORTAR AND GROUT MIXES
A. Thinset Mortar for Vertical Setting Bed: For wall tile provide latex portland cement mortar, in conformance with ANSI A118.4.

B. Mortar for Floor Tile Setting Bed: Mudset mortar shall conform to ANSI A108.1. One part portland cement and 6 parts damp sand, by volume; addition of hydrated lime permissible in a quantity not exceeding 10 percent of the cement content.

C. Provide other materials required for a complete and proper installation, as selected by the Contractor subject to the approval of the City Engineer.

2.4 BOND COAT

A. Provide thinset mortar bond coat.

PART 3 EXECUTION

3.1 WORKMANSHIP AND APPLICATION

A. Workmanship: In accordance with best practice; work performed by skilled workers; jointings, intersections and returns well formed; drilling and cutting neatly done without marring the material; joints straight and solidly filled conforming to applicable "Standard Specifications" of the American National Standards Institute, Inc. ANSI A108.1 and ANSI A108.2.

B. Application: In accordance with manufacturer's directions and American National Standard Institute, Inc. Specification for Glazed Ceramic Mosaic Tile and Quarry Tile.

1. Maintain minimum temperature limits and installation practices recommended by the material manufacturers.

2. Apply bond coat to mortar bed while the setting bed is still plastic.

C. Alternative: As an alternative to bond coated setting bed, dry set mortar or latex portland cement mortar may be used on a cured bed.

3.2 INSPECTION

A. Surface Conditions: Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until detrimental conditions are corrected at no added cost to the City.

B. Surfaces to be Tiled: Surfaces shall fall within the following maximum variations. Report such unacceptable conditions and do not install tile until they are corrected.

1. Walls: 1/4 inch in 8 feet.

2. Floors: 1/4 inch in 10 feet.

3.3 TILE INSTALLATION

A. General: Set floor tile at 1% slope to drain.

1. Symmetrical, avoid small cuts; no tile to be cut to a length or width less than 1/2 of the full length or width of the tile.
2. Rub cuts smooth with a fine stone.
3. Surfaces in even planes; corners and lines straight and true.
4. Straight joint pattern on walls: Floor joints paralleled to walls.

B. Tile Setting:
1. Apply wall setting beds not sooner than 24 hours after application of scratch coat in areas to be tiled.
2. Make floor tile flush and hairline with adjoining surfaces and/or tile divider strips.

C. Divider Strips:
1. Required: At edge of ceramic tile floors at all doors and openings where material of floor finish or covering is different on each side of the opening, unless otherwise indicated or specified.
2. Installation: Placed prior to placing mortar setting bed; securely anchored; top to be flush with finish floor level or adjoining resilient flooring. Divider strips not to be installed where adjoining finish floor is concrete.

D. Accessories: Locate and properly mark prior to start of any tile laying exact locations of accessories, anchoring devices for equipment, toilet stall partitions, and similar items which penetrate through tile finish.

E. Joints:
1. Wall tile joints shall be uniform 1/16-inch wide.
2. Expansion Joints: As per American National Standards Institute or where indicated on the Contract Drawings.
3. Joints as juncture of ceramic tile floor and adjoining concrete finish floor to be same as floor tile joints.
4. Butt joints required between tile and divider strips; make joints flush and hairline, not to be grouted.
5. On floors tile joints shall be aligned and parallel to walls.

F. Grouting and Pointing:
1. Grout all tile joints full and neatly point.
2. Finish grouting for ceramic tile flush with surface of square-edge tile and to be recessed to the depth of the edge for all purpose edge.

G. Grouting Mosaic Floor Tile: Brush into the joints a mix of one part Hydroment Joint Filler and one part fine screen sand, and rub surfaces with woodblock. Brush neat cement paste into joints flush with surface and clean off excess grout with clean burlap or cloth.

3.5 REPAIR WORK
A. Required: Wherever necessary to join to existing tile work.
B. Material: Tile trimmers and tile shapes to match existing work in kind, color, size and finish or texture.

C. Application: Installed in full mortar setting bed, set flush with plumb or level and in pattern matching that of adjoining existing work, with same joints widths and joints aligned. Completed repair work shall show no visible demarcation line between existing and new work.

3.6 CLEANING

A. General: In addition to the provisions of DIVISION 1 - GENERAL REQUIREMENTS, do the following:

1. Remove mortar and grout prior to hardening during progress of work.

2. Clean surfaces thoroughly after grouting and pointing have set sufficiently; remove all cement, dust and other foreign matter with plain water or mild alkaline cleaner. Sandblasting of exposed surfaces is prohibited.

3. Cleaning with a solution not stronger than 10 percent muriatic acid to 90 percent water permitted only on unglazed tile; thoroughly wash afterwards with clean water. Completely protect hardware and fittings metal surfaces, cast iron and vitreous items from acid and fumes.

4. Cleaning shall be done in accordance with the manufacturer's recommendations.

3.7 PROTECTION

A. General: Cover mosaic tile floors with reinforced non-staining building paper with joints lapped 2-inches and sealed as necessary protection against wear or damaged of any kind or accumulations of dirt during work operations or other trades within the tiled floor room areas until accepted by the City.
SECTION 09500
ACOUSTICAL PANEL CEILINGS

PART 1   GENERAL

1.1   DESCRIPTION OF WORK

A. Provide all acoustical panel ceilings as shown on the drawings and as specified, including the following (or equal).

1. Mfr: Armstrong or equal.
   Type: Optima Tegular Open Plan
   Size: 24 x 24
   NRC: .95
   5/8": mineral fiber backing in locations indicated on drawings.

   Type: Optima Tegular Open Plan
   Size: 24 x 48
   NRC: .95

   Type: Optima Tegular Open Plan
   Size: 24 x 72
   NRC: .95

4. Suspension System:
   9/16 Interlude XL, or equal.

1.2   SUBMITTALS

A. Refer to Section 01330, SHOP DRAWINGS-SUBMITTALS, for procedures.

B. Shop Drawings and Product Data: The following list includes the required product data that shall be submitted.

1. Complete layout.

2. Samples. One sample of each specified size and type.

C. Maintenance Materials: Deliver to City's Representative one (1) percent of the total amount of each kind and each size of acoustical units installed at the completion of the project.

D. LEED Data: Provide special submittals conforming to Section 01023 – Environmental Procedures for the following:

1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials:
   a. Acoustical Units (for each different product type and manufacturer used)
   b. Acoustical Suspension System (steel or aluminum)
2. LEED Credit MRc4: Provide recycled content data for each different product type, size and manufacturer used for the following materials:

   a. Acoustical Units (for each different product type and manufacturer used)

   b. Acoustical Suspension System (steel or aluminum)

   c. Recycled content materials claims shall meet the following requirements:


      2) The recycled content of each material shall be provided for the percentage by weight of post-consumer and post-industrial content, as defined in the document referenced above, used in each product type used.

1.3 PRODUCT STORAGE

   A. Storage and Protection of Materials, Equipment and Fixtures: Do not store or install materials in the building until all glazing has been completed, all exterior openings have been closed in, all activities that contribute excessive moisture have been stabilized, and until relative humidity is within the limits recommended by the acoustical material manufacturer.

   B. Retain temperature at a uniform minimum of 60 degrees F (16 degrees C) before, during and after installation.

1.4 QUALITY ASSURANCE

   A. Design of ceiling suspension system, including related components, shall meet or exceed minimum requirements of the California Building Code and UBC Standards, current edition.

   B. Framing shall comply with ASTM C635 "Standard Specification for Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings".

   C. Installation of suspended ceiling system shall be by applicators approved by ceiling manufacturer.

   D. Do not install acoustical materials until proper temperature and humidity conditions as recommended by manufacturer can be maintained.

      1. Interior concrete work, and other wet operations shall be complete and dry.

      2. Windows and doors shall be in place and glazed.

PART 2 PRODUCTS

2.1 MATERIALS

   A. Acoustical units shall conform to FS SS-S 118A and ASTM E84, Class 25 Flame Spread Rating, and be the products indicated, or equal, and as follows:.
1. Units when tested in mounting No. 7 (suspended) shall have a noise reduction coefficient (NRC) of 0.70 or greater and contain not less than 81% recycled material content.

2. When tested in accordance with ASTM E-90, the Sound Transmission Class (STC) shall not be less than 35.

B. The suspended acoustical systems shall be aluminum or steel, as the case may be and shall be as indicated on the Drawings.

C. Wall Angles and Trim:
   1. Length: 10'-0"
   2. Flange: 15/16" and 9/16"
   3. Metal: No. 24 gage
   4. Edges: Shadow
   5. Color: Factory White
   6. Reveal: 3/8"

D. Hold-Down Clips: Ceiling manufacturer's standard to fit system furnished.

E. Edge Moldings:
   1. Metal: Aluminum or steel with white baked enamel finish.

F. Hanger wire shall be galvanized, 12-gauge as required by the type of ceiling to be used. Secure hanger wire to the structure above with methods or devices which develop the full strength of the hanger.

G. Ceiling channels shall be cold-rolled steel, galvanized.
   1. Size of Channel. 1-1/2 inches (38 mm), supported and spaced not more than 4 feet (1.2 m) O.C.

H. Suspension system shall be as indicated on the drawings and shall comply with ASTM C 635, metal suspension systems.

I. Seismic Compression Posts: Provide seismic compression posts of a telescoping design, manufactured from galvanized steel tubing, incorporating an injection molded plastic bulb clip for gripping the bulb on the 88 main tees. The post shall be fitted with a spring steel clip for clasping the ceiling suspension wires. The compression struts shall be adjustable, tested to withstand 500 (minimum) pounds of compressive load.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install acoustical materials with all lines level and true. Neatly make all joints and support all edges.

B. Installation of Suspended Acoustical Ceilings.
1. Install acoustical units and suspension systems in accordance with manufacturer's printed recommendations, with ASTM C 636, UL requirements, and as specified herein.

2. Do not suspend ceilings from 1-1/2-inch (40 mm) metal roof deck; suspend only from framing, purlins or steel floor deck.

3. Ceiling grid members shall be attached to not more than two (2) adjacent walls. Ceiling grid members shall be at least 1/2-inch free of other walls.

4. Provide seismic bracing for all suspended acoustic ceilings.

5. Bracing shall consist of four (4) 12-gauge sway wires spaced 90 degrees apart laterally, connected to a common point on the runner channel system, extending upward at 45 degrees, and attached to structure above. Provide one (1) such brace for each 144 square feet, or portion thereof, of suspended acoustic ceiling area.

6. Install acoustical ceiling in a true and even plane, in straight line course laid out symmetrically about center lines of ceiling. Apply border tile not less than 6 inches (150 mm) wide. Unless otherwise shown, border tiles on parallel sides shall be equal in width.

3.2 ADJUSTMENT AND CLEANING

A. Cleaning: Following erection, clean dirty or discolored surface of units. Remove units which are damaged or incorrectly applied, and replace as approved at Contractor's expense.

3.3 MAINTENANCE MATERIAL (EXTRA STOCK)

A. Furnish one spare acoustical unit for each 100 units installed.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY
A. The Contractor shall furnish and install wood suspended ceiling as indicated on the drawings and specified.

1.2 RELATED WORK NOT INCLUDED UNDER THIS SECTION
A. The General Conditions and the requirements of Division 1 of the Specifications shall apply to all work hereunder.
B. Suspension systems and components for ceilings other than the ceiling manufacturer's suspension carriers.

1.3 SUBMITTALS
A. Submit under provisions of Section 01330.
B. Shop Drawings: Indicate panel layout; show locations of mechanical grills, lighting, access panels, sprinkler heads, and other items affecting ceiling installation.
C. Product Data: Describe components specified in this Section.
D. Samples
   1. Submit the custom stain color required. The color shall match the maple sample that will be provided by the City Engineer.
   2. Submit small size samples of the wood strips proposed.
   3. Submit sample of suspension system; 9 inches wide x 12 inches long.
E. Manufacturer's installation instructions for suspension system.

1.4 DELIVERY, STORAGE, AND HANDLING
A. Provide factory wrapping, packaging, and other means necessary to prevent damage or deterioration during shipment, handling, and storage. Maintain protective coverings in place and in good repair until removal is necessary for the Work.
B. Maintain storage spaces and products in dry condition, and within temperature extremes recommended by manufacturer.

1.5 QUALITY ASSURANCE
A. Installer Qualifications: Installer shall be an organization with not less than two (2) years of successful experience in installation of suspended wood ceilings of similar requirements to this project. The installer shall be acceptable to the City Engineer.
B. Performance Characteristics: When specified as "Fire Resistant", the wood ceilings shall conform to Class 1 or A rating, when tested according to ASTM E84.
PART 2 PRODUCTS

2.1 WOOD CEILINGS

A. The wood shall be beech species and manufactured per WIC Premium Grade, custom stain finish wood as approved by the City Engineer.

B. The natural wood ceiling systems covered by this specification shall be Rulon Panel Grille as manufactured by the Rulon Company, Division of CRF Industries, Incorporated, or equal.

C. The wood shall be modular panels in size approved in the shop drawings.

2.2 CEILING SUSPENSION SYSTEM

A. The suspension system shall be by Rulon (or equal) comprised of a grid system using heavy duty clip rail system. The suspension system shall comply with the requirements of the California Building Code (CBC).

B. The Contractor shall provide hanger wires, hangers, clips and all components required for a complete and finished ceiling installation.

C. Structural Classification: The suspension system shall be classified as Heavy duty, meeting requirements of ASTM C635.

2.3 CEILING PANEL FABRICATION

A. Fabricate and finish panels and accessories at the factory to greatest extent possible, by manufacturer’s standard procedures and processes, as required to fulfill indicated performance requirements demonstrated by laboratory testing.

B. Comply with indicated profiles and dimensional requirements indicated on the drawings.

C. Edges, borders, and perimeter trims, shall be as designated by the City Engineer in accordance with standard design details available from the manufacturer.

D. All wood products specified shall be supplied by the ceiling manufacturer.

E. All wood shall be factory finished with clear sealers, wood stains, or semi-transparent color treatments. All finishes shall be as selected by the City Engineer.

PART 3 EXECUTION

3.1 PREPARATION

A. Layout: The Contractor shall measure ceiling areas, and establish positions of hangers and fasteners in accordance with installation instructions.

B. Coordination: The Contractor shall furnish layouts for supports that shall be installed for suspension of ceilings. The Contractor shall furnish inserts, hangers, and similar devices for installation, well in advance of the time needed for coordination of work.

3.2 CEILING INSTALLATION
A. All work shall be completed in accordance with the manufacturer's instructions, and in a manner satisfactory to the City Engineer. Use the manufacturers’ proprietary tools where recommended by the Manufacturer.

B. The Contractor shall install materials to comply with the Building Code of the City of Los Angeles and applicable industry standards.

C. Hanger Wires
   1. Provide for main runners and cross runners within 8 inches of ceiling perimeter and breaks in ceiling plane.
   2. Provide counterbraced wires for hanger wires more than 1:6 out of plumb.

D. Bracing-Wire Assemblies
   1. Provide hanger and four-way bracing wire sets for each 96 square feet of ceiling area, located and spaced per CBC.
   2. Bracing Wires: Provide set of four of splay wires at approximately 45 degrees unless other specifically designed and detailed bracing is provided. Provide first set of splay wires at 48 inches from walls.

3.3 INSTALLATION TOLERANCES

A. Bottom surface plane of each assembly shall be within plus-or-minus 1/8 inch of ceiling height required.

B. Bottom surface plane of each assembly shall be level and true to plane within 1/8 inch in 12 feet.

END OF SECTION
PART 1   GENERAL

1.1 SUMMARY

A. The Contractor shall furnish all Panel Grilles and suspension dowel clips necessary to complete installation by the contractor, in accordance with plans and specifications. The standard heavy-duty 15/16” T-rail carriers shall be supplied by contractor.

1.2 SUBMITTALS

A. Product Data: The Contractor shall provide product specifications and installation instructions for all supplied ceiling materials.

B. Shop Drawings: The Contractor shall supply shop drawings showing Panel Grille lengths, and placement of hangers, T-rail carriers, and other details deemed pertinent to proper installation.

C. Samples: The Contractor 12”x12” inch wood ceiling sample, in the specified panel grille style, with finish applied, shall be submitted for approval.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: The installer must be a firm with a minimum of two (2) years of successful experience in installation of suspended wood ceilings of similar requirements to this project. The installer shall be acceptable to the Architect, Manufacturer, and Owner's Representative.

B. Fire Performance Characteristics: The ceiling will be "Fire Resistant", Panel Grilles shall conform to Class 1, or A flame spread rating, when tested according to ASTM E-84

1.4 PROJECT CONDITIONS

A. Installation shall be done only when the temperature and humidity closely approximate the interior conditions that will exist when the building is occupied. The heating and cooling systems shall be operating before, during, and after installation, with the humidity of the interior spaces maintained between 25% and 55%.

B. It is important that plenums have proper ventilation, especially in high moisture areas. There shall be no excessive build up of heat in the ceiling areas.

C. Prior to the start of installation, all exterior windows and doors are to be in place, glazed, and weather-stripped. The roof is to be watertight, and all wet trades' work is to be completed, and thoroughly dry.

D. Mechanical, electrical, and other utility service installations above the ceiling plane shall have been completed. No materials should rest against, or wrap around, the ceiling suspension components or connecting hangers.

1.5 COORDINATION OF WORK
A. The layout and installation of panel grilles and ceiling suspension system shall be coordinated with other work penetrating the ceiling. This includes light fixtures, HVAC equipment, and fire suppression system components.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Panel grilles and components shall be delivered to the project site in original, unopened packages.

B. The panel grilles shall be stored flat and level in a fully enclosed space. For a minimum of seventy-two (72) hours immediately prior to ceiling installation, the panel grilles shall be stored in the room in which they will be installed. The temperature and humidity of the room shall closely approximate those conditions that will exist when the building is occupied. The panel grilles shall be stored off the floor.

C. Care in handling shall be exercised to avoid damage.

PART 2 PRODUCTS

2.1 PANEL GRILLES SUSPENDED WOOD CEILING SYSTEM

A. Subject to compliance with specified requirements, panel grille suspended wood ceiling systems shall be the product of Rulon Company, or equal, and have the following attributes:


2. Dimensions of stripes: 11/16" wide, 2" deep.

3. Spacing: 1-5/16".

B. The wood strips shall be made from prime grade, all-natural Beech with a clear lacquer finish. The panel grille shall be (pattern number) having wood strips inches wide x inches deep with inches spacing between strips. Standard panel grilles shall be assembled 1' wide - in nominal lengths of 2' to 10' in 1' increments (actual lengths are 1" shorter to allow for a reveal between panels). Wood strips shall be manufactured without finger-joints, and fastened together with dowels. The dowels shall be positioned 12" on center, starting 5-1/2" from the end of the panel grille, with interconnecting male-to-female attachment for support of the system.

1. Dowels shall be stained. Dowel clips shall be used to suspend panel grilles.

2. Wood shall be a natural product that will undergo changes with variations in the environment. Therefore, all dimension tolerances are ± 1/8".

C. Panel grilles shall be suspended from standard heavy-duty 15/16" 'T'-rail carriers (supplied by contractor) - using Rulon dowel clips for connection. No.12 gauge wire hangers shall suspend 'T'-rail carriers.

D. Edges, borders, and perimeter trims, shall be designated by specifier in accordance with standard design details available. All wood ceiling products specified shall be supplied by the ceiling manufacturer.

E. All Panel Grilles shall be factory-finished with 3 coats stains, lacquers, and coats clear sealers. All finishes shall be selected by the Architect.
1. Wood shall be a natural product with variations in grain, texture, and color – often ranging from light to dark - thereby, affecting the surface look.

2. Product finishes shall be stain, lacquer, or sealer coats - spray-applied to a smooth-sawn surface. The wood strips shall not be sanded.

PART 3 EXECUTION

3.1 PREPARATION

A. Ceiling Layout: The Contractor shall measure ceiling areas, and establish layout of panel grilles and 'T'-rails, in accordance with installation instructions.

B. Coordination: The Contractor shall furnish the layout for supports that shall be installed for suspension of ceilings. The Contractor shall furnish concrete inserts, steel deck hanger clips, or similar devices for installation, in time to coordinate the work.

3.2 INSTALLATION

A. General: The Contractor shall install materials in accordance with the manufacturer’s printed instructions. The installation shall comply with applicable regulations and industry standards.

B. Perimeters: Using a leveling device, the Contractor shall lay out and install the perimeter trim as specified.

C. Suspension: The 'T'-rail carriers shall be suspended and leveled in a direction perpendicular to the wooden strip direction. No.12 gauge wire hangers shall be used to support 'T'-rail carriers. Hangers shall be placed at 4' intervals along the carrier.

D. Wood Suspension: Panel grilles shall be suspended from the 'T'-rail carrier system by dowel clips.

3.3 ADJUSTMENT, CLEANING, AND REPAIR

A. The contractor shall make final adjustments to level or contours.

B. Upon completion of ceiling installation, all panel grilles and borders shall be cleaned free of dirt, dust, grease, oils, and fingerprints. Wood strips shall be wiped with furniture polish to enhance the surface finish.

C. All work which cannot be successfully cleaned or repaired, shall be removed and replaced.

D. Upon completion of ceiling installation, the Owner's Representative shall inspect all finished surfaces to ensure that work has been performed in a manner satisfactory to the Owner. Any deficiencies in the installed ceiling shall be corrected by the Contractor.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY
A. Furnish and install resilient foam sport flooring as indicated on the drawings and specified, including game lines.

1.2 SUBMITTALS
A. Submit shop drawings, product data and samples:
B. Submit shop drawings indicating floor joint pattern, and termination details. Indicate provisions for base corner details, game insert or socket devices.
   1. Indicate location, size, design, and paint materials, and colors for colored game lines.
   2. Submit product data for resilient blocks, floor materials and floor coating.
C. Submit installers qualifications. Only installers who have been approved by the flooring manufacturer will be acceptable.
D. Submit manufacturer’s approved installation instructions.
E. Submit manufacturer’s maintenance procedures and instructions. Include recommended cleaning and stain removal methods.
F. Submit two 24-inch square samples of complete specified assembly, prepared by the flooring system manufacturer, showing range of color variation of the surface materials. The sample shall include one seam.
D. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:
   1. LEED Credit EQc4.1: Provide adhesive and sealant VOC Emissions Data for the following materials. This information should be available on Material Safety Data Sheets (MSDS) or other product manufacturer’s literature. Provide the product manufacturer’s most current VOC emissions data:
      a. Resilient Foam Flooring Adhesive

1.3 QUALITY ASSURANCE
A. All products shall be ISO 9001 certified.

1.4 QUALIFICATIONS
A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum of 3 years experience.
B. Installer shall be a company specializing in applying the work of this Section with documented experience installing a minimum of 3 foam sports floors of similar scale within the past 5 years.

1. Flooring installation company and installation crew shall be acceptable to flooring system manufacturer.

2. Flooring company installation foreman shall have minimum 5 years documented experience installing foam sports floor systems.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and store within area of the flooring work to permit materials to stabilize to ambient conditions. Condition materials for minimum of 72 hours or as recommended by manufacturer.

B. Store and protect products in a manner to prevent damage. When damage or defects are evident, replace the material at no cost to the City.

1.6 ENVIRONMENTAL REQUIREMENTS

A. Do not install foam sport flooring until wet construction work is completed and building is completely enclosed and weatherproofed.

B. Do not install flooring until moisture content of concrete subfloor slab has stabilized at the vapor emission and alkalinity levels that are recommended by the flooring manufacturer.

C. Provide permanent heat, light, and ventilation prior to installation, operating at typical design temperatures.

D. Maintain minimum room temperature 65 degrees F, maximum 78 degrees F for period of 2 days prior to delivery of materials, during, and after installation.

1.7 WARRANTY

A. Provide a two (2) year warranty for sports flooring and accessories.

PART 2 PRODUCTS

2.1 RESILIENT FOAM SPORTS FLOORING

A. Manufacturer: Subject to compliance with specified requirements resilient foam sports flooring shall be “SportsM” by Taraflex (or equal).

B. Resilient foam sports flooring shall be homogenous 2.1 mm thick wear-layer combined with a closed-cell foam cushioned backing, reinforced with a fiber glass mesh interlayer to improve dimensional stability.

1. Vapor Retarder: Provide 6 mil polyethylene sheeting as recommended by manufacturer.

2. Nails: Type recommended by flooring manufacturer.

3. Ventilating Base: Rubber, 4 inch high with a 3 inch toe, ventilating type, with attachment accessories, pre-fabricated corner intersections, black color.
C. A fungistatic and bacteriostatic treatment shall be incorporated throughout the thickness of the surface. The wearlayer shall be treated with a photoreticulated, UV cured polyurethane, anti-dirt treatment, applied at the factory to give the surface high resistance to soiling and scuff marks, while retaining its excellent playing characteristics.

D. Adhesives shall be as recommended by the flooring manufacturer.

E. Paint material for game lines shall be as recommended by the sports flooring manufacturer and approved by the City.

H. Adhesives and Sealants (LEED Credit EQc4.1): Only use adhesives and sealants in the interior of the building that meet or do not exceed the VOC limits of the CURRENT requirements of South Coast Air Quality Management District (SCAQMD) Rule No. 1168 on the interior of the building.

1. Current requirements refers to the date on which the materials are installed in the building.

2. Rule No. 1168: Refer to http://www.aqmd.gov/rules for the actual current version of the rule that will be applicable at the date of installation during construction.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions where installation of products will occur, with Installer present, for compliance with manufacturer’s requirements. Verify that substrates and conditions are satisfactory for flooring installation and comply with the manufacturer’s requirements.

B. Concrete Substrates: Verify that concrete slabs comply with ASTM F 710 and the following:

1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials that may interfere with adhesive bond. Determine adhesion and dryness characteristics by performing bond, moisture, and pH tests recommended in writing by flooring manufacturer.

2. Substrates finishes comply with requirements specified in Division 3 Section “Cast-in-Place Concrete” for slabs receiving resilient flooring.

3. Substrates are free of cracks, ridges, depressions, scale, and foreign deposits.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Use trowelable leveling and patching compounds, according to manufacture’s written instructions, to fill cracks, holes, and depressions in substrates.

B. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
C. Broom and vacuum clean substrates to be covered immediately before product installation. After cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.3 FLOORING INSTALLATION

A. Comply with the recommendations of the flooring manufacturer. Scribe, cut, and fit flooring to butt neatly and tightly to vertical surfaces, equipment anchors, floor outlets, and other interruptions of floor surface.

B. Extend floor coverings into toe spaces, door reveals, closets, and similar openings, unless otherwise indicated.

C. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating subfloor markings on finish flooring. Use nonpermanent, nonstaining marking device.

D. Adhere products to substrates using a full spread of adhesive applied to substrate to comply with adhesive and flooring manufacturers’ written instructions, including those for trowel notching, adhesive mixing, and adhesive open and working times.

   1. Provide completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

E. Lay out sheet flooring to comply with the following requirements.

   1. Maintain uniformity of flooring direction.
   
   2. Arrange for a minimum number of seams and place them in inconspicuous and low-traffic areas, and not less than 6 inches (150 mm) from parallel joints in flooring substrates.
   
   3. Match edges of sheet flooring for color shading and pattern at seams.
   
   4. Avoid cross and butt seams.

F. Heat-Welded Seams: Rout joints and heat weld with welding bead, permanently fusing sections into a monolithic floor finish. Prepare, weld, and finish seams according to manufacturer’s written instructions and ASTM F 1516 to produce surfaces flush with adjoining floor covering surfaces.

### 3.4 FINISHING

A. Sandpaper wood flooring to smooth even finish with no evidence of sander marks, gouges, scratches, gouges, stains, or other defacements.

   1. Take precautions to contain dust. Use equipment with self contained dust collection systems. Remove dust from all floor, wall and ceiling surfaces by use of HEPA high efficiency filter vacuum.
   
   2. Sand using multiple passes of coarse, medium and fine grade sandpaper.
   
   3. After sanding, buff floor with 100 screen back or equivalent sandpaper.
B. Vacuum and tack floor completely. Mask off adjacent surfaces.

C. Wood Floor Finish:

1. Apply finish system in accordance with floor finish manufacturer's instructions.
2. Maintain wet edge at all times at each coat. Install without visible lap marks or edges.
3. After fully curing each coat, screen back and vacuum between each coat.
4. Apply initial seal coat.
5. Apply striping and markings in accordance with standards designated by City Engineer and as shown on drawings. Colors shall be as selected by City Engineer.
6. Apply minimum three finish coats over striping.

D. Game lines shall be primed and painted as recommended by the flooring manufacturer using accurate measurements. Comply with the requirements of the International Amateur Athletic Federation (IAAF) requirements. Layout and measure to close tolerances. Colors shall be as directed by the City Engineer.

E. Notify the City Engineer for timely review of the completed floor.

F. Prohibit traffic across floor until finish is fully cured.

3.5 PAINTING GAME LINES

A. Game line paint shall be applied only by experienced professional game line applicators, and in accordance with the paint manufacturer's recommendations game line paints. Please also note instructions on game line paint containers. Use game line paint designed for application of game line only – maximum 3" width. The paint is not suitable for painting large areas such as solid keys or borders. Allow a minimum 1/2" wide space between different colors of paint to prevent bleeding of colors.

B. Measure and layout game court areas as directed by the City. Double-check all dimensions to avoid errors in layout. All game lines shall be masked with professional masking tape. Rub tape firmly against floor surface to accomplish a tight bond.

C. After masking tape has been completely bonded, the area between the tape shall be cleaned with a white 100% cotton rag dampened with cleaning solvent. Change rags frequently and dispose of all rags carefully as they are flammable. Do not smoke in the room area and make sure the ventilation system is in operation. Also there shall be no flame or pilot lights. Allow cleaning solvent to dry 20 to 30 minutes.

D. Mix primers thoroughly and then apply a thin coat of clear Syntane Primer to all areas between the masking tape. Apply primer with a short nap mohair paint roller 1" wide for 1" lines and 2" wide for 2' lines. Allow Primer to dry for 60 minutes.

E. Mix colored game line paint, part A and part B, thoroughly. After mixing allow paint to sit in can for approximately 20 to 30 minutes. You will then have 3 hours working times.
F. Apply colored game line paint using a short nap mohair paint roller 1" wide for 1" lines and 2" wide for 2' lines. Paint roller shall be solvent resistant. It’s important that the paint be applied in a thin uniform coat. After completion of first coat application, apply a second thin coat of paint. The second coat of paint shall be applied within one to two hours after application of the first coat. It is important that the second be applied while the first coat is still wet to accomplish good quality bond. After painting is completed, remove masking tape within one to two hours.

3.6 CLEANING AND PROTECTING

A. Perform the following operations immediately after installing flooring products and painting the game lines:

1. Remove adhesive and other surface blemishes using cleaner recommended in writing by flooring manufacturer.

2. Sweep and vacuum floor thoroughly.

3. Do not wash floor until after waiting period recommended in writing by flooring manufacturer.

4. Damp mop floor to remove marks and soil using method and cleaner recommended in writing by flooring manufacturer.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended in writing by flooring manufacturer.

1. Apply protective floor polish to floor surfaces that are free from soil, adhesive, and surface blemishes.

2. Do not move heavy or sharp objects directly over floor surfaces. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY
A. Provide testing of moisture vapor emission and alkalinity (pH) for foam sports flooring as specified.

1.2 SUBMITTALS
A. Product data: Submit technical data and specifications. List of materials proposed to be provided under this Section.
B. Test reports: Submit vapor emission and alkalinity test reports.

1.3 PROJECT CONDITIONS
A. Space enclosure and environmental limitations: Prior to testing for moisture vapor emission rate, space shall be enclosed, fully weathertight, wet-work in space complete and nominally dry, work above ceilings finished. The test site shall be at the same temperature and humidity expected during normal use. Do not execute tests when the building interior is below 65 deg. F or above 90 deg. F for 72 hours prior to, and throughout the duration of the tests.

B. Perform testing 2 weeks before the installation of finish flooring over interior concrete slabs.

PART 2 PRODUCTS

2.1 VAPOR EMISSION AND ALKALINITY (pH) TESTING KIT MANUFACTURER
A. Subject to compliance with specified requirements, provide products from the following sources (or equal):
   1. Vaprecision Testing Systems
   2. Sinak Corp.

PART 3 EXECUTION

3.1 TESTING
A. Conduct 3 vapor emission and alkalinity tests for the first 1,000 sq. ft. of floor area and one additional test for each 1,000 sq. ft. thereafter.

B. Vapor emission testing:
   1. Test in accordance with ASTM E 1907.
   2. Report test results in pounds per 1,000 sq. ft. in 24 hours.
C. Alkalinity (pH) testing: Using a pH pencil, draw a small "x" on the surface (approximately 2" x 2"). Pour a small amount of distilled water over the "x" and allow to stand for 30 - 60 seconds. Using the color chart that comes with the pH pencil, determine the alkalinity of testing area.

D. Do not install finish flooring if moisture emission and pH range exceeds flooring materials manufacturers’ requirements.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. All labor, materials and equipment necessary to installation of flooring and rubber base indicated on the Contract Drawings and herein specified.

1.2 SUBMITTALS

A. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:

1. LEED Credit EQc4.1: Provide adhesive and sealant VOC Emissions Data for the following materials. This information should be available on Material Safety Data Sheets (MSDS) or other product manufacturer’s literature. Provide the product manufacturer’s most current VOC emissions data:
   a. Rubber Base Adhesive

PART 2 PRODUCTS

2.1 RUBBER BASE MATERIALS

A. General: Top set type conforming to Federal Specification SS-W-402, Type I, and as follows:

1. Manufacturer: Roppe
2. Product: Premium Wall Base
3. Color: Black
4. 1/8-inch thickness and height 4" unless noted otherwise on the drawings.

2.2 MISCELLANEOUS MATERIALS

A. Adhesive: As recommended by the manufacturer of the rubber base materials. Adhesive shall be waterproof and stabilized type. Asphalt emulsions and other non-waterproof type adhesives will not be acceptable.

B. Other Materials: All other materials, not specifically described but required for a complete and proper installation of the work of this Section shall be as recommended by the manufacturer of the materials used and approved by the City Engineer.

C. Adhesives and Sealants (LEED Credit EQc4.1): Only use adhesives and sealants in the interior of the building that meet or do not exceed the VOC limits of the CURRENT requirements of South Coast Air Quality Management District (SCAQMD) Rule No. 1168 on the interior of the building.

1. Current requirements refers to the date on which the materials are installed in the building.
2. Rule No. 1168: Refer to http://www.aqmd.gov/rules for the actual current version of the rule that will be applicable at the date of installation during construction.

PART 3   EXECUTION

3.1   INSTALLATION

A. Install materials only after finishing operations, including painting, have been completed. Comply with the manufacturer's recommendations.

B. Bond the top-set rubber base to wall surface with adhesive, use preformed base sections at all internal and external corners. Install running base tightly on top of flooring with top edge exactly even with top edges of premolded corners.

END OF SECTION
PART I   GENERAL

1.1   SUMMARY

A. Furnish and install resinous flooring as indicated on the drawings and specified, including substrate preparation by mechanical means.

1.2   SUBMITTALS

A. Product Data: Submit manufacturer's technical data, installation instructions, and general recommendations for each resinous flooring material required. Include certification indicating compliance of materials with requirements.

1. Indicate the mechanical equipment to be used for substrate preparation.

B. Samples: Submit, for verification purposes, 4-inch square samples of each type of resinous flooring required, applied to a rigid backing, in color and finish indicated.

1. For initial selection of colors and finishes, submit manufacturer's color charts showing full range of colors and finishes available.

1.3   QUALITY ASSURANCE

A. Single Source Responsibility: Obtain primary resinous flooring materials including osmotic pressure resistant grout (if required), primers, aggregates, resins, hardening agents, finish or sealing coats from a single manufacturer with not less than ten years of successful experience in manufacturing and installing principal materials described in this section. Contractor shall have completed at least ten projects of similar size and complexity; Stonhard or approved equal, (no known equal).

B. Pre-Installation Conference

1. The Contractor shall arrange a meeting not less than thirty days prior to starting work.

2. Attendance

a. Contractor
b. Architect and Owner's Representative
c. Installer's Representative

C. ISO 9002: All materials, including primers, resins, curing agents, finish coats, aggregates and sealants are manufactured and tested under an ISO 9002 registered quality system.

1.4   DELIVERY, STORAGE AND HANDLING

A. Material shall be delivered to job site and checked by flooring contractor for completeness and shipping damage prior to job start.
B. All materials used shall be factory pre-weighed and pre-packaged in single, easy to manage batches designed to be mixed in a single 5 gallon bucket to eliminate on site mixing errors and ensure thorough mixing of each batch. No on site weighing or volumetric measurements allowed.

C. Material shall be stored in a dry, enclosed area protected from exposure to moisture. Temperature of storage area shall be maintained between 60 and 85°F/16 and 30°C.

1.5 PROJECT CONDITIONS

A. Concrete substrate shall be properly cured for a minimum of 30 days. Calcium Chloride testing to be completed at least 3 weeks prior to scheduled installation. Testing to be provided by manufacturer's representative. A minimum of one test for every 500 square feet is to be administered. Upon acceptance of the vapor pressure conditions of the concrete substrate for installation of resinous flooring by the flooring manufacturer, they are to submit the test results in writing along with their warranty against vapor pressure.

B. Utilities, including electric, water, heat (air temperature between 60 and 85°F/16 and 30°C) and finished lighting to be supplied by General Contractor.

C. Job area to be free of other trades during, and for a period of 24 hours, after floor installation.

D. Protection of finished floor from damage by subsequent trades shall be the responsibility of the Contractor.

1.6 WARRANTY

A. Manufacturer shall furnish a single, written warranty covering all systems (including vapor pressure resistant grout) for both material and workmanship for a period of three (3) full years from date of installation.

PART 2 PRODUCTS

2.1 COLORS

A. Colors: As selected by the Architect from manufacturer's standard colors.

2.2 EPOXY FLOORING AND COVE BASE

A. Stonshield HDI (Stonblend) as manufactured by Stonhard, Inc., or equal, shall be a nominal 3/16”/5mm thick system comprised of a penetrating two-component epoxy primer, three-component mortar consisting of epoxy resin, curing agent and finely graded silica aggregate, three-component, epoxy undercoat, brightly colored, quartz silica aggregate broadcast and two coats of a high performance, two-component, clear epoxy sealer to provide a medium texture.

1. Physical Properties: Provide flooring system in which physical properties of topping including aggregate, when tested in accordance with standards or procedures referenced below, are as follows:

Compressive Strength ................................................................. 10,000 psi (ASTM C-579)
Tensile Strength ................................................................. 2,000 psi (ASTM C-307)
B. Provide the manufacturer's recommended resinous base where indicated on the drawings.

C. Provide a two component polymer modified cementitious, osmotic pressure resistant grout.

D. Provide elastomeric type produced by manufacturer of resinous flooring system for the service and joint condition involved.

PART 3  EXECUTION

3.1 PREPARATION BY MECHANICAL ABRASION

A. Substrate: Concrete preparation shall be by mechanical means and include use of a scabbler, scarifier, high speed grinder or shot blast machine for removal of bond inhibiting materials such as curing compounds or laitance.

3.2 APPLICATION

A. General: Apply each component of resinous flooring system in compliance with manufacturer's directions to produce a uniform monolithic wearing surface of thickness indicated, uninterrupted except at divider strips, sawn joints or other types of joints (if any), indicated or required.

B. Primer: Mix and apply primer over properly prepared substrate with strict adherence to manufacturer's installation procedures and coverage rates. Coordinate timing of primer
application with application of troweled mortar to ensure optimum adhesion between resinous flooring materials and substrate.

C. Troweled Mortar: Mix mortar material according to manufacturer's recommended procedures. Uniformly spread mortar over substrate using manufacturer's specially designed screed box adjusted to manufacturer's recommended height. Hand trowel apply mixed material over freshly primed substrate using steel finishing trowels or power trowel material.

D. Undercoat: Remove any surface irregularities by lightly abrading and vacuuming the floor surface. Mix and apply undercoat with strict adherence to manufacturer's installation procedures and coverage rates.

E. Broadcast: Immediately broadcast quartz silica aggregate into the undercoat using manufacturer's specially designed spray-caster. Strict adherence to manufacturer's installation procedures and coverage rates is imperative.

F. Sealer: Correct surface imperfections by spot sanding and remove excess unbonded granules by lightly brushing and vacuuming the floor surface. Mix and apply sealer with strict adherence to manufacturer's installation procedures. After thorough inspection and correction of imperfections, apply second coat of clear epoxy sealer.

3.3 CURING, PROTECTION AND CLEANING

A. Cure resinous flooring materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of application and prior to completion of curing process. Close area of application for a minimum of 24 hours.

B. Protect resinous flooring materials from damage and wear during construction operation. Where temporary covering is required for this purpose, comply with manufacturer's recommendations for protective materials and method of application. General Contractor is responsible for protection and cleaning of surfaces after final coats.

C. Cleaning: Remove temporary covering and clean resinous flooring just prior to final inspection. Use cleaning procedures and cleansers recommended by the flooring manufacturer.

END OF SECTION
PART 1   GENERAL

1.1 DESCRIPTION

A. Furnish and install carpeting and all carpet accessories on concrete floors as indicated on
the Contract Drawings and in these Specifications as needed for complete and proper
glue-down installation.

1.2. RELATED WORK

A. Documents affecting the Work of this Section include, but are not necessarily limited to
the GENERAL CONDITIONS, SUPPLEMENTARY CONDITIONS and Sections in
DIVISION 1 of these Specifications.

1.3 SUBMITTALS

A. Comply with applicable provisions of SUBMITTALS SECTION 01330 of DIVISION 1 -
GENERAL REQUIREMENTS of these Specifications.

B. Product Data: Within 40 calendar days after the Contractor has received the City's
"Notice to Proceed" submit the following:

1. Materials list of items proposed to be provided under this Section.

2. Manufacturer's specifications and other data needed to prove compliance with the
specified requirements.

3. Manufacturer's recommended installation procedures which, when approved by
the City Engineer will become the basis for accepting or rejecting actual
installation procedures used on the Work.

C. Sample: Contractor at his own expense shall submit three (3) 18-inch x 27-inch samples
of each specified carpets for approval prior to fabrication and installation of the carpet.

D. Shop Drawings: Furnish seaming plans for all carpet areas to the Architect for approval
prior to installation.

E. Tests: One sample (18-inch x 18-inch size) taken from the delivered carpet will be tested
for compliance with specifications requirements. The expense of the testing will be borne
by the City if the carpeting complies. If it does not comply with the requirements of the
specification, the expense of testing will be charged to the Contractor and the delivery will
be rejected.

F. LEED Data: Provide special submittals conforming to Section 01022 – Environmental
Procedures for the following:

1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for
the following materials:

    a. Carpeting
2. LEED Credit MRc4: Provide recycled content data for each different product type, size and manufacturer used for the following materials:
   a. Carpeting
   b. Recycled content materials claims shall meet the following requirements:
      2) The recycled content of each material shall be provided for the percentage by weight of post-consumer and post-industrial content, as defined in the document referenced above, used in each product type used.

3. LEED Credit EQc4.1: Provide adhesive and sealant VOC Emissions Data for the following materials. This information should be available on Material Safety Data Sheets (MSDS) or other product manufacturer’s literature. Provide the product manufacturer’s most current VOC emissions data:
   a. Carpet Adhesive
   b. Seam Sealer

4. LEED Credit EQc4.3: Provide Carpet VOC Emissions Data for the following materials. This information should be available on Material Safety Data Sheets (MSDS) or other product manufacturer’s literature. Provide the product manufacturer’s most current VOC emission data:
   a. Carpet

1.4 QUALITY ASSURANCE

A. Call the Architect for consultation after receipt of carpet from the supplier, and before starting installation. The Architect may make a visual inspection of the delivered carpet as part of the consultation.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to the job-site in unopened suitable packaging bearing the manufacturer's labels.

B. Storage: Store materials where directed by the City Engineer, in a location under cover, safe from weather and damage by construction operations.

C. Protection: Use all reasonable means necessary to protect materials before, during and after installation. In the event of damage, immediately make necessary repairs and/or replacements to the full approval of the City Engineer, at no added cost to the City.

1.6 GENERAL REQUIREMENTS

A. General Warranty: Special warranty specified in this Article shall not deprive the City of other rights the City may have under provisions of the GENERAL CONDITIONS of these
Specifications and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Carpet Warranty: Written warranty, signed by carpet manufacturer agreeing to replace carpet that does not comply with requirements or that fails within specified warranty period. Warranty does not include deterioration or failure of carpet due to unusual traffic, failure of substrate, vandalism, or abuse. Failures include, but are not limited to, more than 10 percent loss of face fiber, edge raveling, snags, runs, and de-lamination.

1. Carpet Warranty Period: 10 years from date of Substantial Completion acceptance by the City.

PART 2 PRODUCTS

2.1 MATERIALS

A. Carpet shall be of the manufacturer, and colors and custom pattern indicated on Drawings, and as follows:

1. Wear Layer Technology: Duracolor® by Lees Stain Resistant System
2. Wear Layer Thickness: 0.132" avg. (3.4 mm)
3. Primary backing: reinforced synthetic
5. Face Yarn Weight: 24 oz/yd² (813.34 gm/m²)
6. Total Weight: 148.25 oz/yd² (5027.16 gm/m²)
7. Static Performance: Less than 3.0 kv when tested under the Standard Shuffle Test at 70° F (21° C) - 20% R.H.

B. Low-Emitting Carpet (LEED Credit EQc4.3): The Contractor shall use carpet systems that meet or do not exceed the emission limits Carpet and Rug Institute (CRI) Green Label Testing Program in the building. The CRI maximum emission limits for carpet systems in milligrams per square meter per hour are as follows:

1. Carpets
   a. Total Volatile Organic Compound (VOCs): 0.50
   b. 4-PC (4-Phenylcyclohexene): 0.05
   c. Formaldehyde: 0.05
   d. Styrene: 0.40

2. Cushion
   a. Total Volatile Organic Compound (VOCs): 1.00
   b. 4-PC (4-Phenylcyclohexene): 0.30
   c. Formaldehyde: 0.05
   d. BHT (butylated hydroxytoluene): 0.30

3. Carpet/Cushion Adhesive
   a. Total VOCs: Not to exceed either of the following:
1). 10.0 milligrams per square meter per hour per CRI.
2). 50 grams per liter per SCAQMD Rule 1168.

b. Formaldehyde: 0.05

c. 2-Ethyl-1-Hexanol: 3.00

C. Other Materials for Installation:

1. Adhesive: Carpet Manufacturer’s recommended adhesive or equal.
2. Seam Sealer: Carpet Manufacturer’s recommended seam sealer or equal.
3. Seam Cleaner: Carpet Manufacturer’s recommended seam cleaner or equal.
4. Finishing accessories color as selected by the Architect and by Johnsonite or equal:
   a. Vinyl reducing strip SSR-92-B (for resilient flooring), color as selected by the architect.
   b. Vinyl adaptor CCA-92 (for ceramic), color as selected by the architect.
   c. Vinyl adaptor CTA-XX-P (for concrete), color as selected by the architect.
5. Provide other materials, not specifically described but required for a complete and proper installation as selected by the Contractor subject to the approval of the City Engineer.
6. Adhesives and Sealants (LEED Credit EQc4.1): Only use adhesives and sealants in the interior of the building that meet or do not exceed the VOC limits of the CURRENT requirements of South Coast Air Quality Management District (SCAQMD) Rule No. 1168 on the interior of the building.
   a. Current requirements refers to the date on which the materials are installed in the building.
   b. Rule No. 1168: Refer to [http://www.aqmd.gov/rules](http://www.aqmd.gov/rules) for the actual current version of the rule that will be applicable at the date of installation during construction.

PART 3 EXECUTION

3.1 INSPECTION OF CONDITIONS

A. The carpet installer, the Contractor and the Inspector shall examine the areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completions of the Work. All detrimental conditions shall be corrected as directed and approved by the City Engineer, before proceeding with Work of this Section. Start of installation operations shall imply Contractor’s acceptance of job conditions.

3.2 PREPARATION

A. All concrete floor surfaces to receive carpeting shall be smooth, dry, and free from oil, grease, or other foreign materials.
1. Contractor shall inspect existing floor before starting Work; all defects, holes, and cracks shall be corrected before proceeding with carpet installation.

2. The floor shall be level and free of irregularities, cracks, and holes to assure constant floor height after carpet is installed.

3. Floor areas to receive the carpeting shall be fully covered with adhesive, as recommended by the adhesive manufacturers or approved equal.

3.3 INSTALLATION - ADHESIVE METHOD

A. Workmanship: Best trade practice, in accordance with the manufacturer's recommendations.

B. General: Carpet tile shall be installed with 1/4 turn method.

C. Reducer Strips: Install and glue down with contact cement at all exposed edges of carpet at doors, adjacent to tile surfaces, Plyboo surfaces and elsewhere indicated on the Contract Drawings.

D. Use of Installed Carpeting: Allow a minimum of 48 hours curing time of adhesive before subjecting carpeting to use - heavy traffic.

3.4 EXCESS CARPET PIECES

A. A minimum of 2% in excess shall be provided in addition to usable pieces of carpeting remaining after completion of installation to remain the property of the City and shall be rolled into bundles, properly marked or identified and stored as directed by the City Engineer.

3.5 CARPET CORRECTION

A. Repair carpeting, repair joints and edges, remove bubbles, after original installation is completed; exact time of this Work as required by the City Engineer, within 12 months after final approval of finished installation.

3.6 PROTECTION

A. Provide a heavy non-staining paper or plastic walkway as required over carpeting in direction of traffic, maintaining intact until the carpet installation is accepted by the City.

3.7 CLEAN-UP

A. Remove all excess materials, equipment, rubbish and debris from the job-site. All spaces used by the Contractor to be left in a clean and safe condition.

B. Thoroughly clean finished carpeting with an upright beater type vacuum, to the satisfaction of the City Engineer.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install fluid applied quartz chip flooring as indicated on the drawings and specified, including the following:

1. Fluid applied epoxy flooring and base with epoxy top coat.
2. Quartz chip aggregate.
3. Base cap edging where used in conjunction with other wall materials.

1.2 QUALIFICATIONS

A. Installer Qualifications: Engage an experienced installer or applicator who has specialized for a minimum of 5 years in installing the specific resinous flooring system required for this Project and who is acceptable to manufacturer of primary materials. Installer must provide a minimum of 3 documented and inspectable installations within 25 mile radius of the subject project at least 5 years old with project names, dates, and owner contacts provided with the submittal.

B. Single-Source Responsibility: Obtain epoxy flooring and wall system materials (including primers, resins, hardening agents, colored aggregates and finish or sealing coats), underlayments, vapor dissipation systems, anti-fracture membranes and waterproof membranes from a single primary manufacturer. Manufacturer shall be EPA-licensed to incorporate the antimicrobial into this system.

1.3 REGULATORY REQUIREMENTS

A. Conform to the California Building Code (CBC) for flooring flame/fuel/smoke ratings in accordance with UL, Standards.

1.4 SUBMITTALS

A. Submit product data under provisions of Section 01330.

B. Submit letter verifying installer qualifications of the installer.

C. Submit product data for base cap.

D. Submit samples approval.

E. Submit two samples 4 x 4 inch in size illustrating color, chip size and variation, and matrix color.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and protect products as recommended by the flooring manufacturer.

B. Store materials in a dry, secure area.
C. Maintain temperature of 55 degrees F.
D. Keep products away from fire or open flame.

1.6 ENVIRONMENTAL REQUIREMENTS
A. Do not install flooring when temperature is below 60 degrees F or above 90 degrees F.
B. Maintain this temperature range, 24 hours before, during, and 72 hours after installation of flooring.
C. Ventilate area where flooring is being installed. Post and enforce NO SMOKING or OPEN FLAME signs until flooring has cured.
D. Provide uniform lighting of 50 fc in area of installation.
E. Restrict traffic from area where flooring is being installed or is curing.

1.7 WARRANTY
A. Warranty: Include coverage for delamination of floor and base materials from substrate, degradation of surface finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS
A. Subject to compliance with specified requirements provide products off one of the following manufacturers (or equal).
   1. General Polymers Corporation, TPM No. 115 Upgraded.
   2. Crossfield Products Corp., Cheminert CF5 K-D.

2.2 PERFORMANCE REQUIREMENTS
A. Conform to the following:

<table>
<thead>
<tr>
<th>Property</th>
<th>Test</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tensile Strength</td>
<td>ASTM C307</td>
<td>2000 psi</td>
</tr>
<tr>
<td>Compressive Strength (7 days)</td>
<td>ASTM D579</td>
<td>10000 psi</td>
</tr>
<tr>
<td>Flexural Strength</td>
<td>ASTM C580</td>
<td>4300 psi</td>
</tr>
<tr>
<td>Flexural Modulus of Elasticity</td>
<td>ASTM D790</td>
<td>2.0 x 10^6 psi</td>
</tr>
<tr>
<td>Hardness</td>
<td>ASTM D2240</td>
<td>85-90 Shore Durometer</td>
</tr>
<tr>
<td>Indentation</td>
<td>MIL-D3134F</td>
<td>No Indentation</td>
</tr>
<tr>
<td>Coefficient of Friction</td>
<td>ASTM D2047</td>
<td>0.7</td>
</tr>
<tr>
<td>Property</td>
<td>Test</td>
<td>Result</td>
</tr>
<tr>
<td>--------------------------------</td>
<td>---------------</td>
<td>------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Heat Deflection Temperature</td>
<td>ASTM D648</td>
<td>100 degrees F/ 38 degrees C</td>
</tr>
<tr>
<td>Water Absorption</td>
<td>ASTM D413</td>
<td>0.10 percent</td>
</tr>
<tr>
<td>Fire Resistance</td>
<td>ASTM D635</td>
<td>Self Extinguishing, Extent of Burning, .25 inches maximum</td>
</tr>
<tr>
<td>Bond Strength</td>
<td>ACI 403</td>
<td>400 psi minimum</td>
</tr>
<tr>
<td>Abrasion Resistance</td>
<td>ASTM D1044</td>
<td>Maximum weight loss of 0.10 gm/1000 cycles</td>
</tr>
</tbody>
</table>

2.3 MATERIALS
A. Primer: A two-component, penetrating, moisture tolerant, epoxy primer.
B. Anti-Fracture Membrane: Semi-rigid epoxy joint reinforcement.
C. Base: A three-component, integral troweled mortar base consisting of epoxy resin, curing agent and finely graded silica aggregate, inch height, as indicated on the drawings.
D. Undercoat: A two-component, thixotropic epoxy undercoat sealer.
E. Aggregate: Brightly colored, quartz aggregate broadcast onto the surface.
F. Topcoat Sealer System: A high performance, two-component, clear epoxy sealer, urethane matte finish, containing #12 glass bead granules applied per approved sample.

2.4 ACCESSORIES
A. Base Caps and Separator Strips: Match divider strips with projecting base of 1/4 inch.

2.5 COLORS
A. Resin and Aggregate: Color as selected by Architect from manufacturers standard color range.

PART 3 EXECUTION

3.1 EXAMINATION
A. Verify that substrate is ready to receive work, and that subfloor surface is clean, dry, and free of substances which could affect bond.
B. Do not begin work until concrete substrate has cured 30 days minimum, and measured moisture content is not greater than 16 percent.
C. Beginning of installation means acceptance of substrate.

3.2 PROTECTION
A. Protect elements surrounding the work of this Section from damage or disfiguration.
3.3 PREPARATION
A. Clean substrate surface free of foreign matter and scrub with manufacturer supplied detergent.

3.4 INSTALLATION - ACCESSORIES
A. Install strips straight and level to locations indicated.
B. Install terminating cap strip at top of base; attach securely to wall substrate.

3.5 INSTALLATION - FLOORING
A. Apply anti-fracture membrane over and at least 2 inches from each side of joint or crack to be bridged.
B. Apply flooring in accordance with manufacturer's instructions.
C. Apply to a minimum thickness of 1/4 inch.
D. Apply sealer coats and non-slip material to a uniform consistency per approved sample.
E. Finish to smooth level surface sloped to drains. Provide cove fillet and cove at vertical surfaces.

3.6 TOLERANCES
A. Maximum Variation from Flat Surface: 1/8 inch in 10 feet.

3.7 PROTECTION
A. Protect finished installation under provisions of Section 01600.
B. Do not permit traffic over finished floor surfaces.

END OF SECTION
SECTION 09778
SOLID PHENOLIC WALL PANELING

PART 1 GENERAL

1.1 SUMMARY
A. Furnish and install solid phenolic wall paneling as indicated on the drawings and specified.

1.2 SUBMITTALS
A. Product Data: Submit product data, including manufacturer’s specifications.
B. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including edge conditions, panel joints, anchorage, accessories, finish colors, patterns and textures.
C. Samples: Submit selection and verification samples for finishes, colors and textures. Submit a small (not less than 12" x 12") wall section, including aluminum reveals and end caps.
D. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
E. Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.
F. Manufacturer’s Instructions: Submit the Manufacturer’s installation instructions.
G. LEED Data: Provide special submittals conforming to Section 01022-Environmental Procedures for the following:
   1. LEED Credit EQ c4.1: Provide adhesive and sealant VOC Emissions Data for the following materials. This information should be available on Material Safety Data Sheet (MSDS) or other product manufacturer’s literature. Provide the product manufacturer’s most current VOC missions data:
      a. Adhesive
   2. LEED Credit EQc4.4: Provide documentation from the manufacturer for each type of composite wood used indicating that panels and cores installed at the project do not contain any ADDED urea-formaldehyde. Products include, but are not limited to the following:
      a. Other composite wood products if used (Plywood, OSB, MDF, Particleboard, Hardboard, Chipboard, Glued Block, Structural composite Lumber, etc.)
   3. LEED Credit MRc04.1: Provide documentation of recycled content (5% post-consumer + 1/2 post industrial).
   4. LEED Credit MRc04.2: Provide documentation of recycled content (10% post consumer + 1/2 post industrial).
H. Closeout Submittals: Submit the following:
1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

2. Warranty: Warranty documents.

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer Qualifications: Manufacturer producing product in ISO 9001 certified facility, capable of providing field service representation during fabrication and approving application method.
   2. Fabricator and Installer Qualifications: The Fabricator and Installer shall be approved by the manufacturer and be experienced in performing work of similar type and scope.

B. Preinstallation Meetings: Conduct preinstallation meeting to verify project requirements, substrate conditions, manufacturer’s installation instructions and manufacturer’s warranty requirements.

1.4 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer’s Warranty: Submit, for Owner’s acceptance, manufacturer’s standard warranty document executed by authorized company official. Manufacturer’s warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

PART 2 PRODUCTS

2.1 SOLID PHENOLIC WALL PANELS

A. Subject to compliance with specified requirements, provide Trespa Virtuon Metallics, or equal.
   1. Material: Solid phenolic wall panel.
   2. Color and Pattern: Submit manufacturer’s standard colors for selection by Architect. Color shall be at least one side, and as selected by the Architect.
   3. Panel Core: Standard black core or Type FR fire retardant black core where fire rating is required.
   4. Panel Thickness: Not less than 5/16 inch (8 mm).

B. Minimum physical attributes shall be as follows:
   1. Modulus of Elasticity: 1,500,000 psi minimum per DIN 53457.
   2. Tensile Strength: 13,000 psi (90 MPa) per DIN 53455.
3. Flexural Strength: 14,500 psi (100 MPa) minimum per DIN 53452.
5. Scratch Resistance: 4 index minimum per EN 438-2 (14).
6. Anti-Static Properties: Anti-static per DIN 51 953 and DIN 53 482.
7. Water Absorption: Less than 1.0% per EN 438-2 (7).

2.2 ACCESSORIES
A. Panel Corner Profile: 3/4" radius.
B. Corner Profile Thicknesses: 5/16 inch and 3/8 inch (8 and 10 mm).
C. Installation Materials: Provide Extruded aluminum reveals and trim, with color matched, corrosion resistant screws. Colors shall be as selected by the Architect.

2.3 FABRICATION
A. Fabricate solid phenolic wall panels and accessory items in accordance with manufacturer’s recommendations and approved submittals.
B. Fabricate panels to profile indicated.

PART 3 EXECUTION
3.1 INSTALLATION
A. Comply with manufacturer’s product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.
B. Install solid phenolic wall panels plumb and level and accurately spaced in accordance with manufacturer’s recommendations and approved submittals.
C. Fasten solid phenolic wall panels to supporting substrate with fasteners and adhesive approved for use with adjoining construction.
D. Accessory Items: Install corner profiles, gaskets and trim [Insert accessory items.] with fasteners and adhesive appropriate for use with adjoining construction as indicated on drawings and as recommended by manufacturer.
E. Cleaning: Remove temporary coverings and protection of adjacent work areas. Repair or replace damaged installed products. Clean installed products in accordance with manufacturer’s instructions prior to Owner’s acceptance. Remove construction debris from project site and legally dispose of debris.

END OF SECTION
PART 1   GENERAL

1.1  SUMMARY

A. Furnish and install high-build fiberglass reinforced glazed coating as indicated on the drawings and specified.

1.2  SUBMITTALS

A. Samples: Submit the following:

1. Material samples, 150 mm (six inches) square, showing the number of coats of each coating material on each substrate to which the material is to be applied. Apply coating to the samples in a setback procedure, leaving exposed a portion of the substrate and subsequent portions of each coat.

2. Color samples, minimum 75 mm (three inches) by 125 mm (five inches) of each color and texture specified.

B. Certificates: Submit the following:

1. Certifying that the coating complies with requirements of this specification, including resistance to abrasion and resistance to perspiration.

2. Certifying that the coating supplied is the same, with manufacturing tolerances, as the coating tested.

C. Manufacturer's Literature and Data: Submit literature and data describing the coating material to be furnished. Printed application for instructions for each substrate.

D. Test Reports: Submit reports of tests certifying compliance with requirement specified.

1.3  ENVIRONMENTAL REQUIREMENTS

A. Apply coatings only when surface and air ambient temperature is above 10°C (50 degrees F) and maintained for a period of not less than 48 hours after applications, except as otherwise required by the coating manufacturer.

PART 2   PRODUCTS

2.1  HIGH-BUILD FIBERGLASS REINFORCED GLAZED COATING

A. Provide Vitrocem as manufactured by Bithell, Inc., or equal. Materials meeting these requirements produced by manufacturers other than those name, may be substituted provided prior Architectural approval is obtained in writing.

B. Coating System: Provide Vitrocem fiberglass reinforced polyester coating system, including the following:

1. Polyester Filler
2. Fiberglass Roving
PART 3  EXECUTION

3.1  PREPARATION OF SURFACES

A.  Patch surfaces as required for receiving glazed coating. Fill masonry block and make surfaces smooth and free of voids and pinholes. Assure surfaces are clean, dry, well cured, sound and free of ridges and depressions.

B.  Wait for new plaster or gypsum wallboard surfaces to cure for not less than 30 days before starting application of the coating system.

C.  Remove or protect items not requiring coating.

3.2  APPLICATION

A.  Apply the glazed coating as recommended by the product manufacturer. Apply materials at not less than the manufacturer's recommended spreading rate.

1.  Apply the first coat of polyester filler by roller at an approximate rate of 100 square feet per gallon.

2.  While the first coat is still wet, apply fiberglass roving by mechanized chopper applicator, to a uniform coverage.

3.  Roll Fibers into the first coat by using a fiberglass roller.

4.  Apply a second coat of polyester filler at an approximate rate of 100 square feet per gallon.

5.  After 8 hours curing, sand entire surface to remove loose fibers.

6.  Apply a coat of polyester enamel at a rate of 200 square feet per gallon.

B.  In rooms or spaces shown or specified to have glazed coating, apply the glazed coating to surfaces behind casework and equipment, except behind those items built into wall recesses.

C.  Make edges of glazed coatings sharp and clean without overlapping adjoining other materials or colors.

3.3  CLEANING AND PROTECTION

A.  During progress of the work and upon completion, promptly clean adjacent surfaces and materials of spills, spatters, drips, and stains from glazed coatings application. Remove glazed coatings by proper methods exercising care to prevent damage to finished surfaces and materials.

B.  Protect work of other trades against damage resulting from glazed coatings work.

C.  Touch up damaged coating surfaces before final acceptance.
END OF SECTION
SECTION 09819
HIGH-BUILD THERMOSETTING POLYESTER GLAZED COATING

PART 1 GENERAL

1.1 SUMMARY
A. Furnish and install high-build thermosetting polyester glazed coating as indicated on the drawings and specified.

1.2 SUBMITTALS
A. Samples: Submit the following:
   1. Material samples, 150 mm (six inches) square, showing the number of coats of each coating material on each substrate to which the material is to be applied. Apply coating to the samples in a setback procedure, leaving exposed a portion of the substrate and subsequent portions of each coat.
   2. Color samples, minimum 75 mm (three inches) by 125 mm (five inches) of each color and texture (Class) specified.
B. Certificates: Submit the following:
   1. Certifying that the coating complies with requirements of this specification, including resistance to abrasion and resistance to perspiration.
   2. Certifying that the coating supplied is the same, with manufacturing tolerances, as the coating tested.
C. Manufacturer’s Literature and Data: Submit literature and data describing the coating material to be furnished. Printed application for instructions for each substrate.
D. Test Reports: Submit reports of tests certifying compliance with requirement specified.

1.3 ENVIRONMENTAL REQUIREMENTS
A. Apply coatings only when surface and air ambient temperature is above 10°C (50 degrees F) and maintained for a period of not less than 48 hours after applications, except as otherwise required by the coating manufacturer.

PART 2 PRODUCTS

2.1 HIGH-BUILD THERMOSETTING POLYESTER GLAZED COATING
A. Provide Vitrocem as manufactured by Bithell, Inc., or equal. Materials meeting these requirements produced by manufacturers other than those named, may be substituted provided prior architectural approval is obtained in writing.
B. Coating System: Provide Vitrocem thermosetting polyester coating system, including the following:
   1. Primer
   2. Polyester base coat
   3. Polyester Enamel
4. Decorative Spotting
5. Clear Glaze

PART 3 - EXECUTION

3.1 PREPARATION OF SURFACES

A. Patch surfaces as required for receiving glazed coating. Fill masonry block and make surfaces smooth and free of voids and pinholes. Assure surfaces are clean, dry, well cured, sound and free of ridges and depressions.

B. Wait for new plaster or gypsum wall board surfaces to cure for not less than 30 days before starting application of the coating system.

C. Remove or protect items not requiring coating.

3.2 APPLICATION

A. Apply the glazed coating as recommended by the product manufacturer. Apply materials at not less than the manufacturer's recommended spreading rate.

1. Apply the first coat of primer by spray and at an approximate rate of 400 square feet per gallon, if necessary (on Gypsum Board and previously painted surfaces).

2. Apply a coat of polyester base coat by roller at a spreading rate of 100 square feet per gallon.

3. After 8 hours curing, sand entire surface to remove defects.

4. Apply a coat of polyester enamel at a rate of 200 square feet per gallon.

5. Apply decorative spotting in two colors using a specially designed spotting gun, available through Vitrocem..

6. Apply a coat of clear glaze at a rate of 200 square feet per gallon.

B. In rooms or spaces shown or specified to have glazed coating, apply the glazed coating to surfaces behind casework and equipment, except behind those items built into wall recesses.

C. Make edges of glazed coatings sharp and clean without overlapping adjoining other materials or colors.

3.3 CLEANING AND PROTECTION

A. During progress of the work and upon completion, promptly clean adjacent surfaces and materials of spills, spatters, drips, and stains from glazed coatings application. Remove glazed coatings by proper methods exercising care to prevent damage to finished surfaces and materials.

B. Protect work of other trades against damage resulting from glazed coatings work.

C. Touch up damaged coating surfaces before final acceptance.

END OF SECTION
SECTION 09841
CO-POLYMER FACED ACOUSTICAL PANELS

PART 1   GENERAL

1.1 SUMMARY
   A. Furnish and install co-polymer faced acoustical panels as indicated on the drawings and specified.

1.2 SUBMITTALS
   A. Product Data: Submit technical specifications, catalogs ad other descriptive data.
   B. Shop Drawings: Submit fabrication and installation details for acoustical panels, including plans, elevations, sections, details, and attachments to other Work. Include installation instructions.
   C. Samples for Initial Selection: Submit the manufacturer's color charts showing the full range of colors, textures, and patterns available for facing materials for each type of acoustical panel indicated. Include samples of installation devices and accessories.
   D. Product Certificates: Submit affidavits signed by manufacturers of acoustical panels certifying that products furnished comply with requirements.
   E. Product Test Reports: Submit reports from a qualified testing agency indicating acoustical panels comply with requirements, based on comprehensive testing of current products.

1.3 QUALITY ASSURANCE
   A. Fire-Test-Response Characteristics: Provide acoustical panels with the following surface-burning characteristics as determined by testing identical products per ASTM E 84 by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify acoustical panels with appropriate markings of applicable testing and inspecting agency.
      1. Flame Spread: 25 or less.
      2. Smoke Developed: 450 or less.
   B. Mockups: Before installing acoustical panels, build mockups for each form of construction and finish required to verify selections made under sample Submittals and to demonstrate aesthetic effects and qualities of materials and execution. Build mockups to comply with the following requirements, using materials indicated for the completed Work:
      1. Build mockups in the location and of the size indicated or, if not indicated, as directed by Architect.
      2. Notify Architect seven days in advance of dates and times when mockups will be constructed.
      3. Demonstrate the proposed range of aesthetic effects and workmanship.
      4. Obtain Architect's approval of mockups before starting acoustical panel fabrication.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.

6. Demolish and remove mockups when directed.

7. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect acoustical panels from excessive moisture when shipping, storing, and handling. Deliver in unopened bundles and store in a dry place with adequate air circulation. Do not deliver material to building until wet-work, such as concrete and plaster, has been completed and cured to a condition of equilibrium. Protect panel edges from crushing and impact.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not install acoustical panels until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Air-Quality Limitations: Protect acoustical panels from exposure to airborne odors, such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.

C. Field Measurements: Verify dimensions by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 PRODUCTS

2.1 CO-POLYMER FACED ACOUSTICAL PANELS

A. Products: Subject to compliance with specified requirements, provide “Sportsboard Conform Panels” by Kinetics Noise Control, or equal. Panels shall have the following attributes.

1. Thickness: 1 1/16 inches (27 mm)

2. Size: As indicated on the drawings up to a maximum 42 inch (1067 mm) x 112 inch (2845 mm) panel.

3. Core: 1 inch (25.4 mm) thick, 5-7 pcf (80-112 kg/m^3) density fiberglass.

4. Edge Detail: Square

5. Formed Copolymer Facing and Edges: 1/16 inch (1.6 mm) thick copolymer perforated with 3/32 inch (2.4 mm) holes on 5/32 inch (4 mm) staggered centers.

   a. Color: As selected from panel manufacturer’s range of standard colors.


7. Mounting Accessories: Manufacturer’s standard HS Metal impaling clips, and adhesive.
8. Install with minimum 1/8 inch (3.2 mm) reveal to allow for expansion and contraction of copolymer.

B. Fabricate panels to sizes and configurations indicated; adhering facing materials to cores to produce installed panels with visible surfaces fully covered and free from waves in fabric weave, wrinkles, sags, blisters, seams, adhesive, or other foreign matter.

   1. Treat fabric wrapped panels using heat shrink process to develop fully taut facing.
   2. Wrap panel edges and return facing fabric 1 inch (25.4 mm) on back of panel. Secure fabric with adhesive applied to edges and back of panel only (Design Series 90).
   3. Hardside and High Impact Hardside Panels: Wrap panel edges and return facing fabric 1-2 inches (25.4-51 mm) on back of panel. Secure fabric with adhesive applied to edges and back of panel only.
   4. Continuously solvent weld panel corners.
   5. Wrap panel edges and return facing fabric 1-2 inches (25.4-51 mm) on back of panel. Secure fabric with adhesive applied to edges and back of panel only (Sportsboard Elite Panels).

PART 3 EXECUTION

3.1 INSTALLATION

   A. Examine substrates and blocking, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting acoustical panel performance. Proceed with installation only after unsatisfactory conditions have been corrected.

   B. Install acoustical panels in locations indicated with vertical surfaces and edges plumb, top edges level and in alignment with other panels, and scribed to fit adjoining work accurately at borders and at penetrations. Comply with panel manufacturer's written instructions for installation of panels using type of mounting accessories indicated or, if not indicated, as recommended by manufacturer.

   C. Construction Tolerances: As follows:

      1. Variation from Plumb and Level: Plus or minus 1/16 inch (1.6 mm).
      2. Variation of Joints from Hairline: Not more than 1/16 inch (1.6 mm).

   D. Clean panels with co-polymer facing, on completion of installation, to remove dust and other foreign materials according to manufacturer's written instructions.

   E. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure acoustical panels are without damage or deterioration at time of Substantial Completion.

    END OF SECTION
PART 1   GENERAL

1.1   DESCRIPTION

A. Provide all labor, materials, equipment and services to apply anti-graffiti coatings on interior and/or exterior wall surfaces and elsewhere where noted or indicated on the Contract Drawings, as specified hereinafter and as needed for a complete and proper installation.

1.2. RELATED WORK

A. Painting in Section 09900.

1.3   SUBMITTALS

A. Comply with applicable provisions of SECTION 01330 of DIVISION 1 - GENERAL REQUIREMENTS of these Specifications.

B. Product Data: Within 40 calendar days after the Contractor has received the City’s “Notice to Proceed” submit the following:

1. Materials list of items proposed to be provided under this Section.

2. Manufacturer’s specifications and other data needed to prove compliance with the specified requirements.

3. Manufacturer’s recommended installation procedures which, when approved by the City Engineer will become the basis for accepting or rejecting actual installation procedures used on the Work.

C. Pre-Warranty Application Form: Applicat or shall submit to the City Engineer a pre-warranty application form to verify amounts of materials to be used.

D. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:

1. LEED Credit EEq4.2: Provide paint VOC Emissions Data for the following materials. This information should be available on Material Safety Data Sheets (MSDS) or other product manufacturer’s literature. Provide the product manufacturer’s most current VOC emissions data:

   a. Anti-Graffiti Coating:

1.4   QUALITY ASSURANCE

A. Labor: Use adequate numbers of skilled craft persons who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.
B. Coordination with manufacturer: Contractor shall contact the manufacturer prior to bidding the Work so as to become familiarized with current costs, application procedures and notification requirements.

C. Job report: Applicator shall complete and file a "Job Report" with manufacturer certifying conformance of application procedures and quantities to the manufacturer's requirements.

D. Material and application shall comply with Rule 66, Los Angeles County Air Pollution Control District and Rule 1113 of the South Coast Air Quality Management District.

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Comply with pertinent provisions of Section 01640 - PRODUCT HANDLING of DIVISION 1 - GENERAL REQUIREMENTS of these Specifications.

B. Delivery: Deliver materials to the job-site in unopened suitable packaging properly identified with the manufacturer's labels indicating manufacturer's name, product name and model number.

C. Storage: Store materials in a suitable location where directed by the City Engineer in original unopened containers in compliance with manufacturer's printed instructions. Store in a location under cover, safe from weather and damage by construction operations.

D. Protection: Use all reasonable means necessary to protect materials before, during and after installation. In the event of damage to specified items, immediately make necessary repairs and/or replacements to the full approval of the City Engineer, at no added cost to the City.

E. Inspect: Inspect for approval before containers are opened and any condemned materials to be removed from the job-site.

1.6 GENERAL REQUIREMENTS

A. Warranty: Comply with provisions of the GENERAL CONDITIONS of these Specifications which shall include a 12-month warranty period which covers parts and labor; effective date of the warranty being the date of acceptance by the City.

B. Guarantee: The Contractor shall also furnish the City with a written guarantee, which guarantees that during a period of two (2) years from the date of acceptance by the City the coating will not turn white, peel, chip or crack. The Contractor will without additional cost to the City, promptly make any repairs required as a result of ordinary wear and tear of the elements, and further guaranties that any defective material or Work shall be properly repaired or replaced without additional cost to the City.

C. Extra Stock of Materials: Upon completion of anti-graffiti coating application at the job-site provide the City Engineer with manufacturer's or retailers credit for 5 gallons of the anti-graffiti coating and 5 gallons of remover used on the project. Credit to be locally redeemable for a period of five years.

PART 2 PRODUCTS

2.1 ACCEPTABLE MATERIALS
A. Materials shall be the products of one manufacturer and be either the ones upon which the design is based on the products of the manufacturer approved in advance by the City Engineer in accordance with applicable conditions in the GENERAL CONDITIONS.

B. Material shall be the appropriate type as recommended by the manufacturers (hereinafter named) or provide an equal product of another manufacturer approved in advance by the City Engineer.

C. Material must be approved for use in the City of Los Angeles Department of Building and Safety and must have a Research Report Number as issued by the City of Los Angeles.

2.2 ACCEPTABLE PRODUCTS

A. Subject to compliance with specified requirements, anti-graffiti coatings shall be one of the following products, "Or Equal:"

1. Genesis Coatings – Graffiti Melt – Anti-Graffiti Coating - 25042
2. Rainguard Products Co – Vandl-Guard Anti-Graffiti Coating - 25060
3. Prosoco – Anti-Graffiti Coating System - 25079
4. Monopole – Monochem Perma Shield Anit-Graffiti Coating - 25080

2.3 MATERIAL PERFORMANCE CRITERIA

A. Completed graffiti protection shall include the following performance criteria:

1. Shall have a flat non-glossy appearance.
2. Shall be non-yellowing and contain no waxes, urethane or other yellowing resins.
3. Shall cause little or no change in the appearance of the treated surface.
4. Shall allow moisture vapor transmission.
5. Can be cleaned a minimum of five times.
6. Shall be renewable and repairable.
7. Be 98% effective in removing all graffiti on masonry surfaces.
8. Dirt pickup shall not be increased by coating.
9. Manufacturer will warrant product performance.
10. Product shall be VOC compliant.
11. Conform to all State and City waste disposal regulations including but not limited to those involving proposition 65.
12. Product shall be capable by manufacturer's literature of withstanding 5 years exterior exposure without significant loss of protection, other than spot restoration of areas attacked by graffiti, cleaned, and re-coated per written instructions of manufacturer.
13. Anti-graffiti treatment must be resistant to rain, weather, abrasion, peel, ultra-violet, and be clear and non-yellowing.
14. Anti-graffiti treatment should be able to withstand repeated removal of all types of paint and other graffiti materials with little or no defacement of or change to the original surface.

B. Any submitted product must be applied to sample area and have the test listed under "C" below performed.

C. After application of materials, a field demonstration or test will be performed to the satisfaction of City Engineer which will include:
   1. Spray paint applied to material to simulate graffiti attack.
   2. Attack allowed to stand 14 days before removal.
   3. Removal by manufacturer’s recommended process shall determine that at least 98% of the graffiti has been removed.

D. Anti-Graffiti Locations:
   1. Full height of all exterior exposed ground level plaster walls and CMU walls. Include monument signs, seating benches, trash containers, ash urns, etc.
   2. On all exterior steel doors and frames.
   3. On all exterior wall mounted plaques and signs.

E. Paint and Primer Maximum Product Emissions Limits (LEED Credit EQc4.2): Top coat interior paints must meet or not exceed VOC (Volatile Organic Compounds) limits of the current requirements of Green Seal Standards GS-11 – Paints in the building. Top coats must contain none of the restricted chemicals, and no more by weight of the limited chemicals, indicated in the current requirements of Green Seal Standards GS-11 – Paints. GS-11 VOC limits for interior paints are as follows. Interior refers to all building construction that is inside of the exterior weatherproofing materials:
   1. Interior, Non-flats: 150 grams per liter of product minus water
   2. Interior, Flats: 50 grams per liter of product minus water
   3. Restricted and/or Limited Chemicals listed in GS-11 must not be used.

2.4 EQUIPMENT
   A. All clear materials shall be applied by airless spray equipment. Tip size .015 -.021

PART 3 EXECUTION

3.1 INSPECTION OF CONDITIONS
   A. Examine the areas and conditions on which materials of this Section will be applied. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed with contracted Work of this Section until such detrimental conditions are corrected. All detrimental conditions shall be corrected as directed and approved by the City Engineer, before proceeding with Work of this Section. Start of installation operations shall imply Contractor’s acceptance of job conditions.

3.2 ENVIRONMENTAL CONDITIONS
A. Do not proceed with application of anti-graffiti materials when the ambient temperature is less than 45 degrees F., when low temperature of 40 degrees F. or less is predicted within a period of 24 hours, or if rain is expected in the next 24 hours.

B. Do not apply materials in rainy conditions or within 5 days after surfaces have become wet from rainfall or other moisture.

3.3 MANUFACTURER’S INSPECTION

A. Applicator shall notify manufacturer's representative a minimum of 72 hours prior to scheduled application for field inspection.

3.4 APPLICATION

A. Preparation of Surface (As applicable):

1. Do not commence application until surface is structurally sound, clean, dry, and free from excess dust, loose paint, greasy stains and efflorescence.

2. Form oils should be completely removed.

3. All cracks, voids, beeholes or mortar shrinkage shall be properly repaired and primed if necessary to make the surface uniform.

4. Allow substrate to dry and age at least 3 weeks before applications of anti-graffiti coating.

5. Porous concrete block should be sealed with approved "Rainproof Acryseal WD" or approved equal a minimum of 48 hours before application of anti-graffiti coating material.

6. If using "Graffitibase" material over a previously paint coated surface apply a small amount in an inconspicuous place to check for lifting.

7. Remove existing graffiti with graffiti remover or approval equal.

8. Applicator/Contractor to use the application tools and methods as recommended by the coating manufacturer and approved by the City Engineer.

9. Applicator/Contractor is responsible for daily application of a small test area on surface to be coated before starting daily general application to assure desired results, especially if there have been temperature changes during application.

B. Application of Anti-Graffiti Coating

1. Coverage: Apply materials at rate per square foot recommended by the material manufacturer.

2. Application Sequence: Apply two coats of the material base coat followed by one coat of top coat in compliance with manufacturer's specifications and recommendations. A minimum drying time of two hours should be allowed between the first and second coats of base coat. A minimum drying time of 4 hours should be allowed between the base coat and the top coat.
3. Anti-graffiti coating process should achieve a non-yellowing, durable, clear film completely protecting the substrate from penetration of paint, ink, crayons, dirt, air pollutants, grime and similar materials and help maintain and protect the original appearance of the surface.

4. Base coat material should be applied with a "crosshatch" method of several horizontal passes followed immediately by vertical passes to build up a heavy wet film to insure sufficient uniformity. This is considered one coat and the same method is repeated for the second coat to build a minimum dry film thickness of 3 mils. Spray large areas in sections so overlap occurs before previously coated areas have dried. Start application at top of wall and work down surface. Schedule Work so that the stopping point each day falls at an opening, column or corner.

5. Top coat should be applied with a "crosshatch" method of several horizontal passes followed immediately by vertical passes to build up a film to insure sufficient uniformity. This is considered one coat.

C. Protection: Applicator shall be responsible for protection of this and all adjacent Work from damage during application with dropcloths or other suitable materials.

D. Repairs: Any soiling of the Work of this Section shall be repaired by the installer of the anti-graffiti material as approved by the City Engineer at no added cost to the City.

E. Contractor shall carefully remove all protection materials from adjacent surfaces and any residue resulting from this operation. Completely remove overspray and spills as soon as possible before curing and excess materials from the job-site.

F. Remove all excess materials, equipment, rubbish and debris from the job-site. All areas in the library structure used by the Contractor to be left in a clean and safe condition.

END OF SECTION
PART 1   GENERAL

1.1    SCOPE

A.   Furnish and install painting as indicated on the drawings and specified, including:

1.    Performance and completion of painting and decorating, interior and exterior, less items of painting hereinafter specified as being excluded.

1.2    RELATED WORK SPECIFIED ELSEWHERE

A.   Shop prime coats:  The following products shall be primer painted at the place of fabrication

1.    Structural steel and miscellaneous metalwork.

2.    Ferrous (ungalvanized) and galvanized sheet metals.

3.    Shop coat on machinery and equipment:  Refer to the sections under which various items of manufactured equipment with factory-applied shop prime coat are finished.  All items of equipment furnished with prime coat finish shall be finish painted under this Section, unless specified otherwise.

B.   Color coding of mechanical piping:  Color coding is in addition to painting of piping which may be required under this Section.

1.3    MATERIALS AND EQUIPMENT NOT TO BE PAINTED

A.   Unless scheduled, specified, or required by the drawings to be painted, the following items do not require painting.  These surfaces shall be left completely clean and free from droppings and accidentally applied material.

1.    Non-ferrous metals, chrome plated metal, and stainless steel.

2.    Finish Hardware.

3.    Ceramic tile.

4.    Floor finish materials.

5.    Acoustic tile.

6.    Equipment furnished with complete factory-applied finish, (except A.C. units) unless specifically noted on the drawings or specified herein to be painted.

1.4    SUBMITTALS

A.   Prior to start of painting, submit three copies of a complete list of all materials, identified by manufacturer's name and product label or stock number, to the Architect for approval.  This list shall be in the form of a repetition of the paint finishes specified, with the addition of the specific product intended for each coat.
B. Two copies bearing Architect's approval and corrections will be returned to the Contractor, one copy of which shall be on file in the Contractor's construction office on the job prior to start of painting work.

C. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:

1. LEED Credit EQc4.2: Provide paint VOC Emissions Data for the following materials. This information should be available on Material Safety Data Sheets (MSDS) or other product manufacturer's literature. Provide the product manufacturer's most current VOC emissions data:
   a. Paints: Interior, Flats (for each product used)
   b. Paints: Interior, Non-Flats (for each product used)

1.5 CERTIFICATION

A. Each shipment of painting materials delivered to the site shall be accompanied by duplicate copies of an affidavit from the manufacturer certifying that each classification or type of material furnished complies with specification requirements.

B. Deliver one copy of affidavit to the Contractor and one copy to the Architect.

1.6 CODE AND SAMPLES

A. Colors shall be as selected by Architect.

B. Prepare and submit to the Architect, four 8-1/2" x 11" samples shall be on the same materials that are used for this project. Upon approval, two samples will be returned to the Contractor. Where transparent or stained finishes are used, these samples shall be prepared on species and quality of wood that will be installed on the project, and indicating system used.

C. The Contractor shall prepare a finish painted sample wall area for the Architect's approval. Do not proceed with the work until an approval has been received from the Architect.

PART 2 PRODUCTS

2.1 MATERIALS

A. Thinners, vehicles, pigments, and other incidental materials intended to be combined with or used with factory-mixed products shall be of the types and kinds recommended by the paint manufacturer for the intended purpose. Include listing of such materials in the material list required hereinafter.

B. Deliver materials to the job in unopened containers bearing manufacturer's name and product designation corresponding to designation on material list.

C. Insofar as practicable, each kind of coating for the various types of paint finish shall be factory-mixed to match approved samples and colors, and of consistencies ready for immediate application.
D. Paint and Primer Maximum Product Emissions Limits (LEED Credit EQc4.2): Top coat interior paints must meet or not exceed VOC (Volatile Organic Compounds) limits of the current requirements of Green Seal Standards GS-11 – Paints in the building. Top coats must contain none of the restricted chemicals, and no more by weight of the limited chemicals, indicated in the current requirements of Green Seal Standards GS-11 – Paints. GS-11 VOC limits for interior paints are as follows. Interior refers to all building construction that is inside of the exterior weatherproofing materials:

1. Interior, Non-flats: 150 grams per liter of product minus water
2. Interior, Flats: 50 grams per liter of product minus water
3. Restricted and/or Limited Chemicals listed in GS-11 must not be used.

PART 3 EXECUTION

3.1 ACCEPTANCE OF SURFACE

A. Inspect surfaces to be treated to effectively safeguard work of others and to preserve painted work free from damage of every nature.

B. All surfaces which are found to be unsuitable for application of paint finish, shall be properly prepared before painting is started. Application of the first coat of paint shall be construed as acceptance of the surface as satisfactory for application of painter’s finish.

C. Report unsatisfactory conditions disclosed by inspections in writing for correction. Do not proceed with the work until such unsatisfactory conditions have been properly corrected.

3.2 COATS AND INSPECTION

A. The number of coats specified is minimum that shall be applied. It is intended that paint finishes of even, uniform color, free from cloudy or mottled surfaces, be provided. The work shall be “spot-coated” or undercoated as necessary.

B. Each coat shall be of a proper ground color to receive a succeeding coat, and wherever practicable, shall differ in color tint. Each coat shall be approved by the Architect before the next coat is applied; otherwise an extra coat will be required over the entire surface involved, except where otherwise directed.

3.3 MISCELLANEOUS REQUIREMENTS

A. Store and mix paint materials in places as directed. Portions of the building used for paint storage and mixing shall be suitably safeguarded against stains, damage and defects. Take adequate precautions against fire hazard.

B. Mixing and thinning of prepared paints: In accordance with recommendations of manufacturer whose material is being altered, where necessary to produce satisfactory results.

C. Painting materials required for use on the project shall conform in all respects, with applicable air pollution control regulations.

3.4 PROTECTION

A. Provide drop cloths, barricades, or other forms of protection necessary to safeguard work of others, and as required to preserve painted work free from damages of every nature.
1. Post signs immediately following application of paint. Exercise proper care to completely protect fixtures, and cabinets that will be installed before painting operations are complete.

2. Cover well with drop cloths and do not use fixtures or finished building construction of any type for scaffolding or support of scaffolding.

B. In the event finish materials which require no painting should be accidentally splashed with paint or otherwise disfigured by unauthorized application of paint, and if the paint cannot be removed without damage to the material involved, then these materials shall be removed and replaced with new materials, and all costs incidental thereto shall be paid by the Contractor. Cleaning and removal of unauthorized paint or other such materials shall be accomplished with materials and procedures which are non-injurious to the surface, all as approved by the Architect.

C. After completion and acceptance of the painter's work in any area, the Contractor shall be responsible for provision and maintenance of such forms of protection that may be required to protect finished work from damage from any cause prior to acceptance of the job by the Owner. Schedule the work, and exclude traffic and unauthorized personnel from finished areas, to the extent necessary to prevent damage.

3.5 SURFACE PREPARATION

A. Properly prepare all surfaces to receive the finishes herein specified or designated in the Schedule of Finishes. In general, all such work of preparation shall be as follows:

B. Finish woodwork: Additional sanding required for first class finishes shall be done under this Section. Open joints, cracks, nail holes, etc., shall be filled flush and smooth using plastic wood or putty as best adapted to the condition. Knots and permissible pitch pockets shall be shellacked or otherwise suitably sealed prior to further application of material thereon. Woodwork scheduled for transparent finish shall be free of all surface defects.

1. Stain: Woodwork indicated to receive a stain and varnish finish shall be stained to an even color with water borne stain. On open-grained hardwood, mix stain with paste filler and completely fill pores in wood.

C. Galvanized metalwork: When installed without shop prime coat and required to be painted, thoroughly clean with commercial phosphoric acid solution, or other prepared product recommended by the paint manufacturer for pre-treatment for application of galvanized metal primer. Galvanized metal primer shall be recoated with the next coat within the period specified by the manufacturer of the primer.

D. Shop-coated metal work: Thoroughly clean off oil, grease, dirt and foreign matter. Field conditions, welds, soldered joints, and burned and abraded portions shall be spot-coated with the same material used in the shop coats and permitted to thoroughly set and harden. Sand surfaces for coat to follow.

E. Uncoated ferrous metal work: Clean metal surfaces not provided with a shop prime coat by others, of rust, mill scale, oil, grease encrustations, and foreign matter, using rotary brushes, solvents, or sandblasting, as necessary, and leave ready for coat to follow. Pits shall be cleaned down to bright metal.

F. Gypsum board drywall surfaces: Taped and cemented joints shall have been finished smooth and flush and left ready for application of painted finish by the Drywall Contractor.
Any unsatisfactory conditions, such as raised or depressed surfaces, or scuffed paper finish, shall be corrected.

G. Concrete (interior) surfaces: Clean surfaces of dirt, laitance, excess mortar, encrustations and foreign matter. Cracks, holes, pits and other imperfection shall be neatly patched flush and smooth, and the entire surface chemically treated as required to counteract lime and alkali burns, and hot spots

1. Switch and outlet boxes: See that the wall is properly finished around boxes before start of painting so that joint will be properly covered by standard size switch plates.

3.6 SANDING

A. In addition to preparatory sanding, each coat, except the last, shall be sanded unless otherwise specified, using sandpaper appropriate to the finish required. Avoid scratches and swirls.

3.7 SPECULAR REFLECTANCE

A. Reflectance of paint: Determine the degree of gloss or flatness in painting materials by specular reflectance or gloss meter reading on a scale of 100 using "Method of Test of Specular Gloss," ASTM D523, within the following ranges:

<table>
<thead>
<tr>
<th>Finish</th>
<th>Gloss</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloss</td>
<td>75 - 90</td>
</tr>
<tr>
<td>Semi-Gloss</td>
<td>45 - 75</td>
</tr>
<tr>
<td>Eggshell</td>
<td>15 - 45</td>
</tr>
<tr>
<td>Low Luster</td>
<td>6 - 15</td>
</tr>
<tr>
<td>Flat</td>
<td>1 - 6</td>
</tr>
</tbody>
</table>

3.8 PAINTING OF PIPES, DUCTS AND CONDUITS

A. Exposed pipes, ducts and conduits, with their hangers, supports, fittings shall be provided with a paint finish, except where otherwise specified. In rooms in which the walls and ceilings are scheduled to be painted, all exposed piping, ductwork and miscellaneous metal work shall be painted to match. Exposed machinery, equipment, pipes, conduits and ducts shall receive industrial enamel finish, including work in equipment rooms. Bare pipe lines, ducts carrying temperatures in excess of 175 F, shall receive "Bitumastic," high heat finish. Covered pipe prime coat shall be a coat of "size" substituted for the prime coat described for exposed pipe finish.

1. Exposed metal surfaces of electric fixtures, panel boards, switch cabinets, registers and access panels shall have finish same as for exposed conduits, except where installed flush in painted surfaces, or against painted surfaces, finish to match.

B. Paint frames of all recessed lighting fixtures, cabinets, and panels to match adjacent surfaces. Where such frames are installed on unpainted surfaces, and supplied with prime coat finish, they shall be painted as specified or directed.

C. Exposed piping, conduits, pipe racks, supports and hangers occurring in rooms in which the walls and ceilings are not painted, shall be painted as for other exposed piping.
3.9 DUCT THROATS

A. Behind registers, grilles and louvers, duct throat shall be cleaned of all foreign materials and given one coat of metal primer and one coat of flat black oil or alkyd paint.

B. Extend paint finish back into the duct far enough so that no bare metal will be exposed from any normal viewing position.

3.10 REGISTERS, GRILLES AND DIFFUSERS

A. Registers, grilles and diffusers shall be painted to match the surface in which they occur.

B. If furnished with complete factory finish, the finish shall be properly prepared to receive additional coats and repainted to obtain proper color, unless directed otherwise by the Architect. If furnished in anodized aluminum they need not be painted.

3.11 FINISH HARDWARE

A. Finish hardware, except prime coat butts, shall be properly fitted to the doors and frames, and then removed for finish painting, after the completion of which it shall be reinstalled.

B. Prime coated butts shall be painted to match adjacent surfaces. All plated and non-ferrous hardware shall be clean and completely free of paint upon completion.

3.12 WORKMANSHIP

A. All work shall be executed by skilled workers, experienced in their trade, under constant supervision by well qualified foremen. All work to be of the highest standards and methods.

B. Mix paint thoroughly and break up with paddles to smooth, uniform and good brushing consistency, and use strictly in accordance with the manufacturer's directions.

C. Keep all brush washes outside paint storeroom and remove all brush washes from the job site daily. After sealers are applied, make sure that all suction, hot or burned spots, are resealed to assure correct finish coats.

D. All work shall be done under favorable weather conditions, or conditions suitable for the production of first-class work.

E. No exterior or interior painting shall be done until the surface is thoroughly dry and cured. Exterior painting shall not be done in rainy or windy weather.

F. Enamels, varnishes and sanding sealers shall be sanded lightly and dusted clean between coats to produce an even, smooth finish.

3.13 TOUCH-UP WORK

A detailed inspection of paint work shall be made, and abraded, stained or otherwise disfigured portions shall be satisfactorily touched-up or refinished to produce a first-class workmanlike and acceptable job.
3.14  CLEANING

A. After painting work has been completed, make a detailed inspection of paint finish and carefully remove spatterings of paint material from adjoining work particularly from glass, plumbing fixtures, tile and trim.

B. Repair damages that may be caused by such cleaning operations. All implements of service shall be removed from the premises and the entire project left in a condition acceptable to the Architect.

3.15  PAINT FINISHES

A. The required finishes shall be applied to the surfaces specified and/or as scheduled on the finish and paint schedules on the drawings. All materials shall be applied in compliance with manufacturer's instructions on properly prepared surfaces and foundation coats. Unless otherwise specified, all products are from the catalog of ICI Dulux Paint Company, Vista Paint Compond Ameritone, Frazee, Dutch Boy, Pittsburgh, Sherwin Williams, and Dunn Edwards, all subject to approval by the Architect.

B. Interior:

1. Gypsum Board: 3 coats.
   First: Drywall sealer.
   Second and Third: Interior enamel, semi-gloss or as indicated.

2. Concrete: 3 coats.
   First: Concrete sealer.
   Second and Third: Interior enamel, semi-gloss or as indicated.

3. Metal: Shall be cleaned, pre-treated and painted with 3 coats. Items to be painted include but are not limited to: exposed structural and miscellaneous steel, stairs, ladders, railings and handrailings.
   First: Metal primer.
   Second and Third: Interior gloss enamel, or as otherwise directed by the Architect.

   First: As specified under Priming.
   Second, Third and Fourth: Varnish, semi-gloss.

5. Wood doors: 4 coats.
   First: As specified under Priming.
   Second, Third, and Fourth: Varnish, gloss.

6. Other Wood: 3 coats.
a. Varnished or painted as indicated.

b. If varnished, same finish system as painted woodwork, with semi-gloss or gloss finish to match adjacent wall.

C. Exterior:

1. Concrete: 3 coats.
   
   First: Concrete sealer.
   
   Second and Third: Exterior 100% acrylic.

2. Metal: Shall be cleaned, pre-treated and painted with 3 coats.
   
   Items to be painted include, but are not limited to, steel columns and miscellaneous steel items, gravel stops, metal doors and frames, hoods and flashings.
   
   First: As specified under Priming.
   
   Second and Third: Exterior house and trim enamel.

D. Mechanical and Electrical Work:

1. Except where interior mechanical and electrical work to be painted is specified to received another paint finish, work occurring in finished rooms and spaces shall be cleaned, pre-treated and painted with 3 coats. Items to be painted include, but are not limited to: steel and copper piping, pipes, vents, fittings, ducts, plenums, miscellaneous supports and hangers, electrical conduit, fittings, pull boxes, outlet boxes, unfinished surfaces of plumbing fixtures, miscellaneous metal cabinets, panels and access doors and panels.
   
   First: Priming.
   
   Second and Third: Interior enamel, semi-gloss or gloss to match adjacent wall or ceiling finish.

   
   a. Finished Rooms:
      
      First: Interior water borne primer.
      
      Second and Third: Interior semi-gloss or gloss enamel to match adjoining wall or ceiling finish.

   b. On Building Exterior:
      
      First Exterior water borne primer.
      
      Second and Third: Exterior gloss enamel.

3. Inside surfaces of ducts, vents, dampers and louvers as far back as visible from room in which they open shall be painted with 2 coats of flat black paint.
4. Lettering: Where lettering and signs are indicated to be painted, lettering shall be done by an experienced sign painter. Unless otherwise indicated, characters shall be 4" high, 3/4" wide stroke, black.

E. Battery Room Painting: Apply a 3-coat acid resistant epoxy based system the as manufactured by Ameron, Tnemec, PPG, or equal. The primer, intermediate coat, and top coat shall have a dry film thickness of not less than 6 mils (plus or minus 1 mil). Submit technical data for approval.

END OF SECTION
SECTION 09901
CONCRETE STAINING

PART 1   GENERAL

1.1   SUMMARY
A. Furnish and apply concrete staining as indicated on the drawings and specified.
   1. Apply stain and sealer at colored concrete.

1.2   SUBMITTALS
A. Product Data: Manufacturer's catalog data shall be submitted for the stain material. Manufacturer's Instructions shall be submitted for the stain, including details of thinning, mixing, handling, and application.
B. Samples: The manufacturer's color charts shall be submitted showing manufacturer's color, matching the Architect's sample.

1.3   DELIVERY AND HANDLING
A. Materials shall be delivered in their original, unbroken containers bearing the manufacturer's name and product identification. Containers breached by rough handling shall be removed from the site, together with their contents.

PART 2   PRODUCTS

2.1   CONCRETE STAINING
A. Subject to approval of the color sample, and compliance with other specified requirements, the concrete stain shall be Lithochrome Chemstain Classic by L. M. Scofield, or equal. Color as selected by the Architect.
   1. Provide sealer L.M. Scofield Colorwax on exterior surfaces and Colorcure on interior surfaces.

PART 3   EXECUTION

3.1   APPLICATION
A. The manufacturer's recommendations for surface preparation, and applying the stain product shall be considered a part of this specification. At
   1. Apply concrete sealer on stained concrete
B. Cleanup: The Contractor shall be responsible for removal of stain from adjacent surfaces. Contractor shall leave the work area clean and free from rubbish and accumulated material left from his work.
END OF SECTION
PART 1 GENERAL

1.1 SUMMARY
A. Furnish and apply clear concrete floor sealer as indicated on the drawings and specified.
   1. Apply clear sealer at natural grey colored concrete.

1.2 SUBMITTALS
A. Submit under provisions of Section 01330.
B. Product Data
   1. Indicate manufacturer, product, and conformance with specified requirements.
   2. Include complete range of manufacturer's standard colors for color selection.
C. Manufacturer's application instructions.

PART 2 PRODUCTS

2.1 MATERIALS
A. Sealer: Provide Chemtone Clear Sealer by L.M. Scofield, or an "or equal” product of one of the following: W.R. Meadows Inc., Harris Specialty Chemicals Inc., or ChemRex Inc., VOC compliant, clear, low viscosity, acrylic sealer for protection of concrete floors.
   1. The sealer shall be the manufacturer's best product that is recommended for use where the floor will be subject to deterioration due to grease, oil or other chemical spillage. The sealer shall provide long lasting protection.
B. Accessory Materials: Fillers, thinners, and other materials of type recommended by sealer manufacturer for intended application.
C. Fire Hazard Classification: Class A in accordance with ASTM E84.

PART 3 EXECUTION

3.1 APPLICATION
A. Mix and apply sealer in accordance with manufacturer's instructions, using brush, roller, or spray.
B. Apply at coverage rate recommended by manufacturer.
C. Edges abutting other materials shall be sharp and clean without overlapping.
D. Finish surfaces shall be uniform in clear finish.
END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install markerboard and tackboard assemblies as indicated on the drawings and specified including the following types:

1. Modular system with adjustable standards that accommodate both markerboards and tackboards.

2. Floor to ceiling fixed markerboards and tackboards.

1.2 SUBMITTALS

A. Shop Drawings: Shop Drawings to indicate gages, profiles, sections of materials, details of construction, hardware, methods of attachment and/or anchoring, as applicable for specified materials.

B. Samples: Submit the following:

1. 3 inch x 5 inch markerboard Samples, provide manufacturer’s full range of colors.

2. 3 inch x 5 inch tackboard Samples, provide manufacturer’s full range of colors and patterns.

C. Product Data: Submit manufacturer’s technical data, product specifications, installation instructions, and other pertinent information as applicable for each product or material specified.

D. Test Reports: Submit certified laboratory test reports as applicable to indicate compliance with specified requirements.

1.3 QUALITY ASSURANCE

A. Manufacturer shall have been regularly engaged in the business of manufacturing markerboards for at least 5 years.

B. Comply with requirements and recommendations of applicable portions of Porcelain Enamel Institute - PEI 2.

C. Assemblies shall be comprised of factory made markerboards and tackboards, in configurations and sizes indicated on the Drawings. Laminations of panel components shall be by face sheet manufacturer.

1.4 PRODUCT HANDLING

A. Deliver materials to the Project site with manufacturer's labels intact and legible.

B. Provide all means necessary to protect markerboards before, during and after installation.

1.5 JOB CONDITIONS
A. Sequencing, Scheduling:

1. Coordinate with related Work of other sections including gypsum board and tackboards.
2. Do not install markerboards until paint is installed to surfaces concealed behind them.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with specified requirements, markerboard and tackboard assemblies shall be the products of one of the following manufacturers (or equal):

1. Polyvision Corporation.
3. Claridge Inc.

2.2 MODULAR SYSTEM WITH ADJUSTABLE STANDARDS

A. Provide Polyvision (or equal) systems comprised of the following components.

1. P³ Ceramicsteel surface on 1/2" thick particle board with moisture resistant backer.
2. Polyvision 2-3/4" CRA-4D extruded aluminum tray (at marker board only).
3. One inch display rail with natural cork insert.
4. Polyvision 710 Series 710 adjustable modular trim.

B. Tackboard shall be 1/8" thick colored cork on 3/8" thick fiberboard, Polyvision (or equal) Type 9, with clear anodized aluminum trim.

2.3 FLOOR TO CEILING FIXED MARKERBOARDS AND TACKWALLS

A. The floor to ceiling fixed boards shall be a panelized wall system comprised of markerboards and tackwalls.

1. Markerboards shall be P³ Ceramicsteel by Polyvision, or equal.
2. The panelized tackwall shall be 1/8" thick colored cork on 3/8" thick fiberboard with splined joints and concealed fasteners. No trim.

B. Provide a 24" long magnetic chalk tray.

2.4 MATERIALS
A. Dry markerboards shall be porcelain enamel steel manufactured to exceed the performance specifications for porcelain enamel S104 of the Porcelain Institute. Markerboards shall be capable of supporting objects by means of magnets. The writing surface shall resist wear and damage from shock and abrasion and shall not dent, shatter or crack. The surfaces shall retain original color, writing, and erasing qualities and shall not become glossy or shiny in normal use. The gloss variation of a surface shall not exceed 3 units when measured by a 45 degree gloss meter in accordance with the Porcelain Enamel Institute Bulletin 1-18 Gloss Test for Porcelain Enamels and ASTM C 346.

1. Steel: Base metal shall be high quality enameling iron or steel of low metalloid and copper content, especially manufactured and processed for temperatures over 1,400 degrees F. used in coating porcelain on steel units for Architectural purposes; minimum 24 gage.

2. Board surfaces shall consist of the following:
   a. Primer coat, 0.0025 inch minimum thickness.
   b. Vitreous-porcelain writing surface coating of 0.0025 inch minimum thickness.
   c. The reverse side of the steel base sheet shall receive a ground coat of 0.0005 inch thickness and a spray coat of silicon.
   d. The panel edges at butt joints shall be porcelain enamel.
   e. Fuse cover and ground coats to the steel at the manufacturer's standard firing temperature, but at least 1,250 degrees F.

3. The dry markerboard surfaced steel shall be factory laminated to 7/16 inch thick fiberboard core. A moisture blocking backing sheet shall be provided.
   a. Fiberboard Core shall be 45 pound particle board.
   b. Moisture Barrier Backer Sheet shall be minimum .015 aluminum or 28 gauge galvanized steel. Backer sheet shall be factory laminated to the core under pressure.

4. Lamination: The surface facing and the backing shall be bonded to the core material by means of a special flexible adhesive developed for this purpose with no unbonded area. The face and back shall not be removable without rupturing the core material. Panels shall not delaminate under normal use.

5. Joints: Where vertical joints occur, a 14 gage continuous concealed steel spline shall be fitted tightly into grooves in the core material. Factory rabbet to produce a smooth butt joint. Do not furnish exposed trim.

B. Cork Tackable surfaces shall be self-healing, soil resistant, washable finish composition of pure cork and linseed oil on a burlap back.

1. Color shall be as selected by Architect from manufacturer's standard colors.

2. Adhesive shall be as recommended by corkboard manufacturer.

PART 3 EXECUTION
3.1 INSTALLATION

A. Install markerboard and tackboard assemblies in accordance with manufacturer's directions and approved Shop Drawings. Fasteners for assembly of trim and frame units shall be truss head aluminum or stainless steel self-tapping screws with double cadmium-plated finish.

B. Install panels after finish painting of wall surfaces has been completed and paint is cured. Install panels level, plumb and neatly assembled. Before Substantial Completion, trim shall be completely cleaned of dirt, finger-marks, or other foreign material.

C. Install panel guides, spacers, and panels at media wall cabinets as indicated.

END OF SECTION
SECTION 10155
STAINLESS STEEL TOILET PARTITIONS

PART 1 GENERAL

1.1 SUMMARY
A. Furnish and install stainless steel toilet partitions is indicated on drawings and specified.

1.2 SUBMITTALS
A. Product Data: In accordance with Division 01, Section 01330, submit manufacturer's detailed technical data for materials, fabrication, and installation, including catalog cuts of anchors, hardware, fastenings, and accessories.

1.3 QUALITY ASSURANCE
A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication where possible, to ensure proper fitting of work. However, allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay work.

B. Coordination: Furnish inserts and anchorages which must be built into other work for installation of toilet partitions and related work; coordinate delivery with other work to avoid delay.

PART 2 PRODUCTS

2.1 MATERIALS
A. Manufacturer: Subject to compliance with specified requirements, provide products of one of the following:

1. Global Corp.

2. Sanymetal Products Co.

3. Weis-Robart Partitions, Inc.

B. Provide materials which have been selected for surface flatness and smoothness. Exposed surfaces which exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other irregularities are not acceptable.

C. Stainless Steel Sheets: ASTM A 167, Type 302/304, finished on exposed faces with No. 4 bright, directional polish, in following minimum thicknesses:

1. Pilasters: 18 gage.


D. Concealed Anchorage Reinforcement: Minimum 12-gage galvanized steel sheet.

F. Core Material for Metal Partitions: Manufacturer's standard sound-deadening, honeycomb, of impregnated Kraft paper, in thickness to provide finished dimension of 1" minimum for doors, panels, and screens, 1-1/4" minimum for pilasters.

G. Pilaster Shoes: ASTM A 167, Type 302/304 stainless steel, not less than 3" high, 20 gage, finished to match hardware.

H. Stirrup Brackets: Manufacturer's standard design for attaching panels to walls and pilasters, either chromium-plated non-ferrous cast alloy ("Zamac") or stainless steel.

I. Hardware and Accessories: Manufacturer's standard design, heavy-duty operating hardware and accessories of chromium-plated non-ferrous cast alloy ("Zamac"), or stainless steel.

J. Overhead-Bracing: Continuous extruded aluminum, or stainless steel, anti-grip profile, with clear anodized finish.

K. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, chromium-plated steel, or brass finished to match hardware, with theft-resistant type heads and nuts. For concealed anchors, use hot-dip galvanized, cadmium-plated, or other rust-resistant protective-coated steel.

L. Hardware: Furnish hardware for each compartment in partition system, as follows:

1. Hinges: Cutout inset type, adjustable to hold door open at any angle up to 90 degrees. Provide gravity type, spring-action cam type, or concealed torsion rod type, to suit manufacturer's standards.

2. Latch and Keeper: Recessed latch unit, designed for emergency access, with combination rubber-faced door strike and keeper.

3. Coat Hook: Manufacturer's standard unit, combination hook and rubber-tipped bumper, sized to prevent door hitting mounted accessories.

4. Provide bumper, stop, or strike for outswinging doors on handicapped accessible stalls.

5. Door Pull: Manufacturer's standard unit for out-swing doors.

PART 3 EXECUTION

3.1 INSTALLATION

A. General: Comply with manufacturer's recommended procedures and installation sequence. Install partitions rigid, straight, plumb, and level. Provide clearances of not more than 1/2" between pilasters and panels, and not more than 1" between panels and walls. Secure panels to walls with not less than two stirrup brackets attached near top and bottom of panel. Locate wall brackets so that holes for wall anchorages occur in masonry or tile joints. Secure panels to pilasters with not less than two stirrup brackets located to align with stirrup brackets at wall. Secure panels in position with manufacturer's recommended anchoring devices.
B. Ceiling-Hung Units: Provide manufacturer’s standard corrosion-resistant anchoring assemblies complete with threaded rods, lock washers, and leveling adjustment nuts at pilasters for connection to structural support above finished ceiling. Provide assemblies that support pilasters from structure without transmitting load to finished ceiling. Provide sleeves (caps) at tops of pilasters to conceal anchorage.

C. Overhead-Braced Partitions: Secure pilasters to floor, and level, plumb, and tighten installation with devices furnished. Secure overhead-brace to each pilaster with not less than two fasteners. Hang doors and adjust so that tops of doors are parallel with overhead-brace when doors are in closed position.

D. Floor-Supported Partitions: Set pilaster units with anchorages having not less than 2" penetration into structural floor, unless otherwise recommended by partition manufacturer. Level, plumb, and tighten installation with devices furnished. Hang doors and adjust so that tops of doors are level with tops of pilasters when doors are in closed position.

E. Screens: Fasten screens with double continuous stainless steel angles, one each side of the screen. Fasten screens with concealed anchoring devices, as recommended by manufacturer to suit supporting structure. Set units to provide support and to resist lateral impact.

3.2 ADJUST AND CLEAN

A. Hardware Adjustment: Adjust and lubricate hardware for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors (and entrance swing doors) to return to fully closed position.

B. Clean exposed surfaces of partition systems using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES

A. Solid composite phenolic toilet compartments and urinal screens.

1.2 DESCRIPTION

A. Toilet and Shower Compartments (Commercial, Institutional, or No-Sightline):
   1. Ceiling hung type units consisting of phenolic pilasters, panels, and doors, plated steel leveling devices with stainless steel covers; and stainless steel fittings, hardware, and fastenings necessary for complete installation.
   2. Floor supported type units consisting of phenolic pilasters, panels and doors; plated steel leveling devices with stainless steel covers; and stainless steel fittings, hardware and fastenings necessary for complete installation.
   3. Overhead braced type units consisting of phenolic pilasters, panels and doors; plated steel leveling devices with stainless steel covers; aluminum overhead bracing, and stainless steel fittings, hardware and fastenings necessary for complete installation.

B. Urinal Screens
   1. Wall hung type consisting of phenolic screen panels and stainless steel fittings and fastening necessary for complete installation.
   2. Floor supported type units consisting of phenolic pilasters and screen panels; plated steel leveling devices with stainless steel covers, and stainless steel fittings and fastenings necessary for complete installation.

1.3 SUBMITTALS

A. Submittals, procedures and quantities are specified in Section 01330.

B. Shop drawings: Submit shop drawings indicating elevations of partitions, thickness of phenolic, fastenings, proposed method of anchoring, size and spacing of anchors, details of construction, hardware, fittings, mountings and other related items and installation details.

C. Product Data: Submit manufacturer's technical data for materials, fabrication, finishing, fastenings, hardware, and installation details.

D. Samples: Submit samples of phenolic color and pattern selected for verification.

1.4 REGULATORY REQUIREMENTS

A. Accessibility Requirements: Comply with the requirements for the accessibility of the physically disabled of the appropriate jurisdiction and ADA Accessibility guidelines for Buildings and Facilities.
B. Surface Burning Requirements: Fabricate compartments from phenolic panels which are U.L. classified and labeled: Standard interior grades: 5/8" (16mm) to 1" (25mm) flame spread 25, smoke developed 70; 1/2" (13mm) flame spread 30, smoke developed 85.

1.5 DELIVERY, STORAGE AND HANDLING
A. Deliver and store materials in the manufacturer's original protective packaging except that should packaging become wet, remove it immediately to avoid wet stains. Store materials in an enclosed shelter providing protection from damage and exposure to the elements.

1.6 COORDINATION
A. Field Measurements: Secure field measurements before preparation of shop drawings and fabrication where possible, for proper and adequate fabrication and installation of the work.
B. Furnish inserts and anchorage built into other construction for installation of toilet compartments and urinal screens.

1.7 WARRANTY
A. phenolic panels to be warranted for 10 years against delamination. The factory authorized fabricator, product installer and phenolic manufacturer must sign the warranty and submit a copy to the Contractor. The project name must be written on the warranty.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURER
A. Drawings and specifications are based on compartments manufactured with phenolic Virtuon DSS panels, or equal.
B. Approved Fabricators (or equal)

1. Alan Lewis Inc
2. Bobrick Washroom Equip., Inc
3. Lam-Tec Industries
4. Superior Partitions

2.2 MATERIALS
A. Partition panels, pilasters, doors and privacy screens:

1. Core: phenolic impregnated kraft papers. To ensure panel quality and consistency, panel must be at least 93-lbs./cubic foot to ensure full saturation of kraft core.

2. Face sheet: The panels are to have an integrated, decorative surface with pigmented resins. These resins are to be electron beam cured for superior chemical and dirt resistance and integrally compression molded with the core.
   a. Colors: to be selected by Architect from Manufacturer’s standard Metallic color pallet.
   b. Texture: Satin.
3. Panels to be U.L. registered and labeled for quality consistency.

4. Modulus of Elasticity: 1.5 Million PSI minimum.

5. Shear strength: 2,000-PSI minimum.

6. Compressive strength: 24,000-PSI minimum.

7. Water absorption: 3% maximum.

8. Screw pullout strength minimums chart (lbs.):

<table>
<thead>
<tr>
<th>Screw depth</th>
<th>#6</th>
<th>#8</th>
<th>#10</th>
<th>#12</th>
<th>1/4&quot;</th>
<th>5/16&quot;</th>
<th>3/8&quot;</th>
<th>7/16&quot;</th>
<th>1/2&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/2&quot; panels</td>
<td>250</td>
<td>300</td>
<td>340</td>
<td>390</td>
<td>450</td>
<td>560</td>
<td>680</td>
<td>790</td>
<td>900</td>
</tr>
<tr>
<td>3/4&quot; panels</td>
<td>510</td>
<td>590</td>
<td>680</td>
<td>850</td>
<td>1,000</td>
<td>1,200</td>
<td>1,400</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

B. Chemical resistance: Panels to meet or exceed Scientific Equipment Furniture Association’s (S.E.F.A.) list of 49 standard chemicals.

C. Stainless Steel: ASTM A167, Type 304.

D. Concealed Fasteners and Leveling Devices: Zinc or cadmium coated steel.

2.3 FABRICATION

A. Panels and Urinal Screens: Flush, formed of 1/2" thick phenolic electron-beamed cured solid phenolic panels. Height and width as indicated in drawings.

B. Pilasters and Doors: Flush, formed of 3/4" thick phenolic electron-beamed cured solid phenolic panels.

1. Door Dimensions: Unless otherwise indicated, furnish 24" wide in-swinging doors for standard toilet compartments, 36" wide clear opening out-swinging doors when located at the end, and 36" wide clear opening out-swinging doors when located at the side for stalls equipped for use by the physically disabled.

2. Anchorage Devices: Provide galvanized steel anchorage devices, complete and threaded rods, washers, and leveling adjustment nuts at pilasters, to permit connection to Floor slab. Furnish devices, which are designed to support pilasters from structure without transmitting load to floor fill.

3. Overhead Bracing: Provide anti-grip, decorative, heavy duty, extruded aluminum head rail with clear anodized finish.

2.4 COMMERCIAL DUTY HARDWARE AND FITTINGS

A. Materials: Type 304 stainless steel, unless otherwise specified. Aluminum or die cast zinc alloy castings will not be acceptable.

B. Stirrup Brackets: Provide 3 U-brackets for attaching each panel to pilaster and 3 double-eared brackets for attaching panels and urinal screen to the wall. Fasten brackets with stainless steel, one-way shouldered through-bolts and barrel nuts.

C. Hinges: Heavy duty, surface mounted, self-closing type, adjustable to hold door open at any angle up to 90 degrees.
D. Latch and Keeper: Surface mounted latch unit designed for physically disabled accessibility, with combination rubber-faced door strike and keeper.

E. Coat Hook: Combination hook and rubber-tipped bumper, sized to prevent door from hitting mounted accessories.

F. Door Pull: Manufacturer's standard for out-swinging doors.

PART 3 EXECUTION

3.1 EXAMINATION

A. Before covering wall and ceiling framing with finish materials, examine framing to ensure that backing plates and structural framing have been installed in such position as to receive all attachment screws.

B. Verify spacing of plumbing fixtures to ensure compatibility with installation of compartments.

C. Do not start the work of this section until all deficiencies have been corrected.

3.2 INSTALLATION

A. General: Install toilet compartments and urinal screens as shown on the shop drawings and in accordance with Manufacturer's specifications and printed installation instructions. Install toilet compartments and doors in a rigid and substantial manner, straight and plumb, with horizontal lines level.

B. Pilasters: Secure pilasters to supporting members and level, plumb and tighten the installation with leveling nuts and washers.

C. Panels and Urinal Screens: Secure panels and doors to pilasters so the exterior faces are flush. Provide clearances of not more than 1/2 inch between pilasters and panels, and 1 inch between panels and walls. Secure panels and urinal screens to walls with 2 stirrup brackets located near the top and bottom of each panel, or one continuous bracket from top to bottom. At light gauged steel framed walls, fasten brackets with toggle or molly bolts into metal studs or backing plates fastened directly to the studs. At wood framed walls, fasten brackets with wood screws into wood studs or blocking fastened directly to the studs. At concrete or masonry walls, fasten brackets with screws and expansion anchors.

3.3 ADJUSTING AND CLEANING

A. Hardware Adjustment: After installation, carefully adjust hardware for proper operation. Set hinges on in-swinging doors to hold open approximately 30 degrees from the closed position when unlatched. Set hinges on out-swinging doors to return to the fully closed position. Adjust doors so that bottoms of doors are level with the bottoms of the pilasters when the doors are in the closed position.

B. Cleaning: Clean compartments and doors upon completion and leave free from imperfections.

END OF SECTION
SECTION 10205
GALVANIZED WALL LOUVERS

PART 1  GENERAL

1.1  DESCRIPTION

A. Furnish and install galvanized wall louvers as indicated on the drawings and specified.

1.2  SUBMITTALS

A. All submittals shall be made in accordance with Division 01, Section 01330.

B. Shop Drawings: Submit shop drawings showing the louver construction, thickness of the materials, methods of joining, reinforcement and anchorage features of all sheet metal work. Provide complete information regarding concealed joints.

1.3  PRODUCT HANDLING

A. Protect sheet metal materials before, during and after installation. Protect the installed work of other trades. Do not install bent or damaged materials.

1.4  COORDINATION

A. The work under this section to be built into or connected with roofing work shall be coordinated so that all flashings and like items will provide a water and weathertight installation.

PART 2  PRODUCTS

2.1  GALVANIZED STEEL

A. Conform to ASTM A526 or ASTM A527, galvanized in accordance with ASTM A525, coating designation G90.

2.2  WALL LOUVERS

A. Louvers shall be fixed type, of size and design shown. Heads, sills and jamb sections shall have formed caulking slots or be designed to retain caulking. Head sections shall have exterior drip lip, and sill sections an integral water stops. Furnish louvers with sill extension or separate sill as shown. Frame shall be of welded construction with welds dressed smooth and flush. Louvers shall be secured in opening as shown. Provide bird screens on outside of all exterior louvers.

B. Provide galvanized steel wall louvers of the weather resistant type, with bird screens and made to withstand a wind load of not less than 30 pounds per square foot.

2.3  FRAMED BIRD SCREENS

A. For galvanized steel louvers, provide 1/4-inch square mesh, 16-gauge zinc-coated steel or copper bird screening.

B. Miter corners and join by concealed corner clips or locks extending about 2-1/4 inches into rails and stiles.
C. Fasten frames to outside of louvers with galvanized or stainless steel devices designed to allow removal and replacement without damage to the louver.

2.4 FASTENERS AND ACCESSORIES

A. Provide zinc-coated or stainless steel screws and fasteners for steel louvers. Provide other accessories required for complete installation.

B. Fasteners for securing louvers to adjoining construction, except as otherwise specified or shown, shall be toggle or expansion bolts, of size and type as required for each specific type of installation and service condition. Where type, size, or spacing of fasteners is not shown or specified, submit shop drawings showing proposed fasteners, and method of installation.

2.5 SHOP PRIMING

A. Shop prime galvanized steel with baked-on or oven dried shop prime coat material as standard with the louver fabricator.

B. Surfaces of steel work shall be cleaned free from scale, rust, oil and grease, and then given a light colored prime paint after fabrication. Paint all contact surfaces of assembled work with an additional shop coat of similar paint.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install using stops or moldings, flanges, or jamb fasteners as appropriate for the wall construction and in accordance with manufacturer's recommendations. Fasten frames to louvers with screws or bolts.

B. Set work accurately, in alignment and where shown. Items shall be plumb, level, free of rack and twist, and set parallel or perpendicular as required to line and plane of surface.

END OF SECTION
SECTION 10248
ROLL FORMED ALUMINUM SCREENS

PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install roll formed aluminum screens as indicated on the drawings and specified.

1.2 SUBMITTALS

A. Product Data: Submit material specifications and printed installation instructions before starting work.

B. Shop Drawings: Submit dimensioned drawings.
   1. Indicating screen profiles locations, elevations, connection details to adjoining work, frames, gage of metal, stiffeners, clips, and color standard selections.
   2. Signed and sealed by a California registered professional engineer.

1.3 QUALITY ASSURANCE

A. Screens shall be designed to resist wind velocity pressures determined by American Society of Civil Engineers (ASCE) 7-98.
   1. Comply with ASCE 7-98 using a wind speed of 90 mph, exposure category "C", and a wind load importance factor of 1.10.
   2. Screens shall be free from noise caused by rattle or flutter.

B. Deflection: Not to exceed 1/180th of member span.

C. Certification: Submit manufacturer's certification that screens and fastenings conform to the California Building Code, minimum safe and deflection limits, and finish film thickness requirement.

PART 2 PRODUCTS

2.1 ROLL FORMED ALUMINUM SCREENS

A. Subject to compliance with specified requirements, aluminum screens shall be "Econsoscreen Model RV 20", by Construction Inc., or an "or equal" product by one of the following:
   1. Industrial Louvers Inc.
   2. Ruskin Manufacturing Inc.
   3. Willard Shutter Co. Inc.

B. Blades shall be aluminum, ASTM B209 alloy 3003. Supports shall be aluminum, ASTM B221, alloy 6063 or extrusions of equal strength.
1. Sizes and profiles shall be as indicated on drawings.

2. Fasteners: Approved stainless steel fasteners for securing louver frames to wall construction.

3. Finish: Duracolor or Kynar 500 as base vehicle. Color as selected by Architect.


PART 3 EXECUTION

3.1 INSTALLATION

A. Install aluminum screens where indicated on drawings according to manufacturer's printed installation instructions and accepted Shop Drawings.

END OF SECTION
SECTION 10350
FLAGPOLES

PART 1  GENERAL

1.1  DESCRIPTION

A. Provide aluminum flagpoles as indicated on the Contract Drawings and these Specifications and as needed for a complete and proper installation.

B. Design Requirements

1. Three Flag Poles; One for the United States Flag, One for the California State Flag and one for the City of Los Angeles Flag.

2. Height: The flag pole for the US Flag shall be 45’ in height. The California and Los Angeles City flagpoles shall be 40’ in height.

3. Finish: All flagpoles will have a clear anodized aluminum finish.

4. Tops of flagpoles: The US Flagpole shall have a ball top, with an eagle, gold colored. The remaining two poles will simply have ball tops, gold anodized finish.

5. Placement of flagpoles shall be as shown on the drawings. The tallest pole (45’) shall be in the center with two shorter poles (40’) on either side of the taller pole.

6. Anchoring at base: Poles shall be ground set per manufactures recommendations.

7. Flagpoles shall have an internal halyard with locked flush mounted access door to winch plate.

8. Lighting at the base of each flagpole, pointed up.

9. Photo-voltaic cell to activate the lights during periods of darkness.

1.2  RELATED WORK

A. Documents affecting the Work of this Section include, but are not necessarily limited to the GENERAL CONDITIONS, SUPPLEMENTARY CONDITIONS and Sections in DIVISION 1 - GENERAL REQUIREMENTS of these Specifications.

B. Concrete work in Section 03300.

1.3  SUBMITTALS

A. General: Comply with conditions of SUBMITTALS SECTION 01330 of DIVISION 1 - GENERAL REQUIREMENTS of these Specifications.

B. Product Data: Within 40 calendar days after the Contractor has received the City's "Notice to Proceed" submit the following:

1. Materials list of items proposed to be provided under this Section.

2. Manufacturer's specifications and other data needed to prove compliance with the specified requirements.
3. Shop Drawings showing general layout, dimensions, base design and its connection to foundation, anchoring and support system, and grounding system.

4. Design, calculations, drawings, and other data needed to secure approval of foundation from governmental agencies having jurisdiction.

5. Manufacturers’ recommended installation procedures which, when approved by the City Engineer will become the basis for accepting or rejecting actual installation procedures used on the Work.

C. Samples: Submit sample of factory applied finish for approval.

1.4 QUALITY ASSURANCE

A. Labor: Use adequate numbers of skilled craftsmen who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

B. Installer Qualifications: Installer of flagpoles shall have had not less than 3 years experience in the erection of similar types of flagpoles (hereinafter specified) of length equal to or exceeding the length of the specified flagpoles. Installer shall be Los Angeles City Building and Safety Licensed fabricator.

1.5 DELIVERY, STORAGE AND HANDLING

A. General: Comply with the provisions of Section 01640 – PRODUCT HANDLING of DIVISION 1 – GENERAL REQUIREMENTS of these Specifications.

B. Delivery: Deliver flagpoles and accessories to the job-site in manufacturer’s protective wrappings bearing the manufacturer’s label and model number as applicable.

C. Storage: Store specified components where directed by the City Engineer, in such manner as to prevent damage of any nature thereto.

D. Protection: Use all reasonable means necessary to protect products and materials before, during and after installation.

E. Furnish bolt circle template to the Contractor for accurate setting of anchor bolts and grounding rod in concrete foundation.

1.6 GENERAL REQUIREMENTS

A. Warranty: Comply with provisions of the GENERAL CONDITIONS of these Specifications which shall include a 12-month warranty period which covers parts and labor; effective date of the warranty being the date of acceptance by the City.

B. Permit: Provide plans and calculations by a licensed Engineer as required to obtain approvals and permits. Contractor shall submit to the Department of Building and Safety and pay for all plan checks and permits.

PART 2 PRODUCTS

2.1 FLAGPOLES
A. Provide commercial ground set tapered aluminum flagpoles, accessories, bases and anchorage devices as complete ground set unit, furnished with the following attributes:

1. Overall dimensions as indicated on the drawings.

2. Fabrication
   a. Taper 1-inch in 5'-6".
   b. Provide internal splicing, self-aligning sleeve of the same material as the flagpole for snug fitting, precision field joints, without welding and without offsets and no plug welds.
   c. Provide flagpole made from all new, seamless aluminum tubing, having a uniform conical taper as manufactured by Concord Industries, Independence Flagpole Cat No. I40080188 and I45080188 or equal.

3. Finish
   b. Below ground: Shop coat of asphaltic paint inside and outside.

B. Fittings and Accessories

1. Ball: 3-inch diameter seamless 14-gauge aluminum, gold anodized spun aluminum with flush seam.

2. Eagle shall be cast aluminum with a 15" wing span on a 3" ball, gold colored.


4. Halyards: Cable based internal halyard, equipped with nickel-plated snap hooks each to secure the flags.

5. Internal Halyard, Winch System: Manually operated winch with control stop device and removable handle, stainless-steel cable halyard, and concealed revolving truck assembly with plastic-coated counterweight and sling. Provide flush access door secured with cylinder lock. Finish truck assembly to match flagpole.

6. Flash Collar: Aluminum 1100 alloy spun of size indicated 7-5/8 inch I.D. and 15-inch O.D.

7. Foundation Sleeve: Fabricated from 16-gauge galvanized steel with a steel base plate. The ground spike shall be 3/4" diameter, and not less than 18" long.

8. Collar: Ornamental base shall be spun aluminum. The diameter of the collar shall be at least 1" larger than the diameter of the foundation sleeve. The finish shall be anodized aluminum.

C. Manufacturers shall be as indicated on the drawings and Los Angeles City Building and Safety licensed fabricators:

1. The Baartol Company
2. ACME Flag Poles Company Division of Lingo, Inc.
3. Concord Industries, Inc.
4. Michigan Flagpole
5. Other manufacturers when approved by the City Engineer.

2.2 FOUNDATION

A. General: Construct concrete foundation as indicated by the manufacturer in accordance with Los Angeles City Building Code and requirements specified in Section 03300 - CAST-IN-PLACE CONCRETE.

1. Use bolt circle template for flange mounted pole, accurately set bolts into foundation receive mounting flange and pole.
2. Accurately place grounding rod and clamp to anchor bolt for flange mounted pole.
3. For ground set pole accurately set sleeve with grounding rod in plumb position and properly centered in foundation excavation prior to concrete pour.

PART 3 EXECUTION

3.1 INSPECTION OF CONDITIONS

A. Examine the areas and conditions under which Work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until detrimental conditions are corrected. Start of installation operations shall imply Contractor’s acceptance of job conditions.

3.2 GENERAL INSTALLATION

A. Install the flagpoles and accessories in accordance with the manufacturers’ recommendations as approved by the City Engineer, aligning plumb to a vertical tolerance of one in 1000, and adjusting operating components for optimum smoothness of operation.

3.3 INSTALLATION OF GROUND SET POLE

A. Center pole in pipe sleeve; set plumb; maintain in accurate position with suitable temporary wedges until firmly supported by fill in sleeve.
B. Fill space around pole in sleeve with clean dry sand to a height 4-inches below top of concrete foundations; tamp sand firm to provide solid setting of pole.
C. Pour grout into top of sleeve, above sand. The grout to be composed of 1 part Portland cement and 2 parts clean sharp sand, by volume, with proper amount of water for suitable consistency. Finish grout smooth and even, flush with top of concrete foundation.
D. Set flashing collar after grout has dried in light-color, non-staining, permanently elastic caulking compound, solidly and level.

END OF SECTION
SECTION 10440
SIGNS

PART 1   GENERAL

1.1   DESCRIPTION

A. Work included: Furnish and install laminated signs where indicated on the Contract
Drawings and as specified herein as needed for complete and proper installation.

1. Dimensional letters – Cut Aluminum
2. Dimensional letters – Cut Acrylic.
3. Dimensional letters – Cast Vinyl Film
4. Interior Modular Interchangeable Signs.
5. Interior Modular Component Signs – Curved Face.
6. Interior Unframed Signs
7. Cast Bronze Commemorative plaque.

B. Related work: Documents affecting Work of this Section include, but are not necessarily
limited to the GENERAL CONDITIONS, SUPPLEMENTARY CONDITIONS and
Sections.

1.2   SUBMITTALS

A. General: Comply with conditions of SUBMITTALS SECTION 01330 of DIVISION 1
GENERAL REQUIREMENTS of these Specifications.

B. Product Data: Within 40 calendar days after the Contractor has received the City's
"Notice to Proceed" submit the following:

1. Materials list of items proposed to be furnished and installed under this Section.
2. Manufacturer's specifications and other data needed to prove compliance with
the specified requirements.
3. Manufacturer's recommended installation procedures which, when approved by
the City Engineer will become the basis for accepting or rejecting actual
installation procedures used on the Work.

C. Shop Drawings: Submit shop drawings showing layout, profiles, and product
components, including dimensions, anchorage, and accessories.

D. Samples: Submit supplier's standard color chart for selection purposes and selected
colors for verification purposes.

E. Installation: Submit supplier's installation instructions.

F. Closeout Submittals:
1. Submit operation and maintenance data for installed products, including precautions against harmful cleaning materials and methods.

2. Submit warranty documents specified herein.

1.3 QUALIFICATIONS

A. Sign Contractor: A signage and graphics specialist subcontractor able to prepare shop drawings and samples and to manufacture fabricate, assemble and install the work shown in these drawings, and who is able to prove demonstrated capability with a complete project record satisfactory to the designer.

B. Responsibility: The fabricator shall assume responsibility for the quality of materials and workmanship required for the execution of the work herein. The fabricator shall guarantee all materials and workmanship for a period of one (1) year following the final acceptance of the work, and if during this period defects or faulty materials are found, the fabricator shall proceed immediately upon notification by the the City at his own expense to remedy the condition together with any damage to surrounding finishes or furnishing which occurred as a result of those defects.

C. Submittals: The fabricator shall submit shop drawings and engineering design drawings with supporting structural calculations as required by code.

D. Product Data: The fabricator shall submit manufacturer’s specifications including paint label analysis and instruction for handling, storage, installation, protection and maintenance of each product.

E. Shop Drawings: Shop drawings shall be submitted in the following manner: One (1) sepia or Xerox reproducible set and one (1) blue or black line print of each drawings. Signs requiring shop drawings will be noted on the graphics sheet Index in the architectural drawing set.

F. Schedule: The successful bidder shall submit the following within (30) working days: A complete schedule of shop drawings and sample submittal dates and a complete production schedule for the sign package assuming three (3) weeks shall be dedicated to the architects and the City Engineer for the review of shop drawings and samples.

G. Samples: The fabricator shall submit full scale samples using actual materials as specified, for all sample sign called for on the sheet index. Samples shall be submitted to the architect and City Engineer for approval. Where feasible, approved samples may be installed as part of the work. Paint samples shall be 4"x5" and clearly marked on the back.

H. Coordination: The fabricator shall furnish information and coordinate with related trades to assure satisfactory completion of the work. In all cases where installation of mounting hardware involved other trades, coordination shall be through the general contractor.

I. Permits: The fabricator shall obtain and pay for all permits required for execution of the work.

J. U.L. Standards: The fabricator shall provide electrical components and component assemblies for each item of illuminated sign equipment which bear either recognized markings as indicated in U.L. listings of the recognizes component index, or a U.L. Label to show compliance with U.L. standards.

1.4 DELIVERY, STORAGE AND HANDLING
A. General: Comply with pertinent provisions of DIVISION 1 - GENERAL REQUIREMENTS of these Specifications.

B. Delivery: Deliver materials to the job-site in unopened suitable packaging properly identified with the manufacturer's labels indicating manufacturer's name, product name and model number.

C. Storage: Store materials where directed by the City Engineer, in a location under cover, safe from weather and damage by construction operations.

D. Protection: Use all reasonable means necessary to protect materials before, during and after installation. In the event of damage, immediately make necessary repairs and/or replacements to the full approval of the City Engineer, at no added cost to the City.

1.5 GENERAL REQUIREMENTS

A. Warranty: Comply with provisions of the GENERAL CONDITIONS of these Specifications which shall include a 12-month warranty period which covers parts and labor; effective date of the warranty being the date of acceptance by the City.

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Subject to compliance with specified requirements, provide products of ASI Sign System, Inc. or one of the following (or equal).

1. Andco Industries Corp.
3. The Southwell Company.

2.2 DIMENSIONAL LETTERS – CUT ALUMINUM

A. Provide ASI LPS Series, or equal.

1. Material: Aluminum, satin faces and sides, color anodized medium bronze
2. Letter style: Optima
3. Letter height: Per drawings
4. Letter depth: 1"

2.3 DIMENSIONAL LETTERS – CUT ACRYLIC

A. Provide ASI LPP Series, or equal.

1. Material: Acrylic painted satin nickel finish.
2. Letter style: Optima.
3. Letter height: Per drawings
4. Letter depth: 1/2
5. Mounting method: Tape strip mount.

2.4 DIMENSIONAL LETTERS – CAST VINYL FILM

A. Provide ASI LTV Series, or equal.
   1. Graphic Material: 2-mil cast vinyl film, digitally cut letters, of integrally color as selected by the Architect.
   2. Lettersyle: Optima

2.5 INTERIOR MODULAR INTERCHANGEABLE SIGNS

A. Provide ASI Interior 20 Series, Notice Boards, or equal.
   1. Size: 20”x20”.
   2. Frame Color: As selected by the Architect.
   4. Letter Tiles: As selected by the Architect.

B. Materials and Components
   1. Fixture panels shall be extruded aluminum with polyester coating, color as selected by the Architect.
   2. Face components shall be composed of aluminum of based panels with polyester coating, and individual injection molded letter tiles, press fitted to textured polycarbonate base.
   3. Mounting Hardware (Wall Rails): Extruded aluminum, alloy AA6060, track-type rail mounted to wall with manufacturer recommended mechanical fasteners.

2.6 INTERIOR MODULAR COMPONENT SIGNS – CURVED FACE

A. Provide ASI Pacific Interior Suspended Signs, or equal.
   1. Signs shall be uniformly curved aluminum 8 3/4” x 34” on both sides of sign, non-illuminated. Provide vandal resistant lock.
   4. Letter Size: Per drawings
   5. Text or Graphic Technique: Screen Process.
   6. Text or Graphic Colors: As selected by the Architect.

B. Provide ASI Pacific Interior 6" wide wall mounted signs, or equal, ADA Ready panels.
   1. Curved Modular Panel Size: Per drawings. Provide the manufacturer's concealed keyed panel lock.
   2. Panel Color: As selected by the Architect.
   4. Text Schedule: Per drawings
   5. Wall attachment: Extruded aluminum, black anodized.

C. Provide ASI Pacific Paper Insert Panels, or equal
   1. Fixture Color: Per Architect from manufacturer's standard color chart.
   2. Laser-printed paper insert color: Per Architect from manufacturer's standard color chart.
   3. Text schedule: Per Drawings: Verify all copy with City Engineer Prior to ordering.

D. Provide Pacific Interior 9' + Wide Wall Mounted Signs; ADA Ready Panels, or equal.
   1. Curved modular panel size: 12 + wide size of panel, and number of modules and height as indicated on the drawings.
   2. Panel color: As selected from manufacturer's standard color chart.
   3. Letter style: Optima
   4. Letter size: As indicated on the drawings
   5. Text schedule: Per Drawings
   6. Wall Attachment: Extruded aluminum wall attachment; black anodized.

2.7 INTERIOR UNFRAMED SIGNS

A. Provide ASI Unframed SP Series, or equal.
   1. Sign face: Clear acrylic 0.25" thick matte first surface.
   3. Size: Per drawings
   4. Color: As selected by the Architect.
   5. Letter style: Optima

2.8 CAST BRONZE COMMEMORATIVE PLAQUE

B. Accessories: Type recommended by manufacturer, best suited for intended application.

C. Tablet: Bronze; size, letter sizes, style and sign content shall be as directed by the City Engineer. The final design of the plaque shall be in accordance with the approved shop drawings.
   1. Mounting: Concealed; threaded bolts screwed into back of plate for insertion into holes in concrete wall.
   2. Tablet: Cast free of pits and gas holes.

D. Letters: Satin finish faces.

E. Border: Satin finish.

F. Background: To be determined by City Engineer and Architect.

G. Shop Finishing: Chemically clean and spray the plaque with 2 coats of ultraviolet resistant clear acrylic lacquer.

2.9 FABRICATION

A. General: Comply with requirements indicated for materials, thickness, finishes, colors, designs, shapes, sizes, and details of construction.

B. Preassemble signs in the shop to the greatest extent possible to minimize field assembly. Disassemble signs only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation, in a location not exposed to view after final assembly.

C. Conceal fasteners if possible; otherwise, locate fasteners to appear inconspicuous.

D. Form panels to required size and shape. Comply with requirements indicated for design, dimensions, finish, color, and details of construction.

E. Coordinate dimensions and attachment methods to produce message panels with closely fitting joints. Align edges and surfaces with one another in the relationship indicated.

2.10 FABRICATION - DIGITALLY CUT VINYL LETTERS

A. Design, fabricate, and install sign assemblies to prevent buckling, opening up of joints, and over-stress welds and fasteners.

B. Mill joints to a tight, hairline fit. Form joints exposed to the weather to exclude water penetration.

C. Conceal fasteners if possible; otherwise, located fasteners where they will be inconspicuous.

D. Create signage to required sizes and layout. Comply with requirements indicated for design, dimension, finish, color and details of construction.
PART 3 EXECUTION

3.1 EXECUTION

A. Inspection: The fabricator shall inspect conditions of locations and surfaces on which signs will be installed. The fabricator shall not proceed with installation until defects or errors which would result in a poor installation have been corrected.

B. Walk-Through: The fabricator shall arrange a meeting with the City Engineer and LAPD at the site for the final location and alignment of sign elements. All signs which do not include room numbers shall be located with use of post-it type tags at the correct location by the City Engineer and LAPD.

C. Installation: Install signs at typical locations as specified in the respective drawing, at mounting heights indicated and by method shown or specified. All installation methods and materials are to be per manufacturer’s recommendations.

D. Protection: The fabricator shall protect the work and adjacent work and materials from damage during progress of the work until completion. Wrap finished work with paper, polyethylene film, or strippable waterproof tape for shipment and storage and protection from damage during installation.

E. Adjust and Clean: The fabricator shall repair any damage incurred during installation to the satisfaction of the City Engineer. Signs which cannot be repaired to a new condition must be replaced. All sign surfaces must be clean, free of smudging and fingerprinting. Adjust all hardware and electrical equipment to assure safe and proper operation and installation. Remove all waste and debris from the site resulting from the sign installation. The signage contractor shall arrange with the general contractor for the use of his/her waste receptacle.

F. ADA Compliance: All signs will be compliant with the Americans with Disabilities Act (ADA) and its supporting regulations and guidelines.

G. Code Sign Compliance: All signs will comply with federal, state and local codes for Fire and Life Safety sign requirements.

3.2 GRAPHIC SCHEDULE AND LOCATION PLANS

A. Graphic Schedule: Site Location, Room Number, Sign Number, Copy, Quantity Drawing Sheet Number and any pertinent remarks are listed in the graphic schedule will comply with the language and nomenclature established by this guidelines manual. Quantities for each sign type have also been indicated on the respective drawing sheets. If there are discrepancies between quantities indicated on the drawing sheets and the graphic schedule. The City Engineer shall be notified immediately.

B. Copy and Graphics: The guidelines manual will establish the sign copy and graphics formats. If there are any ambiguities regarding copy format for any sign, the City Engineer and LAPD shall be consulted immediately. Final format and copy will be submitted to the City Engineer and the LAPD for final approval.

C. Location Plans: All signs will be keyed to the site, or the floor and individual room plans. Each sign shall be located and annotated individually on the respective sign drawing at its respective location. Any ambiguities or conditions which may exist, that prevent location of signage as specified, shall be brought to the attention of the City Engineer prior to installation.
D. Installation: Install signs at typical locations as specified in the respective drawing, at mounting heights indicated and by method shown or specified.

3.3 GRAPHIC FORMAT AND SIZE OF SIGN PACKAGE

A. Graphic Format: The sign package will consist of the following parts:

1. Sign Fonts.
2. Sign Specifications.
3. Sign Quantities by sign types.
4. Sign types with details.
5. Sign Location and Placement with dimensions
7. Sign Location Plan.
8. Sign Maintenance and Updating Instructions.
9. Sign Manufacturer’s name, address and written warranties.
10. Purchased Equipment list with repair and warranty information.

B. Graphic Size: The sign package will be 8 1/2" x 11" in size. An oversized sheet will fold to fit an 8 1/2" x 11" format. The final document will be bound in a 3 ring binder.

3.4 MISCELLANEOUS REQUIREMENTS

A. Sign Package Distribution: Three copies of the sign package (each copy to be bound in a three-ring binder) shall be delivered to Owner.

B. Extra Sign Quantity: A 10% to 15% of extra signs will be included in the sign package, to be kept by the Owner in inventory for future use. The extra signs will be identified by the City Engineer.

END OF SECTION
SECTION 10442
CAST BRONZE BUILDING PLAQUE

PART 1 GENERAL

1.1 SUMMARY

A. General: Furnish all tools, equipment, materials, supplies and perform all labor necessary to fabricate and install the cast bronze building plaque as indicated on the Contract Drawings, as needed for a complete and proper installation.

B. Related Work:

1. Documents affecting work of this Section include, but are not necessarily limited to the GENERAL CONDITIONS, and Sections in DIVISION 1 - GENERAL REQUIREMENTS of these Specifications.

1.2 SUBMITTALS

A. Comply with pertinent provisions of Section 01340 - SUBMITTALS in DIVISION 1 - GENERAL REQUIREMENTS of these Specifications.

B. Product Data: submit:

1. Manufacturer's specifications and other data needed to prove compliance with the specified requirements;

2. Details of installation and anchorage sufficient to enable proper interface of the work of this Section with the work of other trades; and

3. Manufacturer's recommended installation procedures which, when approved by the City Engineer or the Consultant, will become the basis for accepting or rejecting actual installation procedures used on the Work.

C. Contractor shall submit a full size reproduction drawing of a typical layout for the plaque, showing the text and graphics in the actual size, style and letter spacing.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled laborers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Comply with pertinent provisions of DIVISION 1 - GENERAL REQUIREMENTS of these Specifications.

B. The plaque shall not be fabricated and delivered to the job-site before the Consultant or City Engineer has reviewed the Shop Drawings and returned to the Contractor.
PART 2 PRODUCTS

2.1 MANUFACTURERS - PLAQUES

A. Subject to compliance with the specified requirements, the plaque shall be the product of Architectural Signing Inc., Marina Del Rey, CA., or an "Or equal" product of one of the following:

1. The Southwell Company.
3. Mathews Bronze.

2.2 MATERIALS

B. Accessories: Type recommended by manufacturer, best suited for intended application.

2.3 IDENTIFICATION PLAQUE

A. Tablet: Bronze; size, letter sizes, style and sign content shall be as indicated on the drawings. However, the sign content is subject to change. Accordingly, the final design of the plaque shall be as directed by the Consultant and City Engineer, and in accordance with the approved shop drawings.

1. Mounting: Concealed; threaded bolts screwed into back of plate for insertion into holes in concrete wall.

2.4 PLAQUE FABRICATION

A. Tablet: Cast free of pits and gas holes.
B. Letters: Sharp and well defined.
C. Mounting: Concealed.

2.5 PLAQUE FINISHES

A. Letters: Satin finish faces.
B. Border: Satin finish.
C. Background: To be determined by City Engineer and Architect.
D. Shop Finishing: Chemically clean and spray the plaque with 2 coats of ultraviolet resistant clear acrylic lacquer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.
B. Verify field measurements.
C. Verify that components required to be built in to receive the work of this Section are in place, properly located, and ready to receive the work.

D. Beginning installation means acceptance of existing conditions.

3.2 PREPARATION

A. Protect elements surrounding the work of this Section from damage or disfigurement.

3.3 INSTALLATION

A. Install the work of this Section in accordance with manufacturer's instructions.

B. Tolerances

1. Maximum Variation From Level and Plumb: 1/32 inch.

3.4 CLEANING

A. Clean the plaque in accordance with manufacturer's instructions, so that work is clean at the time of Completion.

3.5 PROTECTION

A. Protect finished installation.

END OF SECTION
PART 1   GENERAL

1.1   SUMMARY

A. Furnish and install the monument sign as directed by the Owner.

1.2   SUBMITTALS

A. Product Data: Submit the manufacturer’s construction details relative to design, materials, dimensions of individual components, profiles, and finishes for each type of sign required.

B. Shop Drawings: Provide shop drawings for fabrication and erection of signs. Include plans, elevations, and large-scale sections of typical members and other components. Show anchors, grounds, reinforcement, accessories, layout, and installation details.

C. Submit samples of finishes for approval.

1.4   QUALITY ASSURANCE

A. UL and NEMS Compliance: Provide lighting and electrical components for illuminated signs that are labeled and listed by UL and comply with applicable NEMA standards.

B. Design Criteria: The Owner will provide additional information necessary to design the sign, including sizes, profiles, and dimensional requirements of signs.

C. Field Measurements shall be performed by the Contractor to ensure that the monument sign is properly positioned and located. Take field measurements prior to preparation of shop drawings and fabrication. Show recorded measurements on final shop drawings.

PART 2   PRODUCTS

2.1 MONUMENT SIGN

A. Materials shall be as indicated on the drawings, and especially selected for quality and aesthetic effect. Finishes shall match the approved samples.

PART 3   EXECUTION

3.1 INSTALLATION

Install the monument sign level, plumb, and at the position indicated, with sign surfaces free from distortion or other defects in appearance.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Provisions of Division 01 apply to this section.

B. Section Includes:

1. Single Tier Lockers at Locker Rooms:
   a. Dimensions: 72" h x 18" w x 22" d,
   b. Construction: Integrated Frame All Welded
   c. Lock: Single Point Latch, Padlock with Key Control
   d. Door Type: Solid, no louvers
   e. Mounting: Concrete curb
   f. Accessories: Hat Shelf, Double Prong Ceiling Hook, (2) Single Prong Wall Hooks

2. Six Tier Lockers at Report Writing
   a. Dimensions: 72" h x 12" w x 12" d,
   b. Construction: Integrated Frame All Welded
   c. Lock: Coin Return Lock
   d. Door Type: Solid, no louvers
   e. Mounting: Closed stile base
   f. Accessories: none

1.2 SUBMITTALS

A. Shop Drawings: Submit Shop Drawings indicating locker sizes, locations, and construction details. Indicate size and location of accessories, and mounting heights of hardware.

B. Material Samples: Submit color chips of manufacturer's standard colors for selection by Architect.

C. LEED Data: Provide special submittals conforming to Section 01022 – Environmental Procedures for the following:

1. LEED Credit MR Cost Data: Provide special materials cost data breakdown data for the following materials. Provide separate data for each different manufacturer used:
   a. Lockers (steel)
2. LEED Credit MRc5.1: Provide manufacturer name and location data for the following materials. Provide separate data for each different manufacturer used:
   a. Lockers (steel)

1.3 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer: Regularly engaged in manufacturing metal lockers for at least 5 years.
   2. Installer: Trained and certified by the equipment manufacturer.

1.4 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the Project site with manufacturer's labels intact and legible.

B. Protect metal lockers before, during and after installation. In case of damage, immediately provide necessary repairs and/or replacements as required.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Subject to compliance with specified requirements, lockers shall be Hallowell Model H1005 Single Point All Welded Products, or “or equal” products by the following manufacturers:
   1. Lyon Metal Products Inc.
   2. Republic Storage Systems Co. Inc.
   3. Penco Products.

2.2 FABRICATION

A. Frames: Constructed from 16 gage steel integral frame and sidewall construction with a continuous door stop on each side of frame, and at least 16 gage steel channel cross angles welded at corners. Bodies shall be at least 16 gage cold-rolled steel, with bottoms and intermediate bottoms totally enclosed and bolted. The bottoms and intermediate bottoms will not have more than a 1/16 inch gap at the notches at any assembly point (sides, backs, door stops, etc.). Excess holes punched or drilled are not permitted.

B. Doors:
   1. Doors shall be at least 14 gage cold-rolled steel, solid panel without louvers.
   2. Doors shall be provided with non-corrosive number plates having figure approximately 3/8 inch high etched into metal, finished in black enamel and fastened with binder-head bolts, or rivets. Split rivets are not permitted. Doors shall be bolted to each hinge with 2 binder truss-head machine screws no-slot head, 3/16 inch x 7/16 inch minimum. Locker numbering sequence will be provided by the Owner.
   3. Single tier lockers shall be equipped with recessed handle, single point latch, and padlock with key control.
4. Six tier lockers shall be equipped with Safe-O-Mat (or equal) coin return locks, removable 6 pin cylinder, with 1 user key each with square handle and swivel, 1 outer information sign, mounting screws, lock operation ser for the insertion of either 1 or 2 coins or tokens.

5. Hinges shall be 16 gage, continuous piano type.

C. Hooks and Coat Rods: Hooks shall be smooth, and rustproof and shall be fastened with 2 bolts each. Provide one hat shelf, one double prong ceiling hook, and 2 single prong wall hooks.

D. Exposed ends, backs and tops hoods, shall be 16 gage cold-rolled steel.

E. Parts shall be finished before assembly; fastenings shall be cadmium-plated.

F. Lockers shall be furnished with built-in master keyed combination locks. Each shall be furnished with separate control keys; 12 each for 36 keys. Control key numbers shall be obtained from the Owner.

G. Accessories: Lockers shall be furnished with continuous sloping tops. Lockers shall be furnished with metal legs and skirts unless they are installed on a raised concrete curb and/or platform. Provide 16 gage cold-rolled steel trim, cap strips, filler strips, corner fillers, and other items required for a complete assembly. Caulk locker frame to the adjoining walls if the gap between the locker and wall is less than 3/8 inch.

1. Six tier lockers shall have metal legs and skirts.

2. Curb mounted lockers shall be anchored to the concrete.

2.3 FINISH

A. Before enamel is installed, surface of the steel shall be phosphatized in a 5-stage process to inhibit corrosion. Surfaces shall be finished with a heavy coat of baked-on enamel. Dry film thickness shall be 1 mil for interior surfaces except interior of door. Exterior surfaces and interior of door shall be 2 mils minimum.

2.4 LOCKERS

A. Lockers shall be furnished with right-hand doors, unless otherwise indicated.

B. Single-tier 72-inch high lockers shall be furnished with one shelf, 9 inches from top of locker.

C. Accessible lockers shall be furnished in the quantities required in CBC 1115B.6.4 with a shelf, coat hook, hardware, and signage.

PART 3 EXECUTION

3.1 INSTALLATION

A. Locker banks shall be fabricated with independent backs.

B. Installation of lockers shall be in accordance with manufacturer's written recommendations and reviewed Shop Drawings. Installation shall meet requirements of Department of Health Services codes. Installed lockers shall comply with ADA and CBC requirements.
C. Provide and install trim, sloped and hoods, tops, cap strips, end and back panels, filler strips, corner fillers and any other items required to complete installation in accordance with manufacturer’s written recommendations and this Specification. Exposed ends, tops, and backs shall be 16 gage cold-rolled steel and painted to match new lockers.

D. Lockers shall be completely assembled and ready for installation prior to delivery to the Project site. The lockers shall be set plumb and securely fastened in place. Bottom of lockers shall be reinforced to prevent distortion from anchoring devices.

E. Tie-backs and angle clips must be installed every 4 feet or less on lockers.

F. The back shall be secured with a minimum thickness of 5/16 inch, minimum embedment 2 inches.

3.2 CLEANUP

A. Remove rubbish, debris, and waste materials and legally dispose of off the Project site.

3.3 PROTECTION

A. Protect the Work of this section until Substantial Completion.

END OF SECTION
PART 1   GENERAL

1.1 SUMMARY
   A. Furnish and install fire extinguishers and fire extinguisher cabinets as indicated on the
      Contract Drawings and as directed by the City Engineer.

1.2 SUBMITTALS
   A. Submit product data for the fire extinguisher.

1.3 QUALITY ASSURANCE
   A. Single-Source Responsibility: Obtain fire extinguishers one source from a single
      manufacturer.
   B. UL-Listed Products: Fire extinguishers UL-listed and bear UL “Listing Mark” for type, rating,
      and classification of extinguisher.

PART 2   PRODUCTS

2.1 MANUFACTURERS
   A. Manufacturers: Manufacturers offering products that comply with specified requirements
      include:
      1. J.L. Industries.
      2. Larsen’s Manufacturing Co.
      3. Modern Metal Products by Muckle.

2.2 FIRE EXTINGUISHERS
   A. General: Provide fire extinguishers for each extinguisher cabinet, in colors and finishes
      selected by Architect from manufacturer's standard, which comply with requirements of
      governing authorities.
      1. Fill and service extinguishers to comply with requirements governing authorities and
         manufacturer.
      2. Abbreviations indicated below identify extinguisher types related to UL classification
         and rating system and not necessarily to type and amount of extinguishing material
         contained in extinguisher.
   B. Multipurpose Dry Chemical Type: UL-rated 2-A:10-B:C, 5-LB and 4A-80B:C, nominal capacity.

2.3 FIRE EXTINGUISHER CABINETS
   A. General: Provide fire extinguisher cabinets where indicated, of suitable size for housing fire
      extinguishers of types and capacities indicated.
   B. Recessed: Provide suitable box (tub) recessed in walls of sufficient depth to suit style of trim
      indicated. Recess into stud walls and CMU.
C. Door Material and Construction: Manufacturer’s standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.

1. Fire Rated: Provide fire rated fire extinguisher cabinets when located in one (1) hour walls. Fabricated in accordance with UBC 43-6 (ASTM E814-88).

2. See attached FE Schedule.

D. Identification: Identify fire extinguisher in cabinet with lettering spelling “FIRE EXTINGUISHER” applied to door as indicated on the FE Schedule. Provide lettering to comply with requirements indicated for letter style, color, size, spacing, and location or, if not otherwise indicated, as selected by the City Engineer.


E. Door Style: Manufacturer’s standard design, with locking hardware.

1. See the FE Schedule

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fire extinguishers in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.

3.2 FE SCHEDULE

FE-1
Description: Fire Extinguisher Cabinet-Public Areas
Manufacturer: Larsen’s Manufacturing Company
Product: Architectural Series
Model No: SS-2409-R1
Mounting: Fully Recessed
Trim: 5/16” Flat
Door Type: Vertical Duo
Extinguisher Model: MP5
UL Rating: 2A-10B:C
Accessories: Larson Loc, Vigilante Alarm

FE-2
Description: Fire Extinguisher Cabinet-Employee Areas
Manufacturer: Larsen’s Manufacturing Company
Product: Architectural Series
Model No: SS-2409-R1
Mounting: Fully Recessed
Trim: 5/16” Flat
Door Type: Vertical Duo
Extinguisher Model: MP5
UL Rating: 2A-10B:C
Accessories: None

FE-3
Description: Detention Fire Extinguisher Cabinet
Manufacturer: Larsen’s Manufacturing Company
Product: DEC Series
<table>
<thead>
<tr>
<th>Model No:</th>
<th>S-DEC2409-R</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting:</td>
<td>Fully Recessed</td>
</tr>
<tr>
<td>Lock:</td>
<td>HSL II Deadlock</td>
</tr>
<tr>
<td>Extinguisher Model:</td>
<td>MP5</td>
</tr>
<tr>
<td>UL Rating:</td>
<td>2A-10B:C</td>
</tr>
<tr>
<td>Accessories:</td>
<td>White Baked Enamel Finish with Red Letters</td>
</tr>
</tbody>
</table>

**FE-4**

Description: Fire Rated Extinguisher Cabinet  
Manufacturer: Larsen's Manufacturing Company  
Product: Architectural Series  
Model No: SS-FS2409-R1  
Mounting: Semi Recessed  
Door Type: Vertical Duo  
Extinguisher Model: MP5  
UL Rating: 2A-10B:C  
Accessories: None

**FE-5**

Description: Fire Extinguisher Cabinet  
Manufacturer: Larsen's Manufacturing Company  
Product: Architectural Series  
Model No: AL-2409-SM  
Mounting: Surface Mounted  
Door Type: Solid  
Extinguisher Model: MP10  
UL Rating: 4A-80B:C  
Accessories: Larson Loc, black Type A Die Cut Letters

END OF SECTION
SECTION 10671
METAL STORAGE SHELVING

PART 1  GENERAL

1.1  SUMMARY
A. This Section includes post and shelf storage units.

1.2  SUBMITTALS
A. Product Data: For each type of metal storage shelving specified. Include details of construction and connections relative to materials, dimensions of individual components, accessories, and finishes.
B. Shop Drawings: Include fabrication and assembly of metal storage shelving post-to-shelf connections, bracing, and attachments to other work.
C. Samples: Of each exposed product and for each color and texture required, not less than 3 by 3 inches (75 by 75 mm) in size.
D. Maintenance Data: For metal storage shelving to include in the maintenance manuals specified in Division 1.

1.3  EXTRA CONNECTORS
A. Connector Units: Furnish full-size shelf-to-post connectors. Deliver to Owner in neat packages.

PART 2  PRODUCTS

2.1  MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Adapto Steel Products.
   2. Lyon Metal Products, Inc.
   3. Penco Products, Inc.

2.2  MATERIALS
A. Steel Sheet: ASTM A 366 (ASTM A 366M) matte finish, suitable for exposed applications, and stretcher leveled or roller leveled to stretcher-leveled flatness.

2.3  SHELVING (SEE SHELVING SCHEDULE AT THE END OF THIS SECTION)
A. Shelving Units: Provide open shelving consisting of posts, shelves, and connectors of size, material, and assembly to comply with MH 28.1 an evenly distributed shelf load.
B. Shelving Unit Bracing: Provide as required for stability and load-carrying capacity.

C. Post Base: Steel foot plate drilled for mechanical attachment to floor with bolt leveler.

D. Shelves: Adjustable over the entire height of the post and as follows:
   1. Solid steel sheet as indicated, with raised edge perimeter, of thickness required for loading capacity.

2.4 FABRICATION

A. Fabricate metal storage shelving square and rigid with posts plumb and true, and shelves flat and free of dents or distortion. Fabricate exposed metal edges free of sharp edges and burrs. Fabricate connections to form a rigid structure, free of buckling and warping.

B. Fabricate shelves from one-piece steel sheet.

2.5 BAKED ENAMEL SHEET FINISHES

A. Surface Preparation: Clean surfaces of dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel.

B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked-enamel finish consisting of a thermosetting topcoat. Comply with paint manufacturer's instructions for applying and baking to achieve a minimum dry film thickness of 1.1 mils (0.028 mm) on posts and shelves.
   1. Color and Gloss: As selected by the Architect from manufacturer's full range of colors and glosses.

PART 3 EXECUTION

3.1 INSTALLATION

A. Comply with metal storage shelving manufacturer's written installation instructions and the California Building Code for Seismic Zone 4.

B. Install metal storage shelving level, plumb, square, and true.

C. Anchor shelves to construction by method recommended by manufacturer's written instructions.
   1. Shim foot plates as required to level shelving units prior to anchoring to floor.

D. Install shelves at spacing indicated or, if not indicated, at equal spacing in each unit.

E. Install bracing as recommended by manufacturer and as required for stability, extending and fastening members to supporting structure.

3.2 SHELVING SCHEDULE

<table>
<thead>
<tr>
<th>IS-5</th>
<th>Description:</th>
<th>Automotive Tire Rack</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dimensions:</td>
<td>72” w x 84” h</td>
</tr>
<tr>
<td></td>
<td>Shelf Quantity:</td>
<td>3</td>
</tr>
<tr>
<td>Description</td>
<td>Specification</td>
<td></td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------------------</td>
<td></td>
</tr>
<tr>
<td>Shelf Capacity</td>
<td>990 lbs</td>
<td></td>
</tr>
<tr>
<td>Shelf Construction</td>
<td>Tire beam</td>
<td></td>
</tr>
<tr>
<td>Accessories</td>
<td>Foot Plate</td>
<td></td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1   GENERAL

1.1    SUMMARY

A. Furnish and install locker room benches as indicated on the drawings and specified.

1.2    SUBMITTALS

A. Submit product data and illustrations describing the materials and finishes, including details of construction, dimensions, and profiles, method of installations.

1.3    QUALITY ASSURANCE

A. Single-Source Responsibility: Provide benches produced by the same organization that manufactured the associated lockers.

B. Coordinate bench locations, installation, and sequencing with other work to avoid interference and to assure proper installation, operation, adjustment, and cleaning.

PART 2   PRODUCTS

2.1   LOCKER ROOM BENCHES

A. Provide the locker manufacturer’s standard units with laminated hardwood or solid stock seat of the species and dimensions indicated on the drawings. Furnish galvanized steel pedestal supports not more than 4'-0" o.c., with provisions for fastening to floor and securing to bench.

1. Hardwood shall be White Oak or Maple whether laminated or solid stock.

2. Joints in seats shall be glued together spliced, nd doweled and shall occur only over supports.

3. Finish wood with sealer and 2 coats over supports.

B. Furnish galvanized escutcheons, fasteners and anchorages. Apply manufacturer’s standard transparent coating to bench seat and prime and finish all metal parts with baked enamel, color as selected by the Architect.

PART 3   EXECUTION

3.1    INSTALLATION

Install locker room benches in accordance with manufacturers’ instructions, using materials and fasteners indicated on the drawings or appropriate to substrate and recommended by manufacturer of bench. Install benches plumb and level, firmly anchored in locations and at the proper height. Clean all exposed surfaces in accordance with manufacturer’s recommendations after removing and protective coatings.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY
A. This Section includes the following:
   1. Steel lockers, including the following:
      a. Evidence lockers.

1.2 SUBMITTALS
A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.
B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of locker and bench.
C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other Work.
   1. Show locker fillers, trim, base, sloping tops, and accessories. Include locker-numbering sequence.
D. Samples For Color Selection: Manufacturer's color charts showing the full range of colors available for units with factory-applied color finishes.
E. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals specified in Division 1.

1.3 DELIVERY, STORAGE, AND HANDLING
A. Do not deliver lockers until spaces to receive them are clean, dry, and ready for locker installation.
B. Protect lockers from damage during delivery, handling, storage, and installation.

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Manufacturer: Subject to compliance with requirements, provide products by one of the following:
   1. Evidence Lockers:
      a. DSM Law Enforcement Products.
      b. Montel.
   2. Model Numbers (Based on DSM Law Enforcement Products EDLC series or equal)
a. Model 01  
b. Model 15  
c. Model 16C-01  
d. Model 05C-01

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 366/A 366M, matte finish, suitable for exposed applications, and stretcher leveled or roller leveled to stretcher-leveled flatness.

B. Fasteners: Zinc- or nickel-plated steel, slotless-type exposed bolt heads, and self-locking nuts or lock washers for nuts on moving parts.

2.3 EVIDENCE LOCKERS

A. Body: Form backs, tops, bottom, base, sides and intermediate partitions from steel sheet. Comply with the following:

1. Exterior components: 0.0625 inch (1.58 mm).
2. Base: 0.0781 inch (1.98 mm).
3. Interior Skin: 0.050 inch (1.27 mm).

B. Cabinets: Fabricate with corners welded and ground smooth. Provide base with floor leveling adjusters accessible through a removable shelf in base.

1. Cabinet to be pass through type.

C. Doors shall be solid 16 gage one-piece sheet steel, self closing doors. Equip with door stop to prevent door from opening past 90 degrees. Reinforce doors as required to maintain stiffness. Provide bumpers for cushioning the closing of the door.

1. Rear doors to be full size mesh to allow access to multiple compartments. Door shall have multiple locking points operated by single lever which is not accessible from the front of the cabinet.

2. Handles: Provide projecting handle and latch in recessed opening in door, chromium plated heavy duty, vandal resistant, tee handle with 3 point latching system.

3. Provide numbering plate on front doors.

D. Hinges: Continuous type with non-removable pin.

E. Locks: Manufacturer’s standard non-electric keyless lock for front doors.

1. Once locked, the lock can only be unlocked from back.

2. Provide locking instruction plate near lock.

F. Options

1. Furnish manufacturer’s front door lockout system for removal of evidence from rear doors.

2. Front trim kit.
2.4  FABRICATION

A. Unit Principle: Fabricate each locker with an individual door and frame, individual top, bottom, back, and shelves, and common intermediate uprights separating compartments.

B. Knocked-Down Construction: Fabricate steel lockers for nominal assembly at Project site.
   1. Evidence lockers to be fully assembled units.

C. Fabricate lockers square, rigid, and without warp, with metal faces flat and free of dents or distortion. Make exposed metal edges free of sharp edges and burrs, and safe to touch. Weld frame members together to form a rigid, one-piece assembly.
   1. Form locker-body panels, doors, shelves and accessories from one-piece steel sheet, unless otherwise indicated.

2.5  FINISHES, GENERAL

A. Finish all steel surfaces and accessories, except chrome-plated surfaces.

B. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

D. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.6  STEEL SHEET FINISHES

A. Surface Preparation: Clean surfaces of dirt, oil, grease, mill scale, rust, and other contaminants that could impair paint bond. Use manufacturer's standard methods.

B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard powder coating or baked-enamel finish consisting of a thermosetting topcoat. Comply with paint manufacturer's written instructions for applying to achieve a minimum dry film thickness of 1.4 mils (0.036 mm) on doors and frames, and 1.1 mils (0.028 mm) elsewhere.

PART 3 - EXECUTION

3.1  EXAMINATION

A. Examine concrete bases for suitable conditions where steel lockers are to be installed.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.
3.2 INSTALLATION

A. Install metal lockers and accessories level, plumb, rigid, and flush according to manufacturer's written instructions.

B. Assemble knocked-down lockers with standard fasteners, with no exposed fasteners on door faces and face frames.

C. Anchor lockers to floors and walls at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Install anchors through backup reinforcing plates where necessary to avoid metal distortion, using concealed fasteners.

D. Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.

3.3 ADJUSTING, CLEANING, AND PROTECTION

A. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

B. Clean interior and exposed exterior surfaces and polish nonferrous-metal surfaces.

C. Protect lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit locker use during construction.

D. Touch up marred finishes, or replace locker units that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION
PART 1 GENERAL

1.1 DESCRIPTION

A. The Work specified in this Section includes providing toilet accessories where indicated on the Contract Drawings, as specified herein, and as needed for complete and proper installation.

1.2 RELATED WORK

A. Documents affecting Work of this Section include the GENERAL CONDITIONS, and Sections in DIVISION 1 - GENERAL REQUIREMENTS of these Specifications.

B. Installation of furnishing concealed support devices for the Work of this Section, specified in other pertinent Sections of these Specifications.

1.3 SUBMITTALS

A. Comply with applicable provisions of SECTION 01330 of DIVISION 1 - GENERAL REQUIREMENTS of these Specifications.

B. Product Data: Within 40 calendar days after the Contractor has received the City's "Notice to Proceed" submit the following:

1. Complete materials list of all items proposed to be furnished and installed under this Section.

2. Manufacturer's specifications and other data required to prove compliance with specified requirements.

3. Manufacturer's recommended installation procedures which, when approved by the City Engineer will become the basis for accepting or rejecting actual installation procedures used on the Work.

4. Complete descriptive data on fasteners proposed for each type of wall or partition construction, recommended mounting locations and mounting instructions.

C. Shop Drawings: Submit for approval for each item specified under this Section. Indicate location of backing required to attach to wall or ceiling-support items.

D. Samples: If requested by the City Engineer, submit one full size sample of each specified item. After approval samples may be installed if they are identified and their locations are noted.

E. Non-Stock Items: When so specified submit complete Shop Drawings to the City Engineer for approval.

1.4 QUALITY ASSURANCE

A. Use only skilled workers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.
B. Qualifications of Manufacturers: Products shall be produced by manufacturers regularly engaged in the manufacture of toilet room accessories and with a history of successful production acceptable to the City Engineer.

1.5 DELIVERY, STORAGE AND HANDLING

A. Delivery: Deliver materials to the job-site in unopened suitable packaging properly identified with the manufacturer's labels indicating manufacturer's name, product name and model number.

B. Storage: Store materials where directed by the City Engineer, in a location under cover, safe from weather and damage by construction operations.

C. Protection: Use all reasonable means necessary to protect materials before, during and after installation. In the event of damage, to specified items immediately make necessary repairs and/or replacements to the full approval of the City Engineer, at no added cost to the City.

1.6 GENERAL REQUIREMENTS

A. Warranty: Comply with provisions of the GENERAL CONDITIONS of these Specifications which shall include a 12-month warranty period which covers parts and labor; effective date of the warranty being the date of acceptance by the City.

1.7 REFERENCES

A. ANSI A117-1986 Specifications for making buildings and facilities accessible to and usable by physically disabled persons.

B. UBC - Chapters 5 and 33 Requirements for the Disabled.

C. Title 24, California Code of Regulation, Parts 2, 3, and 5.


E. Fair Housing Amendments Act of 1988, Accessibility Guidelines, Federal Register Volume 56, Number 44.

PART 2 PRODUCTS

2.1 GENERAL

A. Anchors and Fasteners: Provide anchors and fasteners capable of developing a retaining force commensurate with the strength of the accessory to be mounted or installed and well suited for use with supporting construction. Where exposed fasteners are permitted, provide oval head fasteners (vandalproof type) with finish matching the accessory item.

B. Finish: Shall be free of defects.

2.2 ACCEPTABLE MANUFACTURERS

A. Except as otherwise specified, provide products manufactured by Bobrick Washroom Equipment North Hollywood, CA (818) 764-1000 and Easterday Janitorial Supply Company or equal approved in advance by the City Engineer. The Easterday products shall not be substituted because these are standard City accessories.
2.3 TOILET ROOM ACCESSORIES

A. Toilet Room Accessories Schedule

1. Recessed Toilet Seat Cover Dispenser: Bobrick B3013

2. Sanitary Napkin Dispenser and Disposals. (Women's Restrooms Only)
   a. Dispensers: Recessed, Type 304 stainless steel, satin finish, tumbler lock, single 25 cent coin operation. ASI 0864, Bobrick B3500, napkin/tampon dispenser, or equal.
   b. Disposals: Surface-mounted, Type 304 stainless steel, satin finish, and tumbler lock. ASI 0473-A, Bobrick B-254, or equal.


4. Soap Dispenser: Kimberly Clark Model 92194.


7. Mirror: Bobrick No. B-2808 Series (with tempered glass) in men's and women's restroom

8. 36" Grab Bar: Bobrick No. B6806 with 256 anchor plate, and peened gripping surface


2.4 OTHER MATERIALS

A. Provide other materials, not specifically described but required for a complete and proper installation, as selected by the Contractor subject to advanced written approval of the City Engineer.

PART 3 EXECUTION

3.1 INSPECTION OF CONDITIONS

A. Examine the areas and conditions under which Work of this Section will be installed. Correct conditions detrimental to the proper and timely completion of the Work. Do not proceed until detrimental conditions have been corrected. All detrimental conditions shall be corrected as directed and approved by the City Engineer, before proceeding with Work of this Section. Start of installation operations shall imply Contractor's acceptance of job conditions.

3.2 COORDINATION

A. Throughout construction of substrate surfaces, use all means necessary to ensure proper and adequate provisions for concealed support devices and for finished openings to receive the Work of this Section.
3.3 INSTALLATION

A. General:

1. Locate accessories as indicated on the Contract Drawings or as otherwise directed by the City Engineer.

2. Securely attach accessories to adequate supports with concealed approved vandal-proof fasteners.

3. Install accessory items as per manufacturer’s recommendations, mount flush and plumb with adjacent wall surfaces.

4. Installation and locations shall comply with State of California (CAL/ABL) California Architectural Barriers Laws, Title 24 and ADA.

5. Install each item in its proper location, firmly anchored into position, level and plumb, and in accordance with the manufacturer’s recommendations.

B. Adjustment: Before final inspection, inspect each accessory item installation for rigid and secure installation. Take necessary adjustment action for rigid and secure installations.

3.4 CLEAN-UP

A. Comply with applicable provisions of Section 01710 - CLEANING of DIVISION 1 - GENERAL REQUIREMENTS of these Specifications.

B. Remove all excess materials, equipment, rubbish and debris from the job-site. All areas in the library structure used by the Contractor to be left in a clean and safe condition.

END OF SECTION
SECTION 10910
BABY DIAPERING STATION

PART 1   GENERAL

1.1   SECTION INCLUDES

A. Furnish and install baby diapering station as indicated on the drawings and specified

1.2   SUBMITTALS

A. Shop Drawings and Product Data: Submit Shop Drawings and Product Data for approval.

B. Samples: Submit color samples of proposed or selected materials for approval.

PART 2   PRODUCTS

2.1   BABY DIAPERING STATION

A. Subject to compliance with specified requirements, provide ASI Model No. 9010, or "or equal" products of one of the following:

1. American Infant Care Products
2. Brocar Products Inc.
3. Koala Corporation

B. Baby diapering station shall be fabricated of FDA approved high impact plastic with sanitary disposal liners, and safety holding straps. Form units without sharp corners. The platform shall be formed to conform to baby's contours, and equipped with shock absorbers to ensure smooth operation. Opening and closing shall be accomplished with 25 pounds of force or less.

C. Baby diapering station shall be suitable for use by handicapped persons, and conform to ADA requirements.

D. Provide tamper resistant fasteners and steel backer plates for concealed anchorage.

PART 3   EXECUTION

3.1   INSTALLATION

A. Install baby diapering station and specialties according to the manufacturer's instructions, and in compliance with the approved shop drawings. Locate as indicated on Drawings.

B. Install baby diapering station plumb, true and square, in a neat, rigid, and substantial manner. After erection, clean surfaces and touch up with factory furnished matching finish. Adjust hardware and leave in good operating condition.

END OF SECTION
PART 1 GENERAL

1.01 SECTION INCLUDES

A. Furnish protective equipment for the sole use of the Director's Representative and staff. Include a minimum 2 hours of protective equipment training in accordance with governing regulations for no more than 10 persons on the Director's Representative’s staff.

1.02 SUBMITTALS

A. Waiver of Submittals: The "Waiver of Certain Submittal Requirements" in Section 01330 does not apply to this Section.

B. Submittals Package: Submit the product data and quality control submittals specified below at the same time as a package.

C. Product Data: Catalog sheets, specifications, and installation or use instructions. Submit within 5 days after award of Contract.

D. Quality Control Submittals:

1. Training Firm's Qualifications Data: Name, business address, and telephone number of the firm who will be performing the protective equipment training.

E. Contract Closeout Submittals:

1. Bill of Sale and Receipts: Deliver original bill of sale and receipts for each piece of equipment.

1.03 SCHEDULING

A. Provide protective equipment training and furnish protective equipment, ready for use by the Director's Representative and staff, within 30 days after award of Contract.

PART 2 PRODUCTS

2.01 PROTECTIVE EQUIPMENT

A. Portable Gas Monitor: Four-gas portable monitor (LEL, O2, CO, H2S), Passport Kit No. 801092 by MSA Company, PO Box 426, Pittsburgh, PA 15230, (800) 672-2222.

1. Kit Includes: Remote sampling pump, 110V charger, one foot sample probe with hydrophobic filter, and 10 foot sampling line.

B. Calibration Kit: Complete kit, No. 477149 by MSA.


C. Carrying Case: No. 633638 by MSA.
D. Passport Video Tape: No. VT-SP-6 by MSA.

E. Confined Space Retrieval Kit: No. 696540 by MSA.
   1. Kit Includes: Lowering/Arresting/Retrieving (L/A/R) device with full-arrest braking system, quick insert locking pins, 50 foot retractable lifeline with snaphook at one end and pulley with attachment carabiner. Work winch for use with L/A/R device for maneuvering material to tethered worker, complete with quick insert locking pins, 88 foot cable with carabiner. Tripod assembly complete with security chain, telescoping legs with quick insert locking pins and tripod head with attachment eyelets. Carrying bag to hold complete retrieval kit.

F. Coverall/Harness: Quick-on Coverall/Harness, Part No. 495953 or 495954 Nomex III by MSA.
   1. Size as determined by the Director's Representative.

G. Escape Self Contained Breathing Apparatus (SCBA): Ten minute bottle, 2216 psi, plastic hood by Survivair, ISI, North, or Life air.

H. Ventilation Blower: Minimum 600 CFM, 15 amp maximum, UL listed with 20 foot hose, 8 inch hose to hose coupler, 100 foot heavy duty extension cord, and GFI protection by Mopeco, Allegro, Coppus, or Pelsue.
   1. Operation: Gas.

I. Hard Hat: ANSI Standard Z 89.1 brimless shell with peak, nylon web suspension and sweat band by American All Safe, Sentry III, or SN III.

J. Gloves: Leather, sturdy and slip resistant work gloves by Pioneer, North, or Best.
   1. Size as determined by the Director's Representative.

K. Boots: 17 inch high waterproof rubber with top strap, buckle and sure grip cleated outsole by Rainfair or Servus by Lab Safety Supply (800) 356-0783.

PART 3 EXECUTION

3.01 INSTALLATION
   A. Place equipment in storage, at the Site as directed.

3.02 OWNERSHIP
   A. Upon completion of this Project, furnish Bill of Sale and transfer of ownership of all items included in this Section to the State of New York, Office of General Services.

END OF SECTION
PART 1 - GENERAL
1.1 DESCRIPTION
   A. This section specifies factory finished vault door complete with frame, hardware, threshold and day gate.

1.2 SUBMITTALS
   A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
   B. Shop Drawings: Vault door and day gate showing size, material, finish and relation to adjacent construction.
   C. Manufacturer's Literature and Data:
      1. Vault door, combination lock and day gate.
      2. Installation instructions.

1.3 APPLICABLE PUBLICATIONS
   A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by basic designation only.

   B. Federal Specifications (Fed. Spec.):
      AA-D-00600C.............................Door, Vault, Security
      FF-L-2740 ..................................Locks, Combination

PART 2 - PRODUCTS
2.1 VAULT DOOR
   A. Fed. Spec. AA-D-600, Class 5, // Type IIR (right open swing) // Type IIL (left open swing) // Style H, (Hand change combination lock).

2.2 COMBINATION LOCK
   A. Fed. Spec. FF-L-2740, Model HC-(Hand change combination), Class FR-(Front reading), Type Y-(Tube type), Size LD-Large dial).

2.3 DAY GATE
   A. Vault door shall have self-closing metal day gate of expanded mesh or solid bars finished to match vault door and frame.
B. Furnish gate with an automatic locking device controlled by key on the outside of gate, and thumb throw latch release on the inside of the gate, with thumb throw accessible only to the inside.

C. Key lock to the pharmacy hardware keysets.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install vault door and day gate in accordance with manufacturer's printed installation instructions and approved shop drawings.
PART 1 - GENERAL

1.1 DESCRIPTION:
   A. Manufacturer's standard commercial product, complete with bullet resistant glazing material, frames, counters with deal trays and other features as specified.
   B. Location:
      //1. Pharmacy. //
      //2. Agent Cashier.//
      //3. Credit Union. //

1.2 RELATED WORK:
   //A. Metal shutter attached to room side of service window frame in fire rated or smoke partitions: Section 08341, OVERHEAD ROLLING SHUTTERS.//
   B. Specification for bullet resistive glazing: Section 08810, GLASS AND GLAZING.

1.3 SUBMITTALS:
   A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
   B. Shop Drawings: Service windows, showing design, construction and installation.
   C. Manufacturer's Literature and Data: Service windows.
   D. Manufacturer's Certificates: Certificates stating that service windows meet the requirements of UL 752 for the specified power rating.

1.4 APPLICABLE PUBLICATIONS:
   A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
   B. American Society for Testing Materials (ASTM):
   C. The National Association of Architectural Metal Manufacturers (NAAMM):
      AMP 500-88 ...............................Metal Finishes Manual
   D. Underwriters Laboratories Inc. (UL):
      752-2000 .................................Safety Bullet-Resisting Equipment

PART 2 - PRODUCTS

SPEC WRITER NOTE: Make material requirements agree with applicable requirements specified in the referenced Applicable Publications. Update and specify only that which applies to the project.
2.1 MATERIALS:
   A. Stainless Steel: ASTM A167, Type 302 or 304.
   B. Bullet Resistive Glazing: Use bullet resistant assembly UL 752, Power Rating for Super-Small Arms ballistic level; glazing assembly G30, G31 or G32 as specified in Section 08810, GLASS AND GLAZING.

   SPEC WRITER NOTE: Service window deal trays for Agent Cashier and Credit Union conforms to UL 752. Service window oversized deal trays for Pharmacy for Prescription dispensing do not conform to UL 752. Assure details show both conditions. Coordinate with Section 08341 to show overhead rolling shutter on room side where service window units are installed in fire rated or smoke partitions. Detail to show elevation of service window and sill counter shelf for standard height and wheelchair height.

2.2 FABRICATION:
   A. Fabricate service windows to conform to UL 752, Power Rating for Super-Small Arms, except for nonconforming oversized deal trays at Pharmacy service windows.
   B. Frames:
      1. Stainless steel not less than 3 mm (0.1094 inch) thick.
      2. Continuous around each opening and with integral glazing stop on corridor side and removable glazing stop on the opposite side.
      3. Miter and weld removable stops at corners, and secure to frames with countersunk screws, spaced as required for power rating protection.
      4. Provide voice communication baffled jamb openings with glazing frame.
      5. Provide three anchors per jamb; anchor types shall be designed to be compatible with the wall construction.
   C. Sill:
      1. Stainless steel not less than 3 mm (0.1094 inch) thick.
      2. Sill to project full width of opening to edge of jamb with extension for writing shelf on both sides of opening; complete with stainless steel deal tray.
      3. Deal tray to comply with UL 752, except deal tray at pharmacy service windows shall permit the passage of a package 38 by 75 by 375 mm (1-1/2 by 3 by 15 inches).
   D. Glazing:
      1. Factory set and glaze bullet resistive glazing material in stainless steel continuous channel frame not less than 3 mm (0.1094 inch) thick.
      2. Secure channel frame to service window frame permitting expansion and contraction.
   E. Finish on Stainless Steel: NAAMM Mechanical Finish Number 4.
PART 3 - EXECUTION

3.1 INSTALLATION:

A. Install service windows in accordance with manufacturers installation instructions. Securely anchor to steel studs masonry and join frame components as shown on shop drawings.

B. Set units accurately, plumb, and level.

C. After installation, clean window unit and protect from damage until completion of project.

END OF SECTION
SECTION 11130
PROJECTION SCREEN

PART 1 – GENERAL

1.1 SUMMARY

A. Section includes:

1. Projection screens
2. Supplementary parts and components such as inserts, clips, fasteners, anchors, and other miscellaneous supports and accessories required for a complete installation.

B. Related work:

1. Suspended ceilings in Division 9.
2. Projector scissors lift in Section 11132.
3. Electrical power and connections to controls and motors of equipment specified in this Section in Division 16.

1.2 SUBMITTALS

A. Procedure: In accordance with Division One.

B. Data: Manufacture data for the screen, rough-in diagrams and installation requirements for screen.

C. Shop drawings:

1. For project-specific conditions not indicated on the manufacturer’s data.
2. Detail interface with ceiling suspension system, including attachment to overhead supports.
3. Show wiring diagrams for electrically-powered equipment.

D. Samples: 12-inch square sample of screen when requested by the City Engineer.

E. Closeout: Copies of manufacturer operation, service and maintenance data, including name, address and telephone number of nearest authorized service representatives for each piece of equipment.

1.3 QUALITY ASSURANCE

A. Regulatory requirements: Assemblies shall be UL listed and shall bear the UL re-examination markers.
B. Installer’s qualifications: Firm approved by the equipment manufacturer and who has completed successful installations similar in material, design and extent to that indicated for project, with a record of successful in-service performance.

C. Engineering responsibilities:

1. Support, other than primary structural system, and attachment of the work of this section are not fully detailed on the Drawings that indicate desired profile and design intent.
2. It is the Contractor’s responsibility to engineer, fabricate and install these assemblies to conform to the profiles indicated and other requirements of the Contract Documents and to satisfy CBC. If required by authorities having jurisdiction, the Contractor shall obtain its approval and pay fees incurred thereby before start of installation.
3. Limit deflection equipment and their support under load to L/360.

D. Warranty: Provide written warranty covering materials and workmanship of all work of this section for a period of 2 years, and repair or replace all material which becomes defective during the warranty period. Continued use of defective equipment shall be available until replacement equipment is delivered.

PART 2 – PRODUCTS

2.1 PROJECTION SCREEN

A. Manufacture/type: Designer to indicate type and manufacturer. Electrically or manual operation. Recessed, wall mounted, ceiling mounted, etc.

B. Screen Size: Designer to indicate size, contrast etc.

PART 3 – EXECUTION

3.1 EXAMINATION/PREPARATION

A. Verify conditions and measurements affecting the work of this section at site.

C. Correct conditions detrimental to the proper and timely completion of this work before proceeding with installation.

D. Furnish inserts and anchoring devices to be set in wall for anchorage of the units. Provide setting drawings, templates, instructions and directions for installation of anchorage devices.

3.2 INSTALLATION

A. Install the work of this Section in compliance with its manufacturer instructions.
B. Set plumb and level and flush with adjacent suspended ceiling where appropriate. Anchor securely to adjacent construction and support to prevent movement, except those intended, during operation.

3.3 FIELD QUALITY CONTROL

A. Upon completion of installation, and after final electrical connections are made, and in the presence of City designated personnel, conduct tests to ensure the proper operation of each piece of moving equipment. Adjust and lubricate as required for safe and efficient operation.

B. Restore marred or abraded surfaces to original condition using same primer used for shop painting or replace damaged components.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes: Roll-up, electrically operated projection screens.

B. Related sections:

1. Section 05500 - Metal Fabrications: Metal [rods] [chains] [bracing] [fasteners] and other support components for suspending projection screens.

2. Section 06100 - Rough Carpentry: Wood blocking for installation of projection screens.

3. Section 09260 - Gypsum Board Assemblies: Suspended gypsum board ceilings to contain recessed projection screens.

4. Section 09510 - Acoustical Ceilings: Suspended acoustical panel ceilings to adjoin recessed projection screens [and ceiling panels to be adhered to closure panels of screen cases].

5. Section 11136 - Motorized Projector Lifts: Motorized projector lifts to be interfaced with screen controls.

6. [Section 12492 - Manually Operated Window Shades] [Section 12493 - Motorized Window Shades] [Section 12494 - Opaque Window Shade System]: Shades for windows in rooms to receive projection screens [and to be interfaced with screen controls].

7. Section 16[___] - [_____________]: Electrical supply, conduit, and wiring for motorized projection screens.

1.2 SUBMITTALS

A. Submit in accordance with Section 01330 - Submittal Procedures:

1. List of proposed products and product data.

2. Shop drawings showing dimensions, method of attachment, structural support, [bracing,] and electrical wiring.

3. Samples of finishes [for selection by Architect].

4. Manufacturer's installation and maintenance instructions.

1.3 QUALITY ASSURANCE

A. Source limitation: Obtain projection screens from single manufacturer as a complete unit including necessary mounting hardware, motor, controls, limit switches, and accessories.
B. Motorized projection screens shall be certified for use in the United States and Canada by Underwriters Laboratory (UL), Inc. and shall bear UL label.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver projection screens until building is enclosed, other construction within spaces where screens will be installed is substantially complete, and installation of screens is ready to begin.

B. Deliver products in manufacturer's original, unopened, undamaged containers with labels intact.
PARTS 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Draper, Inc., 411 South Pearl Street, Spiceland, Indiana 47385-0425; 765-987-7999.

B. Manufacturers of equivalent products submitted and approved in accordance with Section 01630 - Product Substitution Procedures.

2.2 MOTORIZED PROJECTION SCREENS

A. Type: Electrically operated projection screen for [wall] [ceiling] installation consisting of case, screen, motor, controls, electric brake, limit switches, mounting accessories, and other components necessary for complete installation; [Targa] [Premier] [Envoy] [Ambassador] [Signature/Series E] [Signature/Series V] [Paragon] [Rolleramic] [Access/Series E] [Access/Series V] [Ultimate Access/Series E] [Ultimate Access/Series V] [Silhouette/Series E] [Silhouette/Series V] [Artisan/Series E] [Artisan/Series V] as manufactured by Draper, Inc.

B. Method of installation: [Ceiling mounted.] [Wall mounted.] [Projected mounting with [6 inches] [152 mm] extension brackets.] [Mounted in site constructed recess provided under Section [09260 - Gypsum Board Assemblies]].

C. Screen case: Fabricated in one piece from 22-gauge steel sheet with scratch resistant white polyester finish. End caps with integral roller brackets and universal mounting brackets for wall or ceiling mounting, finished to match case.

D. Roller: [3 inches] [76 mm] diameter steel roller mounted on rubber vibration insulators.

E. Viewing surface securely attached to roller at top and at bottom to weighted dowel.

B. Method of installation: [Ceiling mounted.] [Projected mounting with [6 inches] [152 mm] extension brackets.]

C. Screen case: Fabricated in one piece with flat back from 22-gauge steel sheet with baked-on [white] [black] paint finish and 12 gage steel end caps and brackets with epoxy powdercoat finish matching case color. Provide end caps with universal mounting brackets for wall or ceiling mounting.

D. Roller: [3 inches] [76 mm] diameter steel roller mounted on rubber vibration insulators.

E. Viewing surface securely attached to roller at top and at bottom to weighted dowel. Provide each side of viewing surface with black masking borders and tab-guide cable tensioning system to maintain even lateral tension and to hold surface flat. Top of screen masked by 12” (30 cm) black drop.

F. Method of installation: Suspended recessed ceiling mounted.
G. Screen case: Fabricated without splices from [3/4 inch] [19 mm] warp resistant composition wood with metal lined wiring compartment. Bottom of case fully enclosed by two panels mounted with full length continuous hinges. One panel to open and close automatically as screen operates. Second panel opens manually for access to electrical connections, limit switches, and screen surface. Hinges mounted [flush with case edge] [with offset to allow bottom panels to align with ceiling panels]. Finish of case to be black primer.

H. Roller: [3 inches] [76 mm] diameter steel roller mounted on rubber insulated supports.

I. Viewing surface securely attached to roller at top and at bottom to weighted dowel.

J. Method of installation: Suspended recessed ceiling mounted.

K. Screen case: Fabricated from [3/4 inch] [19 mm] warp resistant composition wood with metal lined wiring compartment. Bottom of case fully enclosed by two panels. One panel mounted with full length continuous hinge to open and close automatically as screen operates. Second panel semi-permanently attached to case. Panel hinge [mounted flush with case edge] [mounted with offset to allow bottom panels to align with ceiling panels] [extended to allow attachment of ceiling panel to closure panel and present flush ceiling condition]. Case to have prime paint finish.

D. Roller: [5 inches] [127 mm] diameter aluminum roller mounted on zinc plated roller brackets with double row radial ball bearings.

E. Viewing surface securely attached to roller at top and at bottom to weighted dowel.

(For Draper SIGNATURE screens use the following paragraphs).

(There are two types of Signature motorized screens: Series E and Series V. Series V has tab-guide cable tensioning, is provided with 12” (30 cm) black drop standard, and is used only with Draper M1300, M2500, HiDef Grey, and Cineflex Rear Projection viewing surfaces. Series E is without tab-guide cable tensioning and is used only with Fiberglass Matt White, Panamax, Glass Beaded, High Contrast Grey, AT1200 Acoustically Transparent and AT Grey Acoustically Transparent viewing surfaces. Size can range from 50 by 50 inches (1.3 m by 1.3 m) to 16 by 16 feet (4.9 m by 4.9 m) for Series E and 50 by 50 inches (1.3 m by 1.3 m) to 12 by 16 feet (3.7 m by 4.9 m) for Series V. Maximum size for M2500 is 14 by 14 feet (4.3 m by 4.3 m), for HiDef Grey is 96” x 96” (2.4 x 2.4 m), for Panamax is 12 by 16 feet (3.7 m by 4.9 m), for High Contrast Grey is 8 by 10 feet (2.4 m x 3 m) and for AT1200 and AT Grey is 6 by 8 feet (1.8 m by 2.4 m). Specify selected viewing surface in Paragraph 2.3)

B. Method of installation: Suspended recessed ceiling mounted.

(Signature screen is provided with patented automatic aluminum ceiling closure with motorized trap door. Suspended acoustical ceiling panels can be attached to closure panel and trap door to present flush ceiling condition. Weight of attached ceiling panel cannot exceed 16 ounces PSF. 3/16 inch (5 mm) minimum clearance is required at trap door)

C. Screen case: Fabricated from aluminum and fire-retardant PVC with semi-gloss paint finish. Bottom of case fully enclosed by aluminum panels and motorized aluminum trap door with concealed hinges. Trap door supported entirely along front and back edges without crack around perimeter of door. Trap door opens into case when screen is lowered. Closure panels screw attached to case and may be removed manually for access to roller and drive assembly. Case shall have white finish.)
(Roller is 3 inches (76 mm) diameter for sizes through 12 by 12 feet (3.7 m by 3.7 m) and 4 inches (102 mm) diameter for sizes larger than 12 by 12 feet (3.7 by 3.7 m).

D. Roller: Steel roller mounted on zinc plated roller brackets with double row radial ball bearings and vibration insulators. Diameter as determined by manufacturer for screen size.

(Signature/Series E screens do not utilize tab-guide cable tensioning for viewing surface. Use the following paragraph for Signature/Series E. Viewing surface shall be either Fiberglass Matt White, Panamex, Glass Beaded, High Contrast Grey, AT1200 Acoustically Transparent or AT Grey Acoustically Transparent.)

E. Viewing surface securely attached to roller at top and at bottom to weighted dowel.

***** Signature/Series V screens utilize tab-guide cable tensioning for viewing surface and are provided with 12" (30 cm) black drop standard. Use the following paragraph for Signature/Series V. Viewing surface shall be either M1300, M2500, HiDef Grey, or Cineflex Rear Projection. *****

E. Viewing surface securely attached to roller at top and at bottom to weighted dowel. Provide each side of viewing surface with black masking borders and tab-guide cable tensioning system to maintain even lateral tension and to hold surface flat. Top of screen masked by 12" (30 cm) black drop.

*****************************************************************************

***** For Draper PARAGON screen use the following paragraphs. *****

***** Paragon screen is used only with Draper Fiberglass Matt White and Glass Beaded viewing surfaces. Size can range from 15 by 20 feet (4.6 m by 6.1 m) to 21 by 28 feet (6.4 m by 8.5 m). Specify selected viewing surface in Paragraph 2.3. *****

B. Method of installation: [Suspended by [threaded rods] [cable] [chain] ] [Wall mounted using Draper Wall Mounting Bracket] specified in Section [_____] - [__________].

C. Screen case: Fabricated from extruded aluminum with white paint finish. Bottom of case fully enclosed with extruded aluminum panel except for slot allowing viewing surface passage. Closure panel removable for access to roller and operating mechanism. Steel mounting brackets integrated into aluminum endplates.

D. Roller: [6 inches] [152 mm] diameter steel tube mounted on painted white brackets with double row radial ball bearings.

E. E. Viewing surface securely attached to roller at top and at bottom to weighted dowel.

F. Ceiling Trim Flange Kit: Finished white [endcaps only] [case only, _____ lengths of 12 feet (366 cm)] [endcaps and case, _____ lengths of 12 feet (366 cm)] for recessing screen.

*****************************************************************************

***** For Draper ROLLERAMIC screen use the following paragraphs. *****
***** Rolleramic screen is used only with Draper Fiberglass Matt White, Glass Beaded, High Contrast Grey and Panamex viewing surfaces. Size can range from 50 by 50 inches (1.3 by 1.3 m) to 20 by 20 feet (6.1 m by 6.1 m). Maximum size for Panamex is 12 by 16 feet (3.7 m by 4.9 m). Maximum size for High Contrast Grey is 8 by 10 feet (2.4 m x 3 m). Rolleramic screens furnished with Panamex viewing surface are not UL listed. Specify selected viewing surface in Paragraph 2.3. *****

B. Method of installation: [Ceiling mounted] [Wall mounted] [Recessed in ceiling and mounted] with brackets.


D. Roller: [5 inches] [127 mm] diameter steel tube mounted on zinc plated brackets with double row radial ball bearings.

E. Viewing surface securely attached to roller at top and at bottom to weighted dowel.

******************************************************************************

***** For Draper ACCESS screens use the following paragraphs. *****

***** Four types of Access motorized screens can be specified in this section:

- Access/Series E - Motorized screen with recessed housing installed initially and screen installed later.

- Access/Series V - Patented motorized screen with tab-guide cable tensioning and recessed housing installed initially and screen installed later.

- Ultimate Access/Series E - Patented motorized screen with recessed housing installed initially and screen installed later. Equipped with motorized ceiling closure door opening housing.

- Ultimate Access/Series V - Motorized screen with tab-guide cable tensioning and recessed housing installed initially and screen installed later. Equipped with motorized ceiling closure door opening housing.

Access/Series M - a manually operated projection screen is specified in SECTION 11131 - MANUALLY OPERATED PROJECTION SCREENS. Access MultiView and Access Sonata, both with motorized masking systems, are specified in SECTION 11133 - ADJUSTABLE MOTORIZED PROJECTION SCREENS.

Series V screens have tab-guide cable tensioning, are provided with 12” (30 cm) of black drop standard, and are used only with Draper M1300, M2500, HiDef Grey, and Cinemex Rear Projection viewing surfaces. Maximum size for HiDef Grey is 8’ x 8’ (2.4 x 2.4 m). Series E screens are without tab-guide cable tensioning and are used only with Fiberglass Matt White, Glass Beaded, High Contrast Grey, AT1200 Acoustically Transparent, AT Grey Acoustically Transparent and Panamex viewing surfaces. Size can range from 50 by 50 inches (1.3 by 1.3 m) to 12 by 12 feet (3.7 m by 3.7 m). Maximum size for AT1200 and AT Grey is 6 by 8 feet (1.8 m by 2.4 m). Maximum size for High Contrast Grey is 8 x 10 feet (2.4 x 3 m). Specify selected viewing surface in Paragraph 2.3. *****
 ***** Draper Access screens are recessed ceiling mounted. Case may be mounted with 3/8 inch threaded rod at ends or along length, with lag screws through brackets, or with wire in a grid ceiling. Mounting brackets slide in channels on top of case, allowing brackets to be moved somewhat to avoid interference with conflicting building structures. Brackets may be locked in position by tightening set screws. For suspended type mounting, support rods will need to be provided under other specification sections. *****

B. Method of installation: Recessed ceiling mounted [[with [3/8 inch] [10 mm] diameter threaded steel suspension rods] [chains] specified in Section [_____] - [____________]]. [as detailed on Drawings.]

C. Screen case:

1. Extruded aluminum housing with white paint finish and stamped steel end caps suitable for installation in return air plenums. Bottom closure panel forms slot for passage of viewing surface and is removable for access to operating mechanism and viewing surface. Bottom perimeter flange provides [support and trim for acoustical ceiling panels] [trim for gypsum board ceiling].

2. Access/Series E and Access/Series V Housing is symmetrical allowing for left and right hand motor locations and for viewing surface to unroll off front or back of roller. For Ultimate Access/Series E and Ultimate Access/Series V Housing, left hand motor location only is available.

3. Housing designed with internal junction box and plug-in wiring connections to allow housing to be installed and connected to building power supply separately from motor and viewing surface.

 ***** Access screen housings are designed to be installed and electrical connection made prior to or as part of ceiling system installation. Viewing surface and motor can be site installed later after construction operations that might damage viewing surface are complete. Motor and viewing surface may also be factory installed. Select appropriate option in the following paragraph. *****

D. Roller: [Factory installed] [Site installed] [3 inches] [76 mm] diameter steel or aluminum tube mounted on zinc plated brackets with double row radial ball bearings. Roller mounted on vibration insulators.


E. Viewing surface securely attached to roller at top and at bottom to weighted dowel.

 ***** Access/Series V and Ultimate Access/Series V screens utilize tab-guide cable tensioning for viewing surface, and are provided with 12” (30 cm) black drop standard. Use the following paragraph for Access/Series V. Viewing surface shall be either M1300, M2500, HiDef Grey, or Cineflex Rear Projection. Maximum size of HiDef Grey is 8’ x 8’ (2.4 x 2.4 m). *****

F. Viewing surface securely attached to roller at top and at bottom to weighted dowel. Provide each side of viewing surface with black masking borders and tab-guide cable tensioning system to maintain even lateral tension and to hold surface flat. Top of screen masked by 12” (30 cm) black drop.
***** Ultimate Access/Series E and Ultimate Access/Series V are equipped with independently motorized ceiling closure door on screen housing. Include the following paragraph for Ultimate Access/Series E and Series V. *****

F. Closure door: Equip housing with independently motorized closure door that opens into screen housing.

*****************************************************************************
***** For Draper SILHOUETTE screens use the following paragraphs. *****
***** There are two types of Silhouette motorized screens: Series E and Series V. Series V has tab-guide cable tensioning, 12” (30 cm) of black drop, and is used only with Draper M1300, M2500, HiDef Grey, and Cineflex Rear Projection viewing surfaces. Series E is without tab-guide cable tensioning and is used only with Fiberglass Matt White, Glass Beaded, High Contrast Grey, AT1200 Acoustically Transparent and AT Grey Acoustically Transparent viewing surfaces. Size can range from 50 by 50 inches (1.3 by 1.3 m) to 96 by 96 inches (2.4 m by 2.4 m). Specify selected viewing surface in Paragraph 2.3. *****

B. Method of installation: [Ceiling mounted with brackets] [Wall mounted with Z clips] [Extended mounting with [6 inches] [152 mm] extension brackets].

C. Screen case: Constructed of aluminum with contoured, removable front cover with die-cast end caps rounded to fit case. Finish to be [black] [white] [dove grey] lightly textured paint. There shall be no exposed fasteners in installed case.

D. Roller: [2 inches] [50 mm] diameter steel roller mounter on rubber vibration insulators.

***** Silhouette/Series E screens do not utilize tab-guide cable tensioning for viewing surface. Use the following paragraph for Silhouette/Series E. Viewing surface shall be either Fiberglass Matt White, Glass Beaded, High Contrast Grey, AT1200 Acoustically Transparent or AT Grey Acoustically Transparent.

E. Viewing surface securely attached to roller at top and at bottom to dowel which disappears inside case when retracted.

***** Silhouette/Series V screens utilize tab-guide cable tensioning for viewing surface, and 12” (30 cm) of black drop is standard. Use the following paragraph for Silhouette/Series V. Viewing surface shall be either M1300, M2500, HiDef Grey or Cineflex Rear Projection. *****

E. Viewing surface securely attached to roller at top and at bottom to weighted dowel. Top of screen masked by 12” (30 cm) of black drop. Provide each side of viewing surface with black masking borders and tab-guide cable tensioning system to maintain even lateral tension and to hold surface flat.

*****************************************************************************
***** For Draper ARTISAN screens use the following paragraphs. *****
***** There are two types of Artisan motorized screens: Series E and Series V. Series V has tab-guide cable tensioning, 12” (30 cm) of black drop and is used only with Draper M1300, HiDef Grey or M2500 viewing surfaces. Series E is without tab-guide cable tensioning and is used only with Fiberglass Matt White, Glass Beaded and High Contrast Grey. Size can range from 50 by 50 inches (1.3 by 1.3 m) to 96 by 96 inches (2.4 m by 2.4 m). Specify selected viewing surface in Paragraph 2.3. *****

B. Method of installation: [Ceiling mounted] [Wall mounted].
***** Screen case finish options are prefinished solid hardwood or plastic laminate on particleboard. Select type of hardwood or plastic laminate color from available options. *****

C. Screen case: [Select, pre-finished [natural cherry] [medium cherry] [natural maple] [light oak] [medium oak] [walnut] [mahogany] with [radius] [rectilinear] [bevel] [traditional] styling. [7/16 inch] [11 mm], 45 pounds density particleboard with [white] [burgundy] [dove grey] [beige] [black] plastic laminate finish and rectilinear styling.] Wiring compartment to be metal lined. There shall be no exposed fasteners in installed case. Bottom of case to be partially closed with manually opened hinged panel for access to viewing surface and operating mechanism.

D. Roller: [3 inches] [76 mm] diameter steel roller and end caps.

***** Artisan/Series E screens do not utilize tab-guide cable tensioning for viewing surface. Use the following paragraph for Artisan/Series E. Viewing surface shall be Fiberglass Matt White, Glass Beaded or High Contrast Grey.

E. Viewing surface securely attached to roller at top and at bottom to weighted dowel which disappears inside case when retracted.

***** Artisan/Series V screens utilize tab-guide cable tensioning for viewing surface, and are provided with 12” (30 cm) black drop. Use the following paragraph for Artisan/Series V. Viewing surface shall be either M1300, HiDef Grey, or M2500. *****

E. Viewing surface securely attached to roller at top and at bottom to weighted dowel. Provide each side of viewing surface with black masking borders and tab-guide cable system to maintain even lateral tension and to hold surface flat. Top of screen masked by 12” (30 cm) black drop.

*****************************************************************************

2.3 VIEWING SURFACE

***** Ten viewing surfaces are available for motorized Draper projection screens:

Fiberglass Matt White Surface
Glass Beaded Surface
High Contrast Grey
Panamax
AT1200 Acoustically Transparent
AT Grey Acoustically Transparent
M1300 Surface
M2500 Surface
HiDef Grey Surface
Cineflex Rear Projection Surface

Some of these are textile backed, with the reflective surface laminated to a woven textile back. Others are unsupported vinyl and require a built-in tensioning system which is available for motorized screens. Refer to Draper product literature to verify availability of selected viewing surface for selected screen model. *****
A. Material: Matt white vinyl surface laminated on woven fiberglass base and surface is washable, flame resistant, and mildew resistant; Fiberglass Matt White Surface. Microscopic spherical glass beads embedded in matt white base material and surface is flame and mildew resistant but cannot be cleaned; Glass Beaded Surface. Matt white vinyl surface laminated on woven fiberglass base and surface is washable; Panamax. Grey vinyl surface laminated on woven fiberglass base and surface providing high contrast and resolution, and is washable, flame resistant, and mildew resistant; High Contrast Grey Surface. Acoustically transparent material with microscopic openings and surface is washable, flame resistant, and mildew resistant; Acoustically Transparent AT1200. Acoustically transparent grey material with microscopic openings and surface is washable, flame resistant, and mildew resistant; Acoustically Transparent AT Grey. Stretchable, matt white, washable, vinyl surface without backing; M1300 Surface. Stretchable, matt white, vinyl surface without backing; M2500 Surface. Stretchable, grey, washable, vinyl surface without backing providing high contrast and resolution; HiDef Grey. Stretchable, neutral grey, vinyl surface without backing and suitable for rear projection; Cineflex Rear Projection Surface as manufactured by Draper, Inc.

***** Appropriate screen size is determined by dimensions of audience area, ceiling height, and use. Use is referred to as projection format and is expressed as aspect ratio (relationship of height to width). Formats and their aspect ratios are as follows:

- Square for horizontal and vertical 35 mm slides: 1.00 to 1.00
- NTSC Video for video and motion pictures: 1.00 to 1.33
- Horizontal for 35 mm slides: 1.00 to 1.48
- HDTV for high definition television: 1.00 to 1.78
- Widescreen for letterboxed video images: 1.00 to 1.85
- Cinemascope: 1.00 to 2.35

Draper provides both standard and custom sizes for most screens. Refer to Draper product literature to verify availability of standard and custom sizes for selected screen model. *****

B. Size of viewing surface: [_____] [inches] [m] high by [_____] [inches] [m] high.

***** Matt white and glass beaded surfaces up to 10' high will be seamless.

***** High Contrast Grey surface is available through 8' by 10' (2.4 x 3 m).

***** High Def Grey surface is available through 8' by 8' (2.4 x 2.4 m).

***** AT1200 surface is available through 8' by 10' (2.4 x 3 m).

***** AT Grey surface is available through 6' by 8' (1.8 x 2.4 m).

C. Joints: Viewing surface shall contain [no] [no more than one flat, horizontal] seams.
***** All Draper screens can be provided with black masking borders. Borders are standard for some screens and optional for others. They are mandatory for all tab-guide cable tensioned screens, which come with masking borders on the sides, are masked at the bottom by the dowel, and are masked at the top by 12 inches (30 cm) of black drop. For screens without tab-guide cable tensioning, masking borders are standard with NTSC Video, HDTV, and Widescreen formats and optional for all other formats. Width of masking borders for tab-guide cable tensioned screens varies from top to bottom. For screens without tab-guide cable tensioning, masking borders are 1-1/2 inches (38 mm) in screen sizes through 70 by 70 inches (1.8 m by 1.8 m) and 2 inches (50 mm) wide for larger sizes. Refer to Draper product literature to verify availability and size of masking borders for selected screen model. *****

D. Edge treatment: [Borderless] [1-1/2 inches] [2 inches] [38 mm] [50 mm] wide black masking borders] [Variable width black masking borders included as part of tab-guide cable tension system].

***** Most screens can be provided with an extra drop, either black or white, at top of screen to increase the screen lowering distance. However, total screen height cannot exceed 21 feet (6.4 m) for Paragon; 20 feet (6.1 m) for Rolleramic; 16 feet (4.9 m) for Signature/Series E; 14 feet (4.3 m) for Signature/Series V; 12 feet (3.7 m) for Targa, Envoy, Premier, Ambassador, Access/Series E; and Access/Series V; and 8 feet (2.4 m) for all other motorized Draper projection screens. Note that screens provided with tab-guide tensioning and extra drop will require case lengths greater than published standard dimensions. Standard color for extra drop for tab-guide cable tensioned screens is white. Standard color for extra drop for screens without tab-guide cable tensioning is black in NTSC Video, HDTV, and Widescreen formats and white for other formats. Refer to Draper product literature to verify availability and color of extra drop for selected screen model. If extra drop is not required, delete following paragraph. *****

E. Extra drop: [_____] [inches] [mm], [black] [white].

2.4MOTOR

***** Use the following paragraph for Draper Ambassador and Rolleramic motorized screens. A heavy duty motor, which adds 6 inches (152 mm) to the case length, is required for the following viewing surfaces:

Fiberglass Matt White with area greater than 144 square feet (13.4 square meters) including extra drop.

Glass Beaded with height of 12 feet (3.7 m) and fabric area greater than 108 square feet (10 square meters) including extra drop.

Panammax greater than 8 feet (2.4 m) wide.

A. Type: Direct drive, [heavy duty.] 110-120 VAC, 60 Hz, 3 wire, instantly reversible, lifetime lubricated, and equipped with internal thermal overload protector, electric brake, and pre-set accessible limit switches.

B. Mount outside screen roller on rubber vibration insulators.

***** Use the following paragraphs for Draper Targa, Premier, Envoy, Signature, Access, and Artisan motorized projection screens. Motor for Draper Signature screen is 5 wire. Motors for other Draper motorized projection screens are 3 wire. *****

A. Type: 110-120 VAC, 60 Hz, [3] [5] wire, instantly reversible, lifetime lubricated, and equipped with internal thermal overload protector, electric brake, and pre-set accessible limit switches.
B. Mount inside screen roller on rubber vibration insulators.

***** Use the following paragraphs for Draper Silhouette motorized projection screens. *****

A. Type: 110-120 VAC, 60 Hz, 3 wire, instantly reversible, lifetime lubricated, and equipped with internal thermal overload protector, electric brake, and pre-set accessible limit switches.

B. Mount inside screen roller. Roller to be mounted on vibration insulators.

***** Use the following paragraphs for Draper Paragon motorized projection screens. *****

A. Type: 110-120 VAC, 60 Hz, 3 wire, instantly reversible, lifetime lubricated, and equipped with internal thermal overload protector, electric brake, and pre-set accessible limit switches.

B. Mount inside screen roller with sound absorbing fixtures.

2.5 CONTROLS

***** Various types of controls are available for motorized Draper projection screens. Either a single station or multiple controls can be provided. Screen can also be interfaced to be controlled by either video projector or Draper projector lift. Select appropriate paragraphs for selected types of controls and delete other options. *****


***** Single station control is standard of all Draper electrically operated projection screens. *****

B. Single station control: 3 position rocker switch with cover plate, accepting 110 V current, and operating by sustained contact.

***** Motorized Draper screens can be controlled from multiple locations using two or more multiple control units. Switches are interconnected to allow only one signal to reach motor when switches are operated simultaneously. *****

C. Multiple station control: 3 position rocker switch with cover plate, suitable for multiple controls, accepting 110 V current, and operating by sustained contact. Automatic override allows only one signal to reach motor when switches are operated simultaneously.

***** Low voltage control can be provided with 3 button switches or without switches as interface with a master control system, a radio frequency remote control receiver, or an infrared remote control receiver. Multiple switches plus radio frequency and infrared remote control receivers can be connected to a single low voltage control unit. *****

D. Low voltage control: Control station [with 3 button switches for up, down and stop functions.] [without switches for interface with [master control system] [radio frequency remote control receiver] [infrared remote control receiver].] Wiring from switches or receivers to low voltage control unit to be 24 V.

***** Portable, remote control hand held transmitters can be provided for operation of motorized Draper screens. These units need to be provided with and connected to a low voltage control unit. *****
E. Radio frequency remote control: Hand held 3 button control for up, down, and stop functions and receiver unit to connect to low voltage control unit.

***** Portable, remote control hand held infrared transmitters can be provided for operation of motorized Draper screens. These units need to be provided with and connected to a low voltage control unit. *****

F. Infrared remote control: Hand held 3 button control for up, down, and stop functions and receiver unit to connect to low voltage control unit. Unit compatible with learnable infrared master control systems.

***** In order to limit access to projection screen controls during specified time periods, all Draper control systems can be provided with a separate key operated switch. Switch controls either low voltage or 110 power to the control switch or receiver of the screen control unit. Key switch is mounted adjacent to control switch or receiver. *****

G. Key operated power supply switch: Key operated switch to control [low voltage] [110 V] power to screen operating [switch] [radio frequency remote control receiver.] [infrared remote control receiver.] Provide with [2] [_____] keys.

***** In order to limit access to projection screen controls, a 3 position control switch with a key locked cover plate is available. Switch is available only for 110 V power. *****


***** In order to limit access to projection screen controls, a standard 3 position control switch can be provided with key type operation. Switch can only be operated with key. Switch can be used for 110 and low voltage. Low voltage switch is momentary contract. *****

I. Key operated control switch: Key operated [, momentary contact] control switch with three key positions for up, down, and stop functions for [low voltage] [110 V] power. Provide with [2] [_____] keys.

***** Video interface controls allow screen to be controlled by either video projector switch or Draper projector lift. When projector or lift is powered, screen descends automatically. There are three video interface controls: Models VIC115, VIC12 and VIC6. Model VIC115 integrates screen operation with 110-115V switched outlet, Model VIC12 with 12V, and Model VIC6 with 6V. Interface controls can be provided with override switch which permits independent operation of screen. Contact Draper for assistance in designing, specifying, and preparing wiring diagrams for interfaced controls. *****

J. Video interface control: Interface to allow motorized screen to be controlled by [video projector] [motorized projector lift] [_____] through [110V] [12V] switched outlet; Model [VIC115] [VIC12] [VIC6] as manufactured by Draper, Inc. Equip interface with override switch permitting independent operation of screen.

K. Provide controls with required boxes and brushed aluminum cover plates.
PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of projection screens with ceiling construction and related components penetrating or above ceilings such as lighting fixtures, mechanical equipment, ductwork, and fire-suppression system.

B. Coordinate requirements for blocking, structural supports, and bracing to ensure adequate means for installation of screens.

C. Coordinate requirements for power supply conduit, and wiring required for projection screen motors and controls.

***** For projection screens recessed in ceilings and screens where ceiling tile is to be adhered to case closure, include the following paragraph. *****

D. Coordinate installation of recessed mounted screens with construction of suspended [acoustical panel] [gypsum board] ceilings specified in Section [_____] - [_______]. [Where acoustical ceiling panels are to be adhered to screen case closure provide and coordinate required tolerances and weight restrictions.]

***** Include the following paragraph if controls for screen are to be interfaced with motorized projector lift, video projector switch, or other equipment. *****

E. Coordinate interface and installation of screen and masking controls with provision of [motorized projector lift] [video projector] [_______].

F. Prior to installation, verify type and location of power supply.

3.2 INSTALLATION

A. Install projection screens and controls at locations and heights indicated on Drawings.

B. Comply with screen manufacturer's written instructions and shop drawings.

***** Access screen housings are designed to be installed and electrical connection made prior to or as part of ceiling system installation. Viewing surface and motor can be site installed later after construction operations that might damage viewing surface are complete. Electrical pin connectors allow this site installation to be accomplished without an electrician. Motor and viewing surface may also be factory installed. If Access housing is to be installed prior to motor and viewing surface, include the following paragraph. If not, delete paragraph. *****

C. Install screen housing and make electrical connections [prior to] [in conjunction with] installation of suspended ceiling system. After interior construction is essentially complete, install viewing surface and drive assembly in housing.

D. Install screens securely to supporting substrate so that screens are level and back of case is plumb.

E. Provide required brackets, hanger rods, and fasteners.

3.3 TESTING AND DEMONSTRATION
A. Test motorized projection screens to verify that screen, controls, limit switches, closure, and other operating components are functional. Ensure that screen is level and viewing surface plumb when extended. Correct deficiencies.

B. Demonstrate operation of screen to Owner's designated representatives.

3.4 PROTECTING

A. Protect projection screens after installation from damage from construction operations. If damage occurs, remove and replace damaged components or entire unit as required to provide units in their original, undamaged condition.

END OF SECTION
PART 1 GENERAL:

1.1 DESCRIPTION:

A. Section Includes:
   1. Automatic Barrier Gates.
   2. Vehicle Detectors.
   3. Card Control Units.

1.2 RELATED WORK:

A. Asphalitic paving: Section 02513, ASPHALTIC CONCRETE PAVING.
B. Concrete paving: Section 02514, SITE WORK CONCRETE.
C. Concrete foundation work: Section 03300, CAST-IN-PLACE CONCRETE.
D. Color and texture: Section 09050, INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH SCHEDULE.
E. Conduit placement for equipment: Section 16111, CONDUIT SYSTEMS.
F. Power supply to disconnect, junction box, in gate arm unit: Section 16127, CABLES, LOW VOLTAGE (600 VOLTS AND BELOW).
G. Electrical characteristics and wiring connections: Section 16140, WIRING DEVICES.

1.3 QUALITY CONTROL:

A. Qualifications:
   1. Approval by Contracting Officer is required of products or service of proposed manufacturer, suppliers, and installers, and will be based upon submission by Contractor of certification that:
      a. Installer: Approved by manufacturer of materials and has technical qualifications, experience, trained personnel and facilities to install specified items.
      b. Manufacturer's product submitted has been in satisfactory operation, on three installations similar and equivalent in size to this project, for three years. Submit list of installations.
   2. Maintenance Proximity: Installer shall maintain a place of business with maintenance facilities not more than two (2) hours normal travel time from project site.
   3. UL and NEMA Compliance: Provide internal electrical components required as part of parking control equipment that are listed by UL and comply with applicable NEMA standards.

1.4 SUBMITTALS:

A. In accordance with Section 01340, SAMPLES AND SHOP DRAWINGS, submit following:
   1. Manufacturer's Literature and Data:
a. Description of parking control equipment material and accessories to be provided.
b. Provide data on operating equipment, characteristics and limitations, and operating
temperature ranges.

2. Samples:
   a. Submit two samples of access cards and security program, illustrating size, and coding
      method.

3. Shop Drawings and Certificates: Indicate plan layout of equipment access lanes, mounting
   bolt dimensions, conduit and outlet locations, power requirements, and conformation of
   building electrical requirements. Provide Contractor with mounting bolt template in time for
   installation.

4. Wiring Diagrams: Detailing wiring for parking control equipment operator, signal, and control
   systems differentiating clearly between manufacturer-installed wiring and field-installed
   wiring.
   a. Show locations of connections to electrical service provided as a unit of work under other
      Divisions.

5. Maintenance Data: For parking control equipment components for inclusion in Operating and
   Maintenance Manuals, include the following.
   a. Maintenance Instructions: Provide manufacturer’s instructions for maintenance of parking
      control equipment.
      1) Include recommended methods and frequency for maintaining equipment in optimum
         operating condition under anticipated traffic and use conditions.
      2) Include precautions against materials and methods that may be detrimental to
         finishes and performance.
      3) Lubrication Schedule and Information: Provide lubrication and periodic maintenance
         requirement schedules including parts list and parts numbers.

6. Operation Data: Provide operating data for operating equipment, including clock timer,
   changing security access code, and any other pertinent information required for Government
   operation.

7. Certificates: Quality Control Certificate Submittals and lists specified in paragraph,
   QUALIFICATIONS.

B. In accordance with Section 01001, GENERAL CONDITIONS, submit following at project
   closeout: Guaranty.

C. In accordance with Section 01010, GENERAL REQUIREMENTS, submit following at project
   closeout:
   1. Project Record Documents: Record actual locations of concealed conduit and vehicle
      detection activators.
1.5 REGULATORY REQUIREMENTS:
   A. Conform to applicable code for fire/ambulance emergency vehicle access.
   B. Products Requiring Electrical Connection: Listed and classified by testing firm acceptable to authority having jurisdiction as suitable for purpose specified and indicated.

1.6 PROJECT CONDITIONS:
   A. Coordinate placement of conduit, accessories, and power wiring to operating equipment.
   B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

1.7 DELIVERY, STORAGE AND HANDLING:
   A. Deliver materials to site in original sealed packages or containers; labeled for identification with manufacturer's name and brand.
   B. Store materials in weathertight and dry storage facility. Protect from damage due to handling, weather, and construction operations before, during and after installation.

1.8 APPLICABLE PUBLICATIONS:
   A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
   B. American Society for Testing Materials (ASTM):
      A500-03 Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
   C. National Electrical Manufacturers Association (NEMA):
      MG 1-03(R2004) Motors and Generators.
   D. National Fire Protection Association (NFPA):
      70-05 National Electrical Code.
   E. Underwriters Laboratories Inc. (UL):
      Electrical Appliance and Utilization Equipment Directory.

1.9 SYSTEM DESCRIPTION:
   A. Parking Control System: Attended Automatic operation at entrance and attended automatic operation at exit.
   B. Design: Protect against interference or damage by lightning or other electrical influence; include fuse, over-voltage protection, flash-over protection, and line filter.
C. Entry – Automatic Gate Arm Control: Electrically operated upon // insertion of coded card // insertion of pass key // detection of vehicle by sensing loop buried in pavement //. // Activate automatic arm reversing switch if an obstacle is sensed in downward motion. //
D. Exit – Automatic Gate Arm Control: Electrically operated upon // detection of vehicle by sensing loop buried in pavement // insertion of coded card // insertion of pass key //. // Activate automatic arm reversing switch if an obstacle is sensed in the downward motion. //

1.10 SCHEDULING:

SPEC WRITER NOTE: Provide one or more of following subparagraph types appropriate to site equipment requirements. Provide a schedule when differing components may be required at different locations.

A. Name Street Gate: Automatic key card operation, single gate arm, single gate exit arm activated with loop detector in pavement, and heated cabinets.
B. Employee Gate: Automatic coded card operation, double entrance, each with gate arms, double gate exit arm activated with key card.

1.11 WARRANTY

A. Submit manufacturer's written warranty for materials and installation in accordance with Section 01001, GENERAL CONDITIONS.
1. Warranty: Cover keeping equipment operational.
2. Final Acceptance: Requirement for final acceptance shall be continued acceptable use of parking control equipment without a breakdown or stoppage for a period of fifteen (15) calendar days after final acceptance of project by Government.

PART 2 PRODUCTS

2.1 MATERIALS:

A. Iron and Steel Hardware: ASTM A153; Zinc coating (hot-dip) on iron and steel hardware.
B. Steel: ASTM A653/A653M; Galvanized to // G90 // Z275 //________//.
C. Structural tubing in rounds and shapes: A500; Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
D. Wood: // Clear fir. // Clear cedar. //_____________________.//

2.2 AUTOMATIC GATE:

A. Provide UL approved automatic barrier gate parking access-control system.

SPEC WRITER NOTE: Coordinate with manufacturer and revise next paragraph if aluminum cabinets are required.
B. Cabinet: 1.9 //_____// mm, (// 0.075 //_____// inch) minimum cold-rolled steel sheet cabinet, welded and weather tight seams, reinforced internally with welded steel angle framing, thermally insulated to permit heater to maintain cabinet temperature to equipment operating minimum, flush access doors and panels, tamper proof hardware, weather tight gaskets, // master keyed //_____// locks; furnish two (2) keys for each gate, keyed alike. Conceal mounting bolts inside units.

1. Finish cabinet, interior and exterior, with manufacturer’s standard // white baked enamel finish over primer system. // color as indicated in Section 09050, INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH SCHEDULE. //

C. Arm Control: Mechanism to raise and lower arm by instant reversing electric motor, enclosed speed reducer operated by self contained, plug-in replaceable controller. Design mechanism with slip clutch to prevent breakage if arm is forced, and to permit manual operation if required. Arm movement to stop and start at reduced speed. Components of // zinc //________// coated steel.

D. Electrical Components: Self-contained, plug-in, replaceable components. Include wiring for control units, zinc plated connection box, grounded convenience outlet, switch for automatic or manual operation, switch to disconnect power unit, thermostatically controlled minimum // 250 //_____// Watt heater strip with control switch and preset thermostat, and thermal protection disconnect for motor.

2.3 ELECTRICAL CHARACTERISTICS AND COMPONENTS:

SPEC WRITER NOTE: Select one or more of following subparagraphs appropriate to equipment requirements.

A. Electrical Characteristics:

1. Provide 1/3 //_____// hp (//_____// W.) ( //_____// rated load amperes.)
2. Provide 115 //_____// volts AC, // single // three // phase, 60 Hz.
3. Provide //_____// amperes maximum // fuse size // circuit breaker size // overcurrent protection //. (//_____// minimum circuit capacity.)
4. Provide //_____// percent minimum power factor at rated load.
5. Refer to Section 16140 – WIRING DEVICES: Electrical connections.

B. Motor: Instant reversing motor for operation of gate arm. // Refer to Sections 16150 and 16170. // NEMA MG1, //_____//.

C. Controls: Transmit power to gate arm drive shaft through a harmonic acting crank and connecting rod. Fabricate cranks, rod, and drive shaft of galvanized solid bar steel. //_____//.

D. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

E. Disconnect Switch: Factory mount disconnect switch // in control panel. // on equipment under provisions of Section 16170. //

2.4 ARM AND SUPPORT:
A. Gate Arm: Fabricate gate arm of nominal 25 mm (1 inch) thick, length as indicated, of // Wood // Aluminum //_______//, one piece arm, // articulating arm with internal counterbalance //, (// with safety rubber bottom edge // and automatic instant reversing arm mechanism that stops downward motion of gates if arm strikes an object, and returning arm immediately to upward position. Equip mechanism with a 0 to 60 second variable time reset device. //).
   1. Finish with manufacturer’s standard coating system with black diagonal stripes on traffic side face.

B. Arm Clamp: // Cast metal //_______//, quick change clamp and hub bracket, to permit rapid replacement of arm without fitting or drilling. Provide breakaway feature to ensure clean break if arm is struck.

SPEC WRITER NOTE: Use Articles below if special length constructed assembly applies to project; delete this article if none apply.

C. End support post required for gate arm of 4.3 m (14 feet) or longer.

D. End Support Post: 50 //_______// mm (// 2 //______ // inch) // square // round // steel tubular section; 1940 //______// mm (// 37 //_______// inches) high, 3.4 mm, (0.135 inch) minimum wall thickness; with alignment bracket, closed cap and baseplate.

E. Padlocking Feature: To lock gate arm in either open or closed position, if required.

2.5 // CARD // KEY // CONTROL:

A. General: Provide pedestal mounted card control units to activate barrier gates.

B. Control Unit: To activate gate arm by // insertion of coded card // pass key // ; //_______// manufactured by //______//.

C. Cabinet: 1.9 mm (0.075 inch) minimum welded cold-rolled steel sheet, weather tight seams; thermally insulated to permit heater to maintain cabinet temperature to equipment operating minimum, flush access doors and panels, tamper proof flush mounted lock hardware and two (2) keys // master keyed // to operate access panel, weather tight gaskets. Conceal mounting bolts inside units.
   1. Mount housing on a 50 mm (2 inch) square steel tube pedestal with a curved top to receive housing, and a trim plate to cover anchor bolts.
   2. Finish interior and exterior of cabinet with manufacturer’s // standard baked enamel finish over primer. // color as indicated in Section 09050 INTERIOR/EXTERIOR FINISHES, MATERIALS, AND FINISH SCHEDULE. //

D. // Card // Key // Slot: Mount //______// mm, // ______ inches // above vehicle pavement surface, // illuminate and protect with projecting weather shield//.

SPEC WRITER NOTE: Select one of following subparagraphs appropriate to equipment requirements.

E. Coded Cards: // Laminated plastic // Cardboard // with // embossed // or // magnetic // coding // for // one //______// month validation periods //. // Include anti-pass-back card control. //
F. Pass Keys: Supply //_____// keys.

2.6 VEHICLE DETECTION:

A. Vehicle Detection: For use in temperature range of -40 to 71 //_____// °C; ((-40 to 160) //_____// °F) to consist of detector unit in conjunction with sensing loop to activate //card control// //barrier gate// when vehicle enters or exits.

B. Loop Wire: 14 gage, XHWN or THWN copper; loop size of 1 200 X 1 800 //_____ X _____// mm. ((48 X 72) //_____ X _____// inches.)

C. Loop Groove Fill: // Same material as pavement. // Hot poured asphalt. // Cold poured rubberized asphalt emulsion. //

D. Treadle Plate: // Steel, galvanized, // Stainless steel, // 3300 X 1800 //_____ X _____// mm size, (// 12 X 72 //_____ X _____// inches // ; to consist of weatherproof sensor detector to activate // card control // barrier gate // when vehicle enters or exits.

2.7 FINISHES:

SPEC WRITER NOTE: Select following subparagraphs appropriate to equipment requirements. Coordinate gate arm color and markings with code requirements, if required.

A. Gate Arm: Two coat enamel with // reflective // black and // yellow // white // diagonal stripes //_____// both sides of arm.

B. Gate Posts and Cabinets: Baked enamel on steel, //_____// color // as selected //.

PART 3 EXECUTION

3.1 EXAMINATION:

A. Verification of existing conditions before starting work.

1. Prior to beginning installation, examine areas to receive parking control equipment. Verify that critical dimensions are correct and that conditions are acceptable.

   a. Do not proceed with installation of parking control equipment until unsatisfactory conditions have been corrected.

B. Verify that anchor bolts, and //_____// are ready to receive work and dimensions are as indicated // on shop drawings. // instructed by manufacturer. //

C. Verify that electric power is available and of correct characteristics.

3.2 PREPARATION:

A. Provide templates for anchor bolts and other items encased in concrete or below finished surfaces in sufficient time so as not to delay work.

3.3 INSTALLATION:

A. Install parking control system and components in accordance with manufacturer's instructions and placement drawings.

B. Cut grooves in pavement surface, install vehicle detection loops and lead-in wires, and fill grooves with loop filler.
C. Install internal electrical wiring, conduit, junction boxes, transformers, circuit breakers, and auxiliary components required.

3.4 ADJUSTING:
A. Prior to final acceptance of project adjust system components for smooth operation.
B. Fit and adjust hardware for ease of operation.
   1. Lubricate hardware and other moving parts.
   2. Readjust parking control system and components at completion of project.

3.5 CLEANING:
A. Clean metal surfaces promptly after installation, exercising care to avoid damage to coatings. Touch up damaged shop-applied finishes as required to restore damaged areas.
B. Follow recommendations of manufacturer in selection of cleaning agents. Do not use cleaning agents containing ammonia or other compounds that might damage finished metal surfaces.

3.6 FIELD QUALITY CONTROL:
A. Tests:
   1. Test operating functions in accordance with manufacturer’s printed checklist.
   2. Correct defects revealed by tests. Retest corrected areas until functions are operating properly.

3.7 DEMONSTRATION, TESTING AND ACCEPTANCE:
A. Instruct Owner’s personnel in proper operation and maintenance of parking control equipment. Train personnel in procedures to follow in event of operational failures or malfunctions.
B. Acceptance: At completion of project, and as a condition of acceptance, parking control equipment and systems shall be operated for a period of 15 consecutive calendar days without breakdown.

3.8 PROTECTION:
A. Protect parking control equipment finished surfaces from damage during erection, and after completion of work until final inspection and acceptance.

END OF SECTION
LISTED MANUFACTURERS

SPEC WRITER NOTE:
Verify manufacturers’ capability to comply with indicated requirements each time the Section is edited.

PARKING CONTROL EQUIPMENT:

American Parking Equipment Inc.
535 Oxford Street
Etobicoke, Toronto, Ontario M8Y 1E5
(800) 565-4666.

Amano Parking Systems (Headquarters)
140 Harrison Avenue
Roseland, NJ 07068
(800) 367-6649

Amano Parking Systems (Factory)
130 Commerce Boulevard
Loveland, OH 45140
(513) 697-9000

Delta Scientific Corporation
24901 West Avenue Stanford
Valencia, CA 91335
(800) 521-9330

Federal APD
24700 Crestview Court
Farmington Hills, MI 48335
(800) 521-9330

Magnetic Automation Corporation
1715 Independence Blvd., Suite. B-7
Sarasota, FL 34234
(941) 351-7116

Parking Products, Inc.
2517 Wyandotte Road
Willow Grove, PA 19090
(215) 657-7500
PART 1  GENERAL

1.01  PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION
A. Install anchor bolts under the Work of Section 03050 or 03300.

1.02  RELATED WORK SPECIFIED ELSEWHERE
A. Cast-In-Place Concrete:  Section 03050 or 03300.
B. Metal Fabrications:  Section 05500.
C. Basic Electrical Materials and Methods:  Section 16050.
D. Wiring for Motors and Motor Controllers:  Section 16051.

1.03  RELATED ITEMS PROVIDED BY OTHERS
A. Power Wiring to Power Source:  Electrical Work Contract.

1.04  REFERENCES
A. Welding:  Comply with "Structural Welding Code - Steel, AWS D1.1” by the American
   Welding Society.

1.05  SUBMITTALS
A. Shop Drawings:  Show installation details.
B. Product Data:  Catalog sheets, specifications, and installation instructions.
C. Contract Closeout Submittals:
   1. Operation and maintenance data.
   2. Warranty.

1.06  SEQUENCING
A. Coordinate location and installation of required anchor bolts with cast-in-place concrete
   Work.
   1. Dock Bumpers:  Locate top of bumpers one to 2 inches below dock level.

1.07  WARRANTY
A. Special Warranty for Dock Levelers:  The one year period required by Paragraph 9.8 of
   the General Conditions is extended to 10 years for the dock leveler structures (including
   deck platform, lip section, rear hinge, and front hinge) and power source.  Refer to
   Supplementary Conditions.

PART 2  PRODUCTS
2.01 DOCK BUMPERS

A. Laminated Tread Type: Bumper units fabricated of multiple plies cut from fabric reinforced rubber truck tires, pressure laminated and securely mounted to hot-dipped galvanized or aluminum enameled 3/4 inch diameter steel tie rods and 1/4 inch thick structural steel angle supports, complete with 3/4 inch galvanized anchor bolts, nuts and washers to suit installation conditions. Tread plies shall extend 1-1/2 inches beyond edge of closure angles.
   1. Tread Plies: 4-1/2 inches thick (projection from dock).
   2. Tread Plies: 6 inches thick (projection from dock).

B. Molded Rubber Type: Cord reinforced, molded rubber bumpers not less than 3 inches thick with predrilled countersunk mounting holes, complete with 3/4 inch galvanized or cadmium plated anchor bolts, nuts, and washers to suit installation conditions.

2.02 MECHANICAL DOCK LEVELERS

A. Type and Rating: Manual control, counterbalance and spring operation, with vertical travel 12 inches above and 12 inches below dock level.
   2. Style: Pit type.
   3. Style: Box type.

B. Construction and Features:
   1. Welded steel construction to suit required capacity and operation.
   2. Deck Platform: One piece safety tread steel plate.
   3. Lip: One piece safety tread steel plate full width of platform, with full width hinge. Lip yieldable at all times.
   4. Toe Guards: Guards or skirts providing complete protection throughout full operating range of platform travel.
   5. Safety Stops: Structural safety devices which will limit downward travel of platform if carrier bed is suddenly withdrawn.
   6. Factory Finish: One coat of primer and one coat of enamel.
   7. Cross Traffic Support and Lip Lock: Leveler designed to provide support for cross traffic and automatic lip lock when leveler is in the stored position.
   8. Weatherseal: Weatherseal between the leveler and pit walls at top of dock.
   10. Steel Box Assembly: Minimum 13 gage steel box enclosing bottom, sides and rear of leveler, with minimum 3/16 inch thick structural steel curb angles and steel concrete anchors welded in place.
C. Operation: By manually activating a release mechanism, which disengages an integral locking hold-down device, leveler platform shall rise. Lip shall automatically extend to working position. Lip shall remain in extended position until contact with carrier bed.

1. Float: Leveler automatically adjusts for variations in height of carrier bed.
2. Tilt: Platform and lip designed to compensate for canted truck bed up to 4 inches.
3. Lip automatically retracts behind face of bumpers if carrier bed support is removed.
4. Leveler shall be completely operable by one person.

2.03 HYDRAULIC DOCK LEVELERS

A. Type and Rating: Electric control from a remote control panel, fully hydraulic operation, with vertical travel 12 inches above and 12 inches below dock level.

2. Style: Pit type.
3. Style: Box type.

B. Construction and Features:

1. Welded steel construction to suit required capacity and operation.
2. Deck Platform: One piece safety tread steel plate.
3. Lip: One piece safety tread steel plate full width of platform, with full width hinge. Lip yieldable at all times.
4. Toe Guards: Guards or skirts providing complete protection throughout full operating range of platform travel.
5. Safety Stop: Hydraulic safety stop which will limit platform free fall to not more than 3 inches if carrier bed is suddenly withdrawn.
6. Factory Finish: One coat of primer and one coat of enamel.
7. Cross Traffic Support and Lip Lock: Leveler designed to provide support for cross traffic and automatic lip lock when leveler is in the stored position.
8. Weatherseal: Weatherseal between the leveler and pit walls at top of dock.
9. Maintenance Strut: Furnish maintenance strut which will support platform and lip during servicing.
10. Steel Box Assembly: Minimum 13 gage steel box enclosing bottom, sides and rear of leveler, with minimum 3/16 inch thick structural steel curb angles and steel concrete anchors welded in place.

C. Operation:
1. Electric Control: When control button is pushed and held, leveler platform rises and the lip automatically extends to working position. When control button is released, platform and lip settles onto the truck bed. Leveler returns to stored position automatically when carrier bed support is removed. Leveler returns to stored position while leveler is supported on truck bed, and while leveler is in any position without carrier bed support, when control button is pushed.
   a. Control box shall have a fused secondary control power transformer (maximum control voltage 120 volts) mounted within control box.
3. Tilt: Platform and lip designed to compensate for canted truck bed up to 4 inches.
4. Float: Leveler automatically adjusts for variations in height of carrier bed.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verification of Conditions: Examine surfaces to receive loading dock equipment for defects that will adversely affect the execution and quality of the Work. Do not proceed until unsatisfactory conditions are corrected.
   1. Verify location and size of required anchors bolts.

3.02 INSTALLATION

A. Install loading dock equipment in accordance with manufacturer's instructions, unless otherwise indicated.
B. Securely anchor equipment assemblies to substrate.
C. Install electric work required for complete operation of equipment, from power source (at safety switch or junction box near control box) to equipment, in accordance with the requirements of Division 16.

3.03 FIELD QUALITY CONTROL

A. Tests:
   1. Preparation: Notify the Director's Representative at least three working days prior to the tests so arrangements can be made to have a Facility Representative witness the tests.
   2. Testing: Individually test each piece of equipment. Test each function and feature, one at a time.

3.04 ADJUSTING

A. Adjust dock levelers for safe, efficient operation.

3.05 CLEANING

A. Clean dirt, grease, and other foreign material from equipment.
B. Restore marred and abraded areas of baked enamel finish.
3.06 DEMONSTRATION AND INSTRUCTION

A. Demonstrate the proper operation and use of the equipment for the Facility employees who will be involved in the operation and use of the equipment. Instruct these employees and Facility maintenance employees in the proper operation and maintenance procedures for the equipment. Instructor shall be a factory trained employee of the equipment manufacturer.

END OF SECTION
SECTION 11170
AUTOMOBILE MAINTENANCE EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Provide automotive maintenance equipment as indicated, specified and required.

B. Related sections:
   1. Section 16050 – Basic Electric Materials and Methods
   2. Section 15410 – Plumbing Piping

1.2 SUBMITTALS

A. Product Data:
   1. Submit complete catalog data. Submit catalog cuts of each type of unit.

B. Shop Drawings: Submit shop drawings showing the following:
   1. Dimensions of each item.
   3. Details as follows:
      a. Details of construction.
      b. Anchorage of building structure.
      c. Method of assembling sections.
      d. Critical installation clearances.
      e. Location and installation of hardware and accessories.
      f. Size, shape and thickness of materials, joints and connections.
      g. Indicate manufacturer recommended seismic anchorage details for Title 24 compliance.
   4. Relationship to adjoining work.

C. Installation Instructions: Provide complete installation instructions for each type of unit.

D. Operation and Maintenance Manuals: Prepare maintenance manuals for each item, including, but not limited to the following items:
   1. Lubrication instructions.
   2. Equipment maintenance requirements
   3. Capability of servicing equipment by local firm listing name, address, and telephone number of firm, and name of authorized service representative.

E. Certificate of Test and Compliance. Furnish report of field test of operation under no-load and full load under all conditions of operation for lifts. Furnish certificate of compliance with requirements of the specifications for each item.

1.3 PRODUCE DELIVER, STORAGE AND HANDLING

A. Deliver material in manufacturer’s original packaging.
B. Identify contents, manufacturer, brand name and applicable standards.

C. Store and handle in manner to prevent damage and marring of finish.

D. Protect finished surface from damage. Store units on pallets or other approved devices.

E. Store materials inside building, under protective covering, and protect from weather, moisture, open flames and sparks.

1.4 WARRANTY

A. Provide written warranty covering materials and workmanship of all work of this section for a period of 2 years, and repair or replace all materials which becomes defective during warranty period. Continued use of defective equipment shall be available until replacement equipment is delivered.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Product Acceptability: The Products section contains lists of acceptable products. If product substitutions are proposed, they must be made based upon a comparison of equivalence to the product specified. Considerations may include but shall not be limited to functional, physical, aesthetic and/or interface aspects. The City shall be the sole judge of whether or not a submitted substitution is deemed to be “equivalent” to that specified.

B. Use only products of one manufacturer for each item unless otherwise noted or specified.

C. Contractor is responsible for verifying and updating all model numbers for all equipment.

D. Equipment of other manufacturers may be accepted when approved in accordance with Section 01630.

2.2 EQUIPMENT LIST

A. Item 1: Steam Cleaner, manufactured by Hotsy, 1125 N. Kraemer Place, Anaheim, California 92806. (714) 237-1400, Fax (714) 237-1407. Model 980SS, High Pressure Washer, or equal. The washer shall have the following properties:
   1. 4.0 GPM @ 2000 psi
   2. 5 HP Electric Motor, 230 Volt, 60 Cycle, single phase
   3. Triplex Ceramic Plunger Pump, belt drive
   4. Adjustable temperature control
   5. Stainless Steel coil wrap
   6. Vertical burner, natural gas fired
   7. Rust-proof fuel tank with fuel gauge
   8. 50 foot high pressure hose
   9. Trigger Gun Control, with wand and adjustable nozzle
   10. Power coat finish
   11. 8" Draft Diverter
B. Item 2: Gear Lube Pump, manufactured by Aro, Model 4KK57 or equal. Pump ratio 3:1, 55 gallon container, 300 psi outlet pressure, 6 gpm working flow, air inlet NPT ¼ in., fluid in/out NPT ¾”.

C. Item 3: Chassis Lube Pump, manufactured by Graco, P.O. Box 1441, Minneapolis, MN 55440, (612) 623-6000, Fax (612) 623-6777. Model 239877 or equal. Pump shall have a 5:1 ratio, maximum working pressure of 8400 psi, air motor diameter of 3”, meets OSHA Noise Control requirements, an integral muffler, air cylinder materials is to be aluminum and corrosion resistant. To prolong the life of the throat packing, the pump shall feature an adjustable packing nut.

D. Item 4: Transmission Fluid Pump, manufactured by Aro, Model 4KK57 or equal. Pump ratio 3:1, 55 gallon container, 300 psi outlet pressure, 6 gpm working flow, air inlet NPT ¼ in., fluid in/out NPT ¾”.

E. Item 5: Tire Machine, manufactured by Snap-On Industrial, (877) 740-1901. Model EEWH302A, or equal. High performance tire changer. Outside clamping rim diameter capacity 10 to 20 inches, rim width maximum 12”, bead braking force 3300 lbs at 150 psi air supply, electric requirements 110V, 60HZ 20 amps, air requirements 140-170 psi, 8.5 cfm @ 140 psi nominal airflow volume, safety air shut-off 55 – 65 psi. Provide the following:
1. Safety Restraint Arm
2. Water Filter & Air Lubricator 3/8”
3. Lubrication Storage Bottle
4. Tire Mounting Bar
5. Mount/demount head replacement insert
6. Bead Depressor
7. Side Storage Cabinet
8. Literature packet with operator manual, parts reference & instructional video
9. Motorcycle wheel adapter

F. Item 6: Tire Balancer, manufactured by Snap-on Industrial, (877) 740-1901. Model EEWB305A or equal. Computer wheel balancer. Rim diameter range 6” – 26”, rim width range 3” – 16”, maximum tire diameter 44”, maximum tire width 19”, power requirements 110v, 60HZ. Provide the following:
1. Rim with Calipers
2. Cone – Small Passenger vehicle
3. Cone – Medium Passenger Vehicle
4. Cone – Large Passenger Vehicle
5. Cone – Light Truck
6. Lightweight Polymer Quick Nut
7. Quick Nut Pressure Cup
8. Pressure Disk
9. Motorcycle Adapter

G. Item 7: Bench Grinder, Floor Mounted, manufactured by Dayton, 2211E. Olympic Blvd., Los Angeles, CA 90021 (213) 624-8733, Fax (213) 624-7663. Model 4Z123. Wheel diameter 6”, power rating 1.3 HP, maximum speed 3450 rpm, arbor wheel ½”, power requirement 115v, 3.5/1.75 amps. Provide the following accessories:
1. Grinder Tool Stand
2. Light Eye Shield
3. Safety Shields
4. Dresser

H. Item 8: Drill Press, Floor Mounted, manufactured by Westward, 2211 E Olympic Blvd., Los Angeles, CA 90021 (213) 624-8733, Fax (213) 624-7663. Model 4TM73 or equal. 15" floor mounted drill press, 1-1/2HP, capacity 250-3000 rpm, 12 speeds, table work surface 12" x 12". Rack and pinion elevation control.

I. Item 9: Shop Press, manufactured by Arcan, 1-(800)-221-0516. Model 145924 or equal. 20 Ton Professional Shop Press.

J. Item 10: Strut Compressor wall mounted, manufactured by Branick, 3705 New Macland Road, Powder Springs, GA 30127 (770)943-7524, Fax (770)22-8327, Model BRA7200 or equal.

K. Item 11: Air Compressor, manufactured by Ingersol Rand, 1810 W. Venice, Los Angeles, California 90006 (323)733-4733, Fax (323)733-1254, Model SSR-UP6-20-125 or equal. Electric motor driven, single-stage rotary screw compressor. Capacity 83 cfm @ 125 PSIG, maximum operating pressure 12 PSIG, outlet size 1.0" NPT. 120 gallon receiver tank, starter voltage with Intellisys 230volt, 3 phase, 60 HZ. Provide the following:
   1. Nema 1 Enclosure, Intellisys Option
   2. Standard Efficiency Air Filter
   3. Intellisys Controller (Microprocessor)
   4. Ultra Plus Coolant
   5. Power Outage Restart

   1. 10" Eyewash Bowl
   2. Chrome-plated brass sprayhead assembly with twin, soft flow, eyewash heads and protective spray head covers.
   3. Chrome-plated brass ½" IPS stay-open ball valve.
   4. Galvanized steel and waste tee with floor flange protected with BRADTECT Safety yellow coating
   5. Dome-type strainer and 1-1/4" drain fittings
   6. Water supply ½" IPS

M. Item 13: Safety Storage Cabinet, manufactured by Eagle, 1964 Freeman Avenue, Signal Hill, CA 90075, (888) 401-8862, Fax (562) 248-0232, Model 1947, o equal. Cabinet constructed of 18Ga steel, side, top, bottom, and doors double-walled with 1/1/2" air space between walls. Vents with fire baffle and cap. 3 point key lock and 2" raised leakproof door sill. Adjustable shelves supported by 4 brackets to support 350 lbs. Maximum capacity 45 gallons, 43" W X 18"D x 65"H.

N. Item 14: Key cabinet, refer to Section 10990.
O. Item 15: Bulletin boards, refer to Section 10115

P. Item 16: Vehicle Lift, manufactured by Rotary, 13509 S. Raymond Avenue, Garden, CA 90247, (310) 323-3155, Fax (310) 323-3606. Model SL29i or equal. Two (2) post Smartlift, in ground 9000 lbs capacity, 81-1/8" rise height, 2PH 208V – 230V, single phase phase motor, drive thru overhead clearance 79-1/2". Lift shall have Smartguard Protection.

Q. Item 17: Vehicle Lift, manufactured by Rotary, 13509 S. Raymond Avenue, Garden, CA 90247, (310) 323-3155, Fax (310) 323-3606, Model SL212i or equal. Smartlift in ground 12,000 lbs. capacity, 84-1/4" rise height, 2HP 208V-230V, single phase motor, drive thru overhead clearance 88". Lift shall have Smartguard Protection.

R. Item 18: Not used.

S. Item 19: Eye Wash Shower, manufactured by Bradley, 5556 Ontario Mills Parkway, Ontario, CA 91764, (909) 481-72255, Fax (9909) 481-3466, Model S19-310UU or equal. Combination Drench Shower/Eye Wash Unit, stainless steel shower head and bowl. 10" shower head. Complies with ANSI Standard Z358.1-1998. Galvanized steel protected with BRADTECT Safety yellow coating. Provide the following items:
1. 10" Shower Head
2. Chrome-plated brass 1” IPS stay-open ball valve
3. 10" Eye Wash Bowl
4. Chrome-plated circular spray ring
5. Chrome-plated ½" IPS stay-open ball valve
6. 1-1/4" IPS water supply

T. Items 20 and 21: Battery Charger, manufactured by Associated, 5043 Farlin Avenue, Saint Louis, Mo. 63115, (314) 385-5178. Model ASO6065, or equal. Battery Charger shall have 30A, 14.9V D.C. output. Charging capacity up to 10 to 12V. Charge rated 16. voltmeter 11-17V. Provide the following accessories:
1. UL Listed circuit breaker protection
2. Bus Bar Associated 6075

U. Item 22: Fuel Pumps, refer to Section 15485.

V. Item 24: Overhead Reel, manufactured by Graco, for air, water, engine oil, transmission fluid, gear lube and chassis lube.

W. Item 25: Overhead Reel Light, manufactured by Appleton Electric, EGS Electric Group, 2330 B Artesia Avenue, Fullerton, CA 92833, (714) 525-7100, Fax (714) 525-4502. Model RL5365 or equal. Heavy Duty Cord Reel, grounded with locking ratchet, shock absorbing ball stop and RE-HL5SRG handlamp having switch and receptacle in handle. 50 foot cord length, rating 9A-125V.

X. Item 26: Smog machine: In-ground dynamometer by Maha and WEP500 BAR97 Computer Analyzer with minimum 900 MHz CPU, telephone line hookup and modem by Worldwide Environmental Products Inc., 430 S. Cataract Avenue, San Dimas, CA 91733, (909) 599-6431.

Y. Item 27: Automated fuel control terminal by EJ Ward Inc., refer to Section 15485.

Z. Item 28: Tire rack, Allstor by Masc Manufacturing Inc. Rack shall have a minimum capacity of 50 tires.
AA. Item 29: Transmission Fluid Pump, manufactured by Aro, Model 4KK57 or equal. Pump ratio 3:1, 55 gallon container, 300 psi outlet pressure, 6 gpm working flow, air inlet NPT ¼ in., fluid in/out NPT ¾”.

2.3 IDENTIFICATION
A. Attach to each item of equipment, in conspicuous place, a label stating the capacity or load rating, name of manufacturer, model number, serial number.

PART 3 - EXECUTION

3.1 PREPARATION
A. Furnish templates, piping and wiring diagrams as required for complete installation of equipment where coordination with work of other divisions is required.

3.2 INSPECTION
A. Verify correct dimensions, piping, wiring and anchor bolt locations. Start installation only when conditions are correct. Be sure that openings are sized and aligned within applicable tolerance.

3.3 INSTALLATION
A. Conform to the approved submittals and the manufacturers instructions.

3.4 TESTING
A. In presence of City Engineer, provide operating tests of equipment and demonstrate that the equipment operates smoothly and safely under all conditions or operation. Provide written report of tests. Test each item in all operating modes as applicable.

3.5 INSTRUCTION
A. Furnish the services of a factory trained engineer to train the City’s personnel in operation and maintenance of each item of equipment. Training shall be provided at time directed by City Engineer.

3.6 ADJUST AND CLEAN
A. Make adjustment for efficient operation of equipment.
B. Upon completion of installation, removed debris resulting from the work from the site, and restore all abraded surfaces to original condition using touch-up paint and other approved methods.

END OF SECTION
SECTION 11196
STEEL DETENTION SCREENS

PART 1  GENERAL

1.01  SUBMITTALS
A. Shop Drawings: Show application to project and connection to adjoining construction.
B. Product Data: Screen manufacturer's specifications and installation instructions.
C. Samples:
   1. Wire Cloth: 12 inch by 12 inch pieces.
   2. Steel detention screen approximately 36 inches by 24 inches wide complete with bit key lock mechanism and baked enamel finish.
D. Quality Control Submittals:
   1. Manufacturer's Qualifications Data: If requested, submit to the Director the names and addresses of 5 similar projects where the manufacturer's detention screens have been in use for 3 years.

1.02  QUALITY ASSURANCE
A. Manufacturer's Qualifications: The detention screen manufacturer shall be regularly engaged in the production of detention screens and shall have furnished such products for 5 similar projects that have been in use for not less than 3 years.

PART 2  PRODUCTS

2.01  STEEL DETENTION SCREENS
A. Furnish detention screens with either Type A or Type B frames.
B. Type A (Channel Type) Frames: Assemblies consisting of a fixed unit and a hinged unit.
   1. Stiles and rails for each unit shall be minimum 12 gage steel, formed basically channel shape in cross section, and welded at corners with welds ground smooth on exposed surfaces.
   2. Locking mechanism, hinges, and wire cloth assembly shall be concealed and inaccessible when screen is closed.
   3. Joints between fixed and hinged units shall be equal on all four sides, and shall not exceed 1/8 inch in width.
   4. Rubber bumpers shall be securely fastened to a frame on the lock bolt housing side.
C. Type B (Tubular Type) Frames: Assemblies consisting of a fixed unit and a hinged unit.
1. Stiles and rails of the hinged unit shall be tubular in cross section and shall conceal the locking mechanism and the wire cloth assembly. Tubular members shall be built-up of minimum 12 gage channel/Z members with minimum 18 gage removable concealment plate on the back side of unit. Stiles and rails shall be welded at the corners with welds ground smooth on exposed surfaces.

2. Fixed unit shall be fabricated of minimum 12 gage steel, and members shall be welded at the corners with welds ground smooth on exposed surfaces.

3. Joints between fixed and hinged units shall be equal on all four sides, and shall not exceed 1/8 inch in width.

4. Rubber bumpers shall be securely fastened to a frame on the lock bolt housing side.

D. Wire Cloth: 0.028 inch diameter wire, 12 mesh to the inch, with 43 percent open area, woven from Type 304 stainless steel wires. The wires shall have double crimped crossings, and a woven wire tensile strength of not less than 800 pounds per linear inch after weaving.

E. Wire Cloth: 0.047 inch diameter wire, 10 mesh to the inch, with 28.1 percent open area, woven from Type 304 stainless steel wires. The wires shall have double crimped crossings, and a woven wire tensile strength of not less than 1,600 pounds per linear inch after weaving.

F. Wire Cloth: 0.054 inch diameter wire, 8 mesh to the inch, with 32.8 percent open area, woven from Type 304 stainless steel wires. The wires shall have double crimped crossings, and woven wire tensile strength of not less than 1,600 pounds per linear inch after weaving.

G. Wire Cloth Support Assembly:
   1. Springs: Oil tempered and cadmium plated, flat leaf or coil type, attached to the hinged unit of the frame and connected to wire cloth retainers. Flat leaf type springs shall be provided with clevis and adjusting screw, and shall be spaced as required to receive wire cloth retainers on not exceeding 8 inches on center on 4 sides of the frame. Coil type springs shall be provided with yoke and pins, and shall be spaced not more than 8 inches on center on 4 sides of the frame.
   2. Retainers: Cadmium plated retainer bars, spaced not more than 8 inches on center or continuous retainer bar, on 4 sides of hinged unit, attached to springs. Retainers shall securely hold wire cloth in place.
   3. Support assembly shall have a minimum capacity of 175 lb per 1/2 inch of movement of each retainer.
   4. Support assembly shall provide a minimum overall wire cloth movement of 5/8 inch in both width and height.

H. Hinges: Concealed, electro-galvanized, 0.125 inch steel, with 1/4 inch diameter loose stainless steel or hard brass pins.

I. Locking System:
   1. Mechanism consisting of connecting rods or bars, slide bolts and key control assembly, concealed in stile. Lock case shall be fastened to screen edge with machine screws, and projecting bar linked to connecting rods with cotter pins, for removal without disassembly of complete locking system.
2. Each detention screen shall be equipped with reinforced lock bolts that operate simultaneously from bit key lock through 1/8 inch x 3/8 inch rectangular, or 1/4 inch diameter, minimum, steel, full hard temper bars. Case shall be three pieces of 0.090 inch steel with 0.050 inch steel cover to accept 1/2 inch diameter x 1-3/8 inches long, case hardened steel bolt. Bolt shall have a minimum travel of 1/2 inch. Bolt slide cover shall be attached to main body of case by two steel shoulder type rivets. Bolt reinforcement shall be welded to main body.

3. Lock shall have a minimum of 4 tumblers.

4. Two or three point locking, as required, shall be actuated simultaneously by bit key in control assembly (lock case) accessible from both sides of screen through contoured key holes in stile.

5. Materials: Lock tumblers shall be brass or Type 302 stainless steel; tumbler springs phosphor bronze or beryllium copper alloy, securely staked; slide bolts of case-hardened steel; lock case and cover, and all other parts, brass, electroplated steel, or Type 302 stainless steel.

6. Keying:

J. Scribe Members: Minimum 16 gage steel, and as required to form a close fitting joint between jambs and head of the opening and the screen frame.

K. Fastening Devices: Screen manufacturer's standard screws and anchors unless otherwise shown on the Drawings.

L. Shop Finishing: Except for galvanized or cadmium plated ferrous metal, ferrous metal Work included in this Section, including scribe members, shall be completely finished in the shop using one of the following methods:

1. Method 1: The ferrous metal shall be thoroughly cleaned, bonderized, given a coat of screen manufacturer's standard primer, and then given one coat of screen manufacturer's standard baked-on enamel of standard color as selected.

2. Method 2: The ferrous metal shall be thoroughly cleaned, given a baked-on coat of rust inhibitive primer, and then given 2 coats of screen manufacturer's standard baked-on enamel of standard color as selected.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the Work of this Section in accordance with the screen manufacturer's instructions, except as otherwise shown or specified.

B. Locate fastenings at openings not more than 3 inches from ends of each member. Space fastenings not more than 12 inches on center between end fastenings unless otherwise shown.

3.02 ADJUSTING

A. Adjust and lubricate hardware to Work freely and easily, ready for use.

3.03 CLEANING

A. Clean exposed surfaces of wire cloth and frames of dirt and other foreign material. Comply with screen manufacturer's recommendations for cleaning.
B. Touch-up damaged painted surfaces to match shop finish.

END OF SECTION
SECTION 11410
FOOD SERVICE COOKING EQUIPMENT

SPEC WRITER NOTES:
1. Delete between // _____ // if not applicable to project.
2. Delete other items or paragraphs in the section that are not applicable and renumber the paragraphs.
3. Select cooking equipment according to usage requirements and available utilities.
4. DESIGNER NOTE:
   This specification has links connected to other documents in VA “Technical Information Library (TIL).” These links are to facilitate designers to look into related documents while edited this specification. These links must be deleted before the specification is finalized for a particular project. To delete these links make sure macros are installed on your system, and if not do the following:
   Click on Tools.
   Go to Macro and click on Security.
   Check the Medium Security Level.
   Close the specification, if open.
   Open the specification (again) and follow the prompts on the screen.
   Click on Enable Macros when first prompt appears.
   Delete the links only if specification is ready to be included in the project.

PART 1 - GENERAL
1.1 DESCRIPTION
A. This section specifies food service cooking equipment as follows:
   //1. Ranges, electric.//
   //2. Ranges, gas.//
   //3. Char-broilers, gas.//
   //4. Fryers, deep fat, electric.//
   //5. Fryers, deep fat, gas.//
   //6. Pans, braising, tilting, electric.//
   //7. Pans, braising, tilting, gas.//
   //8. Kettles, steam, stationary, gas.//
   //9. Kettles, steam, tilting, gas.//
   //10. Kettles, steam, stationary, electric.//
   //11. Table-top kettles, tilting, self-contained.//
   //12. Steamers, pressureless convection, countertop, electric.//
   //13. Steamers, pressureless, convection, two compartment.//
   //14. Ovens, rotating rack.//
   //15. Ovens, conveyor.//
17. Ovens, quick bake.
18. Ovens, convection.
19. Urns, coffee.

1.2 RELATED WORK
A. Seismic Restraint of Equipment: Section 13081, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
B. Plumbing Connections: Section 15400, PLUMBING SYSTEMS.
C. Electrical Connections: Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
D. Electrical Disconnect Switches: Section 16170, DISCONNECT SWITCHES (MOTOR AND CIRCUIT).

1.3 QUALITY CONTROL
A. Installer Qualifications: Experienced in food service equipment installation or supervised by an experienced food service equipment installer.
   1. Where required to complete equipment installation, electrician and plumber shall be licensed in jurisdiction where project is located.

   SPEC WRITER NOTE: UL Environmental and Public Health (EPH) Classification Mark is currently used by UL to certify compliance with NSF/ANSI standards. Equipment evaluated by UL before 2001 may bear the UL Food Service Product Certification Mark.

B. NSF Compliance: Equipment bears NSF Certification Mark or UL Classification Mark indicating compliance with NSF/ANSI 4.
C. UL Listing: Equipment is listed in UL "Heating, Cooling, Ventilating and Cooking Equipment Directory" and is labeled for intended use.
   1. Electric Cooking Equipment: Evaluated according to UL 197.

   SPEC WRITER NOTE: The American Gas Association (AGA) no longer certifies gas-burning equipment.

   2. Gas-Burning Cooking Equipment: Evaluated according to ANSI Z83.11/CGA 1.8-M96 and its addendum.
D. Steam-Generating Equipment: Fabricated and labeled to comply with ASME BPVC.

   SPEC WRITER NOTE: Retain paragraph and subparagraphs below if required for project location.

E. Seismic Restraint:
   1. Comply with requirements in Section 13081, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

F. In-Use Service: At least one factory-authorized service agency for equipment shall be located in the geographical area of the installation and shall have the ability to provide service within 24 hours after receiving a service call.

1.4 SUBMITTALS
A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
B. Manufacturer's Literature and Data:
   1. Include manufacturer's address and telephone number.
   2. Include catalog or model numbers and illustrations and descriptions of cooking equipment.
C. Installation Drawings: Show dimensions, details of installation, coordination with plumbing and electrical work, and other work required for a complete installation.
D. Operating Instructions: In accordance with requirements in Section 01010, GENERAL REQUIREMENTS.

1.5 WARRANTY
Warrant food service equipment to be free from defects in materials and workmanship in accordance with requirements of "Warranty of Construction" article in Section 01001, GENERAL CONDITIONS.

1.6 APPLICABLE PUBLICATIONS
A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
B. American National Standards Institute/Canadian Gas Assoc. (ANSI/CGA):
   Z83.11-02..................................Gas Food Service Equipment
C. ASME International (ASME):
   BPVC-2005 ...............................Boiler and Pressure Vessel Code
D. NSF International/American National Standards Institute (NSF/ANSI):
   4-02 .....................................Commercial Cooking, Rethermalization, and Powered Hot Food Holding and Trans Equipment
E. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
   Kitchen Ventilation Systems and Food Service Equipment Fabrication and Installation Guidelines, 2001
F. Underwriters Laboratories Inc. (UL):
   197-03 .................................Commercial Electric Cooking Appliances
   UL Heating, Cooling, Ventilating and Cooking Equipment Directory

PART 2 – PRODUCTS

SPEC WRITER NOTE:
1. Symbols below correspond with "Room Equipment Guide" identification system. Verify project requirements before specifying equipment that deviates from "Room Equipment Guide."
2. Edit symbols to coordinate with identification shown on drawings.

2.1 RANGES, ELECTRIC

A. General Requirements: Heavy-duty (designed for constant use in institutional-type kitchen) electric ranges as follows:
   1. Stainless-steel exterior finish.
   2. Swivel casters, with brakes on front casters.
   3. Accessories:
      a. Extra oven rack for each oven compartment.

SPEC WRITER NOTE: Select range top component according to anticipated use and menu.

B. Electric Range Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>TOP COMPONENT</th>
<th>BASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>K5001</td>
<td>Six burner</td>
<td>Standard oven</td>
</tr>
<tr>
<td>K5002</td>
<td>Six burner</td>
<td>Convection oven</td>
</tr>
<tr>
<td>K5003</td>
<td>Six burner</td>
<td>Cabinet storage</td>
</tr>
<tr>
<td>K5011</td>
<td>Four burner</td>
<td>Standard oven</td>
</tr>
<tr>
<td>K5022</td>
<td>Even heat</td>
<td>Standard oven</td>
</tr>
<tr>
<td>K5023</td>
<td>Even heat</td>
<td>Convection oven</td>
</tr>
<tr>
<td>K5024</td>
<td>Even heat</td>
<td>Cabinet storage</td>
</tr>
<tr>
<td>K5042</td>
<td>Griddle</td>
<td>Standard oven</td>
</tr>
<tr>
<td>K5043</td>
<td>Griddle</td>
<td>Convection oven</td>
</tr>
<tr>
<td>K5044</td>
<td>Griddle</td>
<td>Cabinet storage</td>
</tr>
</tbody>
</table>

2.2 RANGES, GAS

A. General Requirements: Heavy-duty (designed for constant use in institutional-type kitchen) gas ranges as follows:
   1. Stainless-steel exterior finish.
   2. Electronic ignition.
   3. Flue riser not less than 406 mm (16 inch) high.
   4. Rear gas connection.
   5. Swivel casters with brakes on front casters.
   6. Gas flex hose and quick disconnect with restraining device.
7. Accessories:
   a. Extra oven rack for each oven compartment.

   *SPEC WRITER NOTE: Select range top component according to anticipated use and menu.*

B. Gas Range Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>TOP COMPONENT</th>
<th>BASE</th>
</tr>
</thead>
<tbody>
<tr>
<td>K5004</td>
<td>Six burner</td>
<td>Standard oven</td>
</tr>
<tr>
<td>K5005</td>
<td>Six burner</td>
<td>Convection oven</td>
</tr>
<tr>
<td>K5006</td>
<td>Six burner</td>
<td>Cabinet storage</td>
</tr>
<tr>
<td>K5014</td>
<td>Four burner</td>
<td>Standard oven</td>
</tr>
<tr>
<td>K5029</td>
<td>Even heat</td>
<td>Standard oven</td>
</tr>
<tr>
<td>K5030</td>
<td>Even heat</td>
<td>Convection oven</td>
</tr>
<tr>
<td>K5031</td>
<td>Even heat</td>
<td>Cabinet storage</td>
</tr>
<tr>
<td>K5049</td>
<td>Griddle with full-width grease trough and spillage drawer</td>
<td>Standard oven</td>
</tr>
<tr>
<td>K5050</td>
<td>Griddle with full-width grease trough and spillage drawer</td>
<td>Convection oven</td>
</tr>
<tr>
<td>K5051</td>
<td>Griddle with full-width grease trough and spillage drawer</td>
<td>Cabinet storage</td>
</tr>
</tbody>
</table>

2.3 CHAR-BROILERS, GAS

A. General Requirements: Heavy-duty (designed for constant use in institutional-type kitchen) gas char-broilers as follows:

1. Stainless-steel exterior finish.
2. Rear gas connection.
3. Swivel casters with brakes on front casters.
4. Gas multiflex hose and quick disconnect with restraining device.
5. Gas electronic ignition.

B. Gas Char-Broiler Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>ACCESSORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>K5055</td>
<td>Cabinet base</td>
</tr>
<tr>
<td></td>
<td>Splash guard</td>
</tr>
<tr>
<td>K5056</td>
<td>Cabinet base</td>
</tr>
<tr>
<td></td>
<td>Splash guard</td>
</tr>
</tbody>
</table>
2.4 FRYERS, DEEP FAT, ELECTRIC

A. General Requirements, Fryers: Electric deep-fat fryers as follows:
   1. Stainless-steel pot, door, and cabinet.
   2. Casters.
   3. Twin Full-size basket.
   5. Solid-state controller.
   7. Melt cycle.

B. Modular Filters: Filtering system in mobile stainless-steel cabinet with top-mounted food warmer and holding station.

C. Built-in Filters: In filter-cabinet base located under fryer.

SPEC WRITER NOTE:
   1. Select shortening capacity according to anticipated use; actual use should not exceed 80 percent of unit capacity.
   2. Select filter according to anticipated use and menu.

C. Electric Deep-Fat Fryer and Filter Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>SHORTENING CAPACITY PER FRYER UNIT</th>
<th>NO. OF FRYER UNITS</th>
<th>NO./TYPE OF FILTER UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>K5061</td>
<td>18 kg (40 lb)</td>
<td>One, filter ready</td>
<td></td>
</tr>
<tr>
<td>K5062</td>
<td>23 kg (50 lb)</td>
<td>One, filter ready</td>
<td></td>
</tr>
<tr>
<td>K5065</td>
<td>23 kg (50 lb)</td>
<td>-</td>
<td>One, modular</td>
</tr>
<tr>
<td>K5066</td>
<td>18 kg (40 lb)</td>
<td>One</td>
<td>One, modular</td>
</tr>
<tr>
<td>K5069</td>
<td>23 kg (50 lb)</td>
<td>One</td>
<td>One, modular</td>
</tr>
<tr>
<td>K5067</td>
<td>18 kg (40 lb)</td>
<td>Two</td>
<td>One, modular</td>
</tr>
<tr>
<td>K5070</td>
<td>23 kg (50 lb)</td>
<td>Two</td>
<td>One, modular</td>
</tr>
</tbody>
</table>
2.5 FRYERS, DEEP FAT, GAS

A. General Requirements, Fryers: Gas deep-fat fryers as follows:
   1. Stainless-steel pot, door, and cabinet.
   2. Casters.
   3. Electric ignition.
   4. Twin Full-size baskets.
   5. Basket lifts.
   7. Stainless-steel cover.
   8. Multiflexible quick disconnect, 1219 mm (48 inches) long.

B. Modular Filters: Filtering system in mobile stainless-steel cabinet with top-mounted food warmer and holding station.

C. Built-in Filters: In filter-cabinet base located under fryer.

SPEC WRITER NOTE:
1. Select shortening capacity according to anticipated use; actual use should not exceed 80 percent of unit capacity.
2. Select filter according to anticipated use and menu.

D. Gas Deep-Fat Fryer and Filter Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>SHORTENING CAPACITY PER FRYER UNIT</th>
<th>NO. OF FRYER UNITS</th>
<th>NO./TYPE OF FILTER UNITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>K5063</td>
<td>18 kg (40 lb)</td>
<td>One, filter ready</td>
<td>-</td>
</tr>
<tr>
<td>K5064</td>
<td>23 kg (50 lb)</td>
<td>One, filter ready</td>
<td>-</td>
</tr>
<tr>
<td>K5065</td>
<td>23 kg (50 lb)</td>
<td>-</td>
<td>One, modular</td>
</tr>
<tr>
<td>K5072</td>
<td>18 kg (40 lb)</td>
<td>-</td>
<td>One, modular</td>
</tr>
<tr>
<td>K5075</td>
<td>23 kg (50 lb)</td>
<td>One</td>
<td>One, modular</td>
</tr>
</tbody>
</table>
2.6 PANS, BRAISING, TILTING, ELECTRIC

A. General Requirements: Electric, tilting braising pans as follows:
   1. Stainless-steel construction.
   2. 228 mm (9 inch) deep pan.
   3. Spring-assisted cover.
   5. Gallon and liter markings.
   SPEC WRITER NOTE: Select accessories according to anticipated use and menu.

6. Accessories:
   a. // Single // Double // pantry faucet with swing spout and mounting bracket.
   b. Pan carrier.
   c. 51 mm (2 inch) long, tangent draw-off.
   SPEC WRITER NOTE: Select capacity according to anticipated use; actual use should not exceed 80 percent of capacity of unit.

B. Electric, Tilting Braising Pan Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>K5090</td>
<td>114 L (30 gal.)</td>
</tr>
<tr>
<td>K5091</td>
<td>151 L (40 gal.)</td>
</tr>
</tbody>
</table>

2.7 PANS, BRAISING, TILTING, GAS

A. General Requirements: Gas, tilting braising pans as follows:
   1. Stainless-steel construction.
   2. 228 mm (9 inch) deep pan.
   3. Spring-assisted cover.
   5. Gallon and liter markings.
6. Electric ignition. SPEC WRITER NOTE: Select accessories according to anticipated use and menu.

7. Accessories:
   a. // Single // Double // pantry faucet with swing spout and mounting bracket.
   b. Pan carrier.
   c. 51 mm (2 inch) long, tangent draw-off.
      SPEC WRITER NOTE: Select capacity according to anticipated use; actual use should not exceed 80 percent of capacity of unit.

B. Gas, Tilting Braising Pan Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>K5092</td>
<td>114 L (30 gal.)</td>
</tr>
<tr>
<td>K5093</td>
<td>151 L (40 gal.)</td>
</tr>
</tbody>
</table>

2.8 KETTLES, STEAM, STATIONARY, GAS
A. General Requirements: Gas, stationary steam kettles as follows:
   1. Stainless-steel kettle and supports, Type 304 with No. 4 finish.
   2. // 51 mm (2 inch) // 76 mm (3 inch) // long, tangent draw-off with strainer.
   3. Spring-assisted cover.
   4. Insulated steam jacket.
   5. Electronic ignition.
      SPEC WRITER NOTE: Select options and accessories according to anticipated use and menu.

6. Options and Accessories:
   a. Type 316 stainless-steel kettle liner for high-acid food products.
   b. Hot- and cold-water faucet with swing spout.
   c. Kettle gallon and liter markings.
   d. Kettle brush kit.
   e. Basket inserts.
      SPEC WRITER NOTE: Select capacity according to anticipated use and menu.

B. Gas, Stationary Steam Kettle Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>JACKETED KETTLE</th>
<th>CAPACITY</th>
</tr>
</thead>
</table>
### 2.9 KETTLES, STEAM, TILTING, GAS

**A. General Requirements:** Gas, tilting steam kettles as follows:

1. Stainless-steel kettle and supports, Type 304 with No. 4 finish.
2. \(51 \text{ mm (2 inch)} \) \(76 \text{ mm (3 inch)} \) long, tangent draw-off with strainer.
3. Spring-assisted cover.
4. Insulated steam jacket.
5. Tilt mechanism.

**SPEC WRITER NOTE:** Select options and accessories according to anticipated use and menu.

7. **Options and Accessories:**
   - Type 316 stainless-steel kettle liner for high-acid food products.
   - Hot- and cold-water faucet with swing spout.
   - Kettle gallon and liter markings.
   - Kettle brush kit.
   - Basket inserts.

**SPEC WRITER NOTE:** Select capacity according to anticipated use and menu.

**B. Gas, Tilting Steam Kettle Units:**

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>JACKETED KETTLE</th>
<th>CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>K5146</td>
<td>Two-thirds</td>
<td>76 L (20 gal.)</td>
</tr>
<tr>
<td>K5147</td>
<td>Two-thirds</td>
<td>151 L (40 gal.)</td>
</tr>
<tr>
<td>K5148</td>
<td>Two-thirds</td>
<td>227 L (60 gal.)</td>
</tr>
</tbody>
</table>

### 2.10 KETTLES, STEAM, STATIONARY, ELECTRIC

**A. General Requirements:** Electric, stationary steam kettles as follows:

1. Stainless-steel kettle and supports/cabinet, Type 304, No. 4 finish.
2. // 51 mm (2 inch) // 76 mm (3 inch) // long, tangent draw-off with strainer.
3. Spring-assisted cover.
4. Insulated steam jacket.

SPEC WRITER NOTE: Select options and accessories according to anticipated use and menu.

5. Options and Accessories:
   a. Type 316 stainless-steel kettle liner.
   b. Hot- and cold-water faucet with swing spout.
   c. Kettle gallon and liter markings.
   d. Kettle brush kit.
   e. Basket inserts.

SPEC WRITER NOTE: Select capacity according to anticipated use and menu.

B. Electric, Stationary Steam Kettle Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>K5150</td>
<td>76 L (20 gal.)</td>
</tr>
<tr>
<td>K5151</td>
<td>151 L (40 gal.)</td>
</tr>
<tr>
<td>K5152</td>
<td>227 L (60 gal.)</td>
</tr>
<tr>
<td>K5160</td>
<td>76 L (20 gal.)</td>
</tr>
<tr>
<td>K5161</td>
<td>151 L (40 gal.)</td>
</tr>
<tr>
<td>K5162</td>
<td>227 L (60 gal.)</td>
</tr>
</tbody>
</table>

2.11 TABLE-TOP KETTLES, TILTING, SELF-CONTAINED

A. General Requirements, Kettles: Self-contained, titling, table-top kettles as follows:
   1. Type 304 stainless-steel, one-piece welded construction.
   2. Stainless-steel exposed surfaces.
   3. Large pouring lip.
   4. Right-hand tilt handle.
   5. Two-thirds jacketed insulated steam jacket.

SPEC WRITER NOTE: Select options and accessories according to anticipated use and menu.
7. Options and Accessories:
   a. Double pantry faucet with swing spout.
   b. Lift-off cover.
   c. Type 316 stainless-steel interior.
   d. Basket insert.

B. Kettle Support Stands: With drainer drawer and splash screen, stainless-steel construction.
   SPEC WRITER NOTE: Select capacity according to anticipated use and menu.

C. Self-Contained, Tilting, Table-Top Kettle and Support Stand Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>CAPACITY</th>
<th>DESCRIPTION</th>
<th>SELF-CONTAINED HEAT SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>K5174</td>
<td>9.5 L (10 quart)</td>
<td>Kettle</td>
<td>Electric steam generator</td>
</tr>
<tr>
<td>K5175</td>
<td>19 L (20 quart)</td>
<td>Kettle</td>
<td>Electric steam generator</td>
</tr>
<tr>
<td>K5178</td>
<td>-</td>
<td>Support stand for 9.5-L (10-quart) kettle</td>
<td>-</td>
</tr>
<tr>
<td>K5179</td>
<td>-</td>
<td>Support stand for 19-L (20-quart) kettle</td>
<td>-</td>
</tr>
<tr>
<td>K5195</td>
<td>19 L (20 quart)</td>
<td>Kettle</td>
<td>Gas steam generator</td>
</tr>
</tbody>
</table>

2.12 STEAMERS, PRESSURELESS CONVECTION, COUNTERTOP, ELECTRIC

A. General Requirements: Electric, countertop pressureless convection steamers as follows:
   1. Stainless-steel door, cavity, and steam generator.
   2. One compartment.
   3. Automatic water fill.
   4. 60-minute timer.
   5. Support legs.
   6. Heavy-duty (designed for constant use in institutional-type kitchen) door and latch mechanism.
   SPEC WRITER NOTE: Select accessories according to anticipated use and menu.

7. Accessories:
   a. Floor stand.
   b. Stacking kit.
   c. Cafeteria Pans: // 25 mm (1 inch) // 63 mm (2-1/2 inches) // 101 mm (4 inches) // deep.
     1) Quantity: [_____].
B. Electric, Countertop Pressureless Convection Steamer Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>K5180</td>
<td>Five pans</td>
</tr>
</tbody>
</table>

2.13 STEAMERS, PRESSURELESS, CONVECTION, TWO COMPARTMENT

A. General Requirements: Two-compartment, pressureless convection steam generators as follows:
   1. Stainless-steel construction.
   2. Two independent steamer compartments.
   3. Insulated doors.
   5. 60-minute mechanical timer.
   6. Water-level control system with low water cut-off.
   7. Self-contained heat source.
   8. Water filtering system.

SPEC WRITER NOTE: Select heat source and capacity according to anticipated use and menu.

B. Two-Compartment, Pressureless Convection Steam Generator Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>CAPACITY</th>
<th>SELF-CONTAINED HEAT SOURCE</th>
<th>SERVICE CONNECTION ACCESSORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>K5183</td>
<td>Three pans per compartment</td>
<td>Electric steam generator</td>
<td>-</td>
</tr>
<tr>
<td>K5185</td>
<td>Three pans per compartment</td>
<td>Gas steam generator, electronic ignition</td>
<td>1219-mm (48-inch) flexible gas hose with quick disconnect and restraining device for gas oven section</td>
</tr>
</tbody>
</table>

2.14 OVENS, ROTATING RACK

A. General Requirements: Rotating-rack ovens as follows:
   1. Stainless-steel interior and exterior.
   2. Overhead rack-turning device.
   3. Insulation throughout.
   5. Electronic temperature controls.
   6. Automatic rack-lifting device.
7. Built-in steam system.

SPEC WRITER NOTE: Select accessories according to anticipated use and menu.

8. Accessories:
   a. Oven Racks: // Stainless steel // Aluminum //, front loading with // 76 mm (3 inch) // 101 mm (4 inch) // 127 mm (5 inch) // spacing.
      1) Quantity: [_____].

B. Rotating-Rack Oven Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>CAPACITY</th>
<th>HEATING SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>K5301</td>
<td>Single rack</td>
<td>Electric</td>
</tr>
<tr>
<td>K5302</td>
<td>Double rack</td>
<td>Electric</td>
</tr>
<tr>
<td>K5303</td>
<td>Single rack</td>
<td>Natural gas, electronic ignition</td>
</tr>
<tr>
<td>K5304</td>
<td>Double rack</td>
<td>Natural gas, electronic ignition</td>
</tr>
</tbody>
</table>

2.15 OVENS, CONVEYOR

A. General Requirements: Conveyor ovens as follows:
   1. Stainless-steel front top and sides.
   3. // 609 mm (24 inch) high, stainless-steel stand with casters // Approximately 584 mm (23 inch) high legs with casters for single unit // Approximately 432 mm (17 inch) high legs with casters for double-stacked unit //.
   4. Extension shelf, // 304 mm (12 inches) // 381 mm (15 inches) //.

SPEC WRITER NOTE:
   1. Select heat source according to available utilities and menu.
   2. Select number of sections according to anticipated use and menu.

B. Conveyor Oven Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>SECTIONS</th>
<th>HEAT SOURCE</th>
<th>SERVICE CONNECTION ACCESSORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>K5307</td>
<td>One</td>
<td>Electric</td>
<td>-</td>
</tr>
<tr>
<td>K5309</td>
<td>Two, stacked</td>
<td>Electric</td>
<td>-</td>
</tr>
<tr>
<td>K5311</td>
<td>One</td>
<td>Gas, electronic ignition</td>
<td>1219 mm (48 inch) flexible gas hose with quick disconnect and restraining device for gas oven section</td>
</tr>
</tbody>
</table>
2.16 OVENS, CONVECTION/STEAMER

A. General Requirements: Convection/steamer ovens as follows:
   1. Stainless-steel door, cavity, and steam generator.
   2. Removable pan-rack assembly.
   3. Core temperature probe.
   4. Manual controls for hot air, steaming, hot air and steaming, cool down, generator blow down, and off.
   5. Timer.
   6. Spray hose, // 1500 mm (60 inches) // 3000 mm (118 inches) // long.
      SPEC WRITER NOTE: Select accessories according to anticipated use and menu.

7. Accessories:
   a. Stainless-steel stand with casters.
   b. Stacking kit.
   c. Wire racks.
      1) Quantity: [_____ ].
   d. Chicken rack.
   e. Additional pan insert.
      SPEC WRITER NOTE: Select number of compartments and heat source according to anticipated use and menu.

B. Convection/Steamer Oven Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>COMPARTMENTS</th>
<th>HEAT SOURCE</th>
<th>SPECIAL ACCESSORIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>K5316</td>
<td>Two</td>
<td>Electric</td>
<td></td>
</tr>
<tr>
<td>K5317</td>
<td>One</td>
<td>Gas, electronic ignition</td>
<td>Pan slides for stand 1219 mm (48 inch) flexible gas hose with quick disconnect and restraining device for gas oven section</td>
</tr>
<tr>
<td>K5318</td>
<td>Two</td>
<td>Gas, electronic ignition</td>
<td>1219 mm (48 inch) flexible gas hose with quick disconnect and restraining device for gas oven section</td>
</tr>
</tbody>
</table>
2.17 OVENS, QUICK BAKE
A. General Requirements: Quick-bake ovens as follows:
   1. Stainless-steel front, top, sides, and cavity.
   2. Hinged, stainless-steel door.
   3. Digital controls.
   4. Rear vent.
      SPEC WRITER NOTE: Select heat type according to menu.
   5. Heating by // convected heat and microwave elements // halogen lamps //.
      SPEC WRITER NOTE: Select accessories according to anticipated use, menu, and oven type.
   6. Accessories:
      a. Small Ware: //Cool platter // 406 mm (16 inch) diameter grill // 300 mm (12 inch) diameter nonstick pan // 300 mm (12 inch) diameter cooking dish // Black pans for pizza dough // Cook platter // Paddles //.
      SPEC WRITER NOTE: Select capacity according to anticipated use and menu.
B. Quick-Bake Oven Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>CAPACITY</th>
<th>HEAT SOURCE</th>
</tr>
</thead>
<tbody>
<tr>
<td>K5320</td>
<td>Single section</td>
<td>Electric</td>
</tr>
</tbody>
</table>

2.18 OVENS, CONVECTION
A. General Requirements: Convection ovens as follows:
   1. Stainless-steel door, cavity, and exterior.
   2. Manual controls, for hot air, cool down, and off.
   3. Timer.
      SPEC WRITER NOTE: Select accessories according to anticipated use and menu.
   4. Accessories:
      a. Stainless-steel stand with casters.
      b. Stacking kit.
      c. Wire racks.
         1) Quantity: [_____].
      SPEC WRITER NOTE: Select capacity according to anticipated use and menu.
B. Convection Oven Units:
2.19 URNS, COFFEE

A. General Requirements: Electric, twin coffee urns as follows:
   2. Stainless-steel exterior // insulated //.
   3. Two, sight glass for coffee and water and spigots // single // dual // sided.
   4. Automatic controls.
   5. Low water cut-off.

   SPEC WRITER NOTE: Select accessories according to anticipated use and menu.

   7. Accessories:
      a. Water filter.
      b. Half brew.

B. Urn, Coffee, Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>COMPARTMENTS/ CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>K5411</td>
<td>One/ 23 L (6 gal.)</td>
</tr>
<tr>
<td>K5412</td>
<td>Two/ 23 L (6 gal.)</td>
</tr>
<tr>
<td>K5413</td>
<td>One/ 38 L (10 gal.)</td>
</tr>
</tbody>
</table>
PART 3 – EXECUTION

3.1 INSTALLATION

A. Install cooking equipment level and plumb; arranged for safe and convenient operation; with access clearances required for maintenance and cleaning; and according to manufacturer’s written instructions.

B. Interconnect cooking equipment to service utilities.

SPEC WRITER NOTE: Retain paragraph below if required for project location.

C. Install seismic restraints for equipment.

3.2 CLEAN-UP

A. At completion of the installation, clean and adjust cooking equipment as required to produce ready-for-use condition.

B. Where stainless-steel surfaces are damaged during installation procedures, repair finishes to match adjoining undamaged surfaces.

3.3 INSTRUCTIONS

Instruct personnel and transmit operating instructions in accordance with requirements in Section 01010, GENERAL REQUIREMENTS.

END OF SECTION
SECTION 11411
FOOD SERVICE WAREWASHING EQUIPMENT

SPEC WRITER NOTES:
1. Delete between /// _____ /// if not applicable to project.
2. Delete other items or paragraphs in the section that are not applicable and renumber the paragraphs.
3. Select warewashing machines according to usage requirements (volume and type of ware), available space and utilities, and local plumbing codes.
4. DESIGNER NOTE:
This specification has links connected to other documents in VA “Technical Information Library (TIL).” These links are to facilitate designers to look into related documents while edited this specification. These links must be deleted before the specification is finalized for a particular project. To delete these links make sure macros are installed on your system, and if not do the following:
Click on Tools.
Go to Macro and click on Security.
Check the Medium Security Level.
Close the specification, if open.
Open the specification (again) and follow the prompts on the screen.
Click on Enable Macros when first prompt appears.
Delete the links only if specification is ready to be included in the project.

PART 1 - GENERAL
1.1 DESCRIPTION
A. This section specifies food service warewashing equipment as follows:
   ///1. Dishwashing machines, undercounter.///
   ///2. Dishwashing machines, single tank, electric.///
   ///3. Dishwashing machines, conveyer, single tank, electric.///
   ///4. Dishwashing machines, conveyer, double tank, electric.///
   ///5. Fight-type dish machines, rackless conveyor, electric.///
   ///6. Dishwashing system, circular.///
   ///7. Pot washer, electric, rack.///
   ///8. Warewasher booster heater, electric.///

1.2 RELATED WORK
A. Warewashing Tables: Section 11401, CUSTOM-FABRICATED FOOD SERVICE EQUIPMENT.
B. Waste Disposers: Section 11412, FOOD WASTE MACHINES.

SPEC WRITER NOTE: Retain paragraph below if required for project location.
1.3 QUALITY CONTROL

A. Installer Qualifications: Licensed electrician and plumber either experienced with food service equipment installation or supervised by an experienced food service equipment installer.

SPEC WRITER NOTE: UL Environmental and Public Health (EPH) Classification Mark is currently used by UL to certify compliance with NSF/ANSI standards. Equipment evaluated by UL before 2001 may bear the UL Food Service Product Certification Mark.

B. NSF Compliance: Equipment bears the NSF Certification Mark or UL Classification Mark indicating conformance with NSF/ANSI 3.

C. UL Listing: Equipment has been evaluated according to UL 921, is listed and labeled by UL.

SPEC WRITER NOTE: Retain paragraph and subparagraphs below if required for project location.

D. Seismic Restraint:
   1. Comply with requirements in Section 13081, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

E. In-Use Service: At least one factory-authorized service agency for equipment shall be located in the geographical area of the installation and shall have the ability to provide service within 24 hours after receiving a service call.

1.4 SUBMITTALS

A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.

B. Manufacturer's Literature and Data:
   1. Include manufacturer's address and telephone number.
   2. Include catalog or model numbers, and illustrations and descriptions of warewashing equipment and accessories.

C. Installation Drawings: Show dimensions; method of assembly; and details of installation, adjoining construction, coordination with plumbing and electrical work, and other work required for a complete installation.
D. Operating Instructions: Comply with requirements in Section 01010, GENERAL REQUIREMENTS.

1.5 WARRANTY

Warrant food service equipment to be free from defects in materials and workmanship in accordance with requirements of "Warranty of Construction" article in Section 01001, GENERAL CONDITIONS.

1.6 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. NSF International/American National Standards Institute (NSF/ANSI):
   3-2001 ........................................Commercial Warewashing Equipment


D. Underwriters Laboratories Inc. (UL):
   921-96 ........................................Commercial Electric Dishwashers, including revision through and including March 16, 2000

PART 2 – PRODUCTS

SPEC WRITER NOTE:
1. Select capacity of units according to anticipated use; actual use should not exceed 80 percent of capacity of unit.
2. Symbols below correspond with "Room Equipment Guide" identification system. Verify project requirements before specifying equipment that deviates from "Room Equipment Guide."
3. Edit symbols to coordinate with identification shown on drawings.

2.1 DISHWASHING MACHINES, UNDERCOUNTER

A. General Requirements:
   1. Stainless-steel construction.
   2. Stainless-steel top and side panels.
   3. Capacity based on 508 by 508 mm (20 by 20 inch) racks.
   4. Accessories:
      a. Water-pressure regulating valve.

B. Sanitizing Systems:

SPEC WRITER NOTE:
1. Select booster heater or chemical sanitizing according to functional requirements and hot-water temperature that is available.
2. Select booster heater temperature rise according to hot-water temperature that is available; water
delivered to warewasher from booster heater must be 82 degrees C (180 degrees F).

1. Booster Heater: Built-in, electric that produces a // 22 degrees C (40 degrees F) // 39 degrees C (70 degrees F) // water-temperature rise.
2. Chemical: Low-temperature chemical sanitizing system.

C. Undercounter Dishwashing Machine Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>CAPACITY RACKS/HR.</th>
<th>SANITIZING SYSTEM</th>
</tr>
</thead>
<tbody>
<tr>
<td>K8010</td>
<td>40</td>
<td>Booster heater</td>
</tr>
<tr>
<td>K8011</td>
<td>30</td>
<td>Chemical</td>
</tr>
</tbody>
</table>

2.2 DISHWASHING MACHINES, SINGLE TANK, ELECTRIC

A. General Requirements:

1. Stainless-steel construction.
2. Stainless-steel enclosure panels.
3. Control panel.
4. Electric tank heat.
5. Capacity based on 508 by 508 mm (20 by 20 inch) racks.

SPEC WRITER NOTE:  
1. Select accessories according to functional requirements and space available.
2. Select booster heater temperature rise according to hot-water temperature that is available; water delivered to warewasher from booster heater must be 82 degrees C (180 degrees F).

6. Accessories:

a. Built-in, electric booster heater that produces a // 22 degrees C (40 degrees F) // 39 degrees C (70 degrees F) // water-temperature rise.

b. Water-pressure regulating valve.

c. Corner application.

d. 686 mm (27 inch) wide door opening to accommodate trays and sheet pans.

B. Electric, Single-Tank Dishwashing Machine Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>CAPACITY RACKS/HR.</th>
</tr>
</thead>
<tbody>
<tr>
<td>K8015</td>
<td>53</td>
</tr>
</tbody>
</table>

2.3 DISHWASHING MACHINES, CONVEYOR, SINGLE TANK, ELECTRIC
A. General Requirements:
1. Stainless-steel construction.
2. Stainless-steel front panels.
5. Automatic tank fill.
6. Control panel.
7. Operates // in direction indicated on drawings // right to left // left to right //.
8. Capacity based on 508 by 508 mm (20 by 20 inch) racks.

SPEC WRITER NOTE:
1. Select accessories according to functional requirements and space available.
2. Select booster heater temperature rise according to hot-water temperature that is available; water delivered to warewasher from booster heater must be 82 degrees C (180 degrees F).

9. Accessories:
   a. Stainless-steel vent cowls with stack and locking dampers.
   b. Built-in, electric booster heater that produces a // 22 degrees C (40 degrees F) // 39 degrees C (70 degrees F) // water-temperature rise.
   c. Table limit switch.
   d. Water-pressure regulating valve.
   e. Sideloader // with // without // hood.

B. Electric, Single-Tank, Conveyor Dishwashing Machine Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>CAPACITY</th>
<th>UNIT LENGTH</th>
<th>PREWASH REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>RACKS/HR.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K8030</td>
<td>200</td>
<td>1117 mm (44 inches)</td>
<td>-</td>
</tr>
<tr>
<td>K8031</td>
<td>200</td>
<td>1676 mm (66 inches)</td>
<td>Prewash</td>
</tr>
<tr>
<td>K8040</td>
<td>200</td>
<td>1930 mm (76 inches)</td>
<td>Prewash</td>
</tr>
</tbody>
</table>

2.4 DISHWASHING MACHINES, CONVEYOR, DOUBLE TANK, ELECTRIC

A. General Requirements:
1. Stainless-steel construction.
2. Stainless-steel front panels.
5. Automatic tank fill.
6. Control panel.
7. Operates in direction indicated on drawings // right to left // left to right //.
8. Capacity based on 508 by 508 mm (20 by 20 inch) racks.

SPEC WRITER NOTE:
1. Select accessories according to functional requirements and space available.
2. Select booster heater temperature rise according to hot-water temperature that is available; water delivered to warewasher from booster heater must be 82 degrees C (180 degrees F).

9. Accessories:
   a. Stainless-steel vent cowls with stack and locking dampers.
   b. Built-in, electric booster heater that produces a // 22 degrees C (40 degrees F) // 39 degrees C (70 degrees F) // water-temperature rise.
   c. Table limit switch.
   d. Water-pressure regulating valve.
   e. Sideloader // with // without // hood.

B. Electric, Double-Tank, Conveyor Dishwashing Machine Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>CAPACITY RACKS/HR.</th>
<th>UNIT LENGTH</th>
<th>PREWASH REQUIREMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>K8050</td>
<td>254</td>
<td>1626 mm (64 inches)</td>
<td>-</td>
</tr>
<tr>
<td>K8051</td>
<td>254</td>
<td>2184 mm (86 inches)</td>
<td>Prewash</td>
</tr>
<tr>
<td>K8052</td>
<td>254</td>
<td>2540 mm (100 inches)</td>
<td>Power Prewash</td>
</tr>
</tbody>
</table>

2.5 FLIGHT-TYPE DISH MACHINES, RACKLESS CONVEYOR, ELECTRIC

A. General Requirements:
   1. Stainless-steel frame, legs, and feet.
   2. Stainless-steel front and end panels.
   3. Multitank unit with prewash, wash, and rinse sections.
   4. 508 to 660 mm (20 to 26 inch) wide conveyor.
   5. Electric tank heat with low-water tank heat cut-off.
   7. Automatic tank fill.
   8. Control panel.
   9. Operates in // direction indicated on drawings // right to left // left to right //.
   10. Variable conveyor speed.
11. Rinse saver.

SPEC WRITER NOTE:
1. Select accessories according to functional requirements and space available.
2. Select booster heater temperature rise according to hot-water temperature that is available; water delivered to warewasher from booster heater must be 82 degrees C (180 degrees F).

13. Accessories:
   a. Internally mounted electric booster heater that produces a 22 degrees C (40 degrees F) or 39 degrees C (70 degrees F) water-temperature rise.
   b. Electric blower dryer.
   c. Circuit breakers.
   d. Stainless-steel back panels.
   e. Water-pressure regulating valve.

B. Electric, Rackless-Conveyor, Flight-Type Dish Machines Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>CAPACITY DISHER/HR.</th>
</tr>
</thead>
<tbody>
<tr>
<td>K8060</td>
<td>8,500</td>
</tr>
<tr>
<td>K8070</td>
<td>10,250</td>
</tr>
<tr>
<td>K8090</td>
<td>19,000</td>
</tr>
</tbody>
</table>

2.6 DISHWASHING SYSTEM, CIRCULAR
A. Dishwashing Machines:
1. Stainless-steel frame, legs, and feet.
2. Stainless-steel front and back panels.
5. Automatic tank fill.
6. Control Panel.
7. Operates in direction indicated on drawings clockwise or counter-clockwise.
8. Variable conveyor speed.
9. Rinse saver.
10. Stainless-steel vent cowls.
11. Doors on outside radius.
12. Door safety switches.
13. Hood opening to accommodate 508 by 508 mm (20 by 20 inch) trays.
SPEC WRITER NOTE:
1. Select accessories according to functional requirements and space available.
2. Select booster heater temperature rise according to hot-water temperature that is available; water delivered to warewasher from booster heater must be 82 degrees C (180 degrees F).

14. Accessories:
   a. Internally mounted electric booster heater that produces a // 22 degrees C (40 degrees F) // 39 degrees C (70 degrees F) // water-temperature rise.
   b. Electric blower dryer.
   c. Circuit breakers.
   d. Water-pressure regulating valve.
   e. Automatic shutdown device.

B. Conveyors: With circular conveyor table.
   1. Oval-shaped system.
   2. Stainless-steel table construction, not less than 2.0 mm (0.0781 inch) thick.
   3. Stainless-steel supports, legs, and feet.
   5. Rack overshelf.
   6. Rack storage shelf.
   7. Scrap trough with flushing nozzles.
   8. Start-stop station.
   9. Accessories:
      a. Mounted hose reel.
      b. Extra button start/stop station.
      c. Mounting and piping for // waste disposer // pulper // with controls.
      e. Trough silver saver.

C. Circular Dishwashing Systems:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>DESCRIPTION</th>
<th>CAPACITY RACKS/HR.</th>
</tr>
</thead>
<tbody>
<tr>
<td>K8110</td>
<td>Dishwashing System: Dishwashing machine and conveyor</td>
<td>200 to 254</td>
</tr>
<tr>
<td>K8111</td>
<td>Dishwashing Machine: One to two tanks</td>
<td>200 to 254</td>
</tr>
<tr>
<td>K8112</td>
<td>Conveyor</td>
<td>200 to 254</td>
</tr>
</tbody>
</table>
2.7 POT WASHER, ELECTRIC, RACK

A. General Requirements:
1. Stainless-steel construction.
2. Stainless-steel front and side enclosure panels.
3. Operates straight through // in direction indicated on drawings // right to left // left to right //.
4. Control panel.
5. Electric tank heat.
6. Hold-down grid to protect light ware.
8. Capacity based on 609 by 711 mm (24 by 28 inch) racks.

SPEC WRITER NOTE:
1. Select accessories according to functional requirements and space available.
2. Select booster heater temperature rise according to hot-water temperature that is available; water delivered to warewasher from booster heater must be 82 degrees C (180 degrees F).

9. Accessories:
   a. Water-pressure regulating valve.
   b. Auto fill.
   c. Corner operation.
   d. Electric booster heater that produces a // 22 degrees C (40 degrees F) // 39 degrees C (70 degrees F) // water-temperature rise.

B. Electric, Rack, Pot Washer Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>CAPACITY RACKS/HR.</th>
</tr>
</thead>
<tbody>
<tr>
<td>K8310</td>
<td>25</td>
</tr>
<tr>
<td>K8320</td>
<td>50</td>
</tr>
</tbody>
</table>

2.8 WAREWASHER BOOSTER HEATER, ELECTRIC

A. General Requirements:
1. Lined tank.
2. Temperature/pressure-relief valve.
3. Pressure-reducing valve.
4. Two-temperature pressure gauges.
5. High temperature limit control.
7. On-off switch.
8. Low-water cut-off.
9. // 23- to 30-L (6- to 8-gal.) // 61-L (16-gal.) // storage capacity.
   SPEC WRITER NOTE: Select accessories according to functional requirements and space available.

10. Accessories:
   a. All-stainless-steel body and base.
   b. Brass pressure-reducing valve with bypass.
   c. Adjustable stainless-steel legs, 152 to 203 mm (6 to 8 inches) high.
   d. Shock absorber.
   SPEC WRITER NOTE: Select booster heater size according to hot-water temperature that is available; water delivered to warewashers from booster heater must be 82 degrees C (180 degrees F).

B. Warewasher Booster Heater Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>SIZE (KW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>K8420</td>
<td>4 to 23</td>
</tr>
<tr>
<td>K8421</td>
<td>24 to 58</td>
</tr>
</tbody>
</table>

PART 3 – EXECUTION

3.1 INSTALLATION
   A. Install warewashing equipment, including controls and accessory equipment, arranged for safe and convenient operation and maintenance.
   B. Install warewashing equipment to prevent backflow of polluted water or waste into water supply system or into the warewashing equipment.
   C. Install and interconnect electrical controls and switches.
      SPEC WRITER NOTE: Retain paragraph below if required for project location.
   D. Install seismic restraints for equipment.

3.2 CLEAN-UP
   A. At completion of the installation, clean, lubricate, and adjust warewashing equipment as required to produce ready-for-use condition.
   B. Where stainless-steel surfaces are damaged during warewashing equipment installation procedures, repair finishes to match adjoining undamaged surfaces.
3.3 INSTRUCTIONS
    Instruct personnel and transmit operating instructions in accordance with requirements in Section 01010, GENERAL REQUIREMENTS.

    END SECTION
SECTION 11415
FOOD SERVICE SELF-CONTAINED REFRIGERATION EQUIPMENT

SPEC WRITER NOTES:
1. Delete between // _____ // if not applicable to project.
2. Delete other items or paragraphs in the section that are not applicable and renumber the paragraphs.
3. Select self-contained refrigeration equipment according to usage requirements and available space.
4. Designer Notes:
   This specification has links connected to other documents in VA “Technical Information Library (TIL).” These links are to facilitate designers to look into related documents while edited this specification. These links must be deleted before the specification is finalized for a particular project. To delete these links make sure macros are installed on your system, and if not do the following:
   Click on Tools.
   Go to Macro and click on Security.
   Check the Medium Security Level.
   Close the specification, if open.
   Open the specification (again) and follow the prompts on the screen.
   Click on Enable Macros when first prompt appears.
   Delete the links only if specification is ready to be included in the project.

PART 1 - GENERAL
1.1 DESCRIPTION
   A. This section specifies self-contained refrigeration equipment as follows:
      //1. Automatic ice making and dispensing stations.//
      //2. Automatic ice making and ice and water dispensing stations.//
      //3. Refrigerators // freezers // dual-temperature units //, reach-in and pass-through.//
      //4. Refrigerators // freezers //, roll-in and roll-through.//

1.2 RELATED WORK
   A. Seismic Restraint of Equipment: Section 13081, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.
   B. Plumbing Connections: Section 15400, PLUMBING SYSTEMS.
   C. Electrical Connections: Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL).
1.3 QUALITY CONTROL

A. Installer Qualifications: Factory-trained refrigeration technicians and experienced with food service refrigeration equipment installation or supervised by an experienced food service equipment installer.

   SPEC WRITER NOTE: UL Environmental and Public Health (EPH) Classification Mark is currently used to certify compliance with NSF/ANSI standards. Equipment evaluated by UL before 2001 may bear the UL Food Service Product Certification Mark.

B. NSF Compliance: Equipment bears NSF Certification Mark or UL Classification Mark indicating compliance with NSF/ANSI 4.
   1. Refrigerators and Freezers: Evaluated according to NSF/ANSI 7.
   2. Ice Makers: Evaluated according to NSF/ANSI 12.

C. UL Listing: Equipment is listed and labeled by UL.
   1. Refrigerators and Freezers: Evaluated according to UL 471.
   2. Ice Makers: Evaluated according to UL 563.

   SPEC WRITER NOTE: Retain paragraph and subparagraphs below if required for project location.

D. Seismic Restraint:
   1. Comply with requirements in Section 13081, SEISMIC RESTRAINT REQUIREMENTS FOR NON-STRUCTURAL COMPONENTS.

E. In-Use Service: At least one factory-authorized service agency for equipment shall be located in the geographical area of the installation and shall have the ability to provide service within 24 hours after receiving a service call.

1.4 SUBMITTALS

A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.

B. Manufacturer’s Literature and Data:
   1. Include manufacturer's address and telephone number.
   2. Include catalog or model numbers and illustrations and descriptions of refrigeration equipment and accessories.

C. Installation Drawings: Show dimensions, details of installation, coordination with plumbing and electrical work, and other work required for a complete installation.

D. Operating Instructions: In accordance with requirements in Section 01010, GENERAL REQUIREMENTS.
1.5 WARRANTY
Warrant food service equipment to be free from defects in materials and workmanship in accordance with requirements of "Warranty of Construction" article in Section 01001, GENERAL CONDITIONS, except warranty period for refrigeration compressors shall be five years.

1.6 APPLICABLE PUBLICATIONS
A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
B. NSF International/American National Standards Institute (NSF/ANSI):
   7-2001 ........................................Commercial Refrigerators and Freezers
   12-1992 ......................................Automatic Ice Making Equipment
C. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
D. Underwriters Laboratories Inc. (UL):
   471-95 ........................................Commercial Refrigerators and Freezers, including revisions through and including April 27, 1998
   563-95 ........................................Ice Makers, including revisions through and including June 28, 2001

PART 2 – PRODUCTS
SPEC WRITER NOTE:
1. Symbols below correspond with "Room Equipment Guide" identification system. Verify project requirements before specifying equipment that deviates from "Room Equipment Guide."
2. Edit symbols to coordinate with identification shown on drawings.

2.1 AUTOMATIC ICE MAKING AND DISPENSING STATIONS
A. General Requirements: Automatic ice makers and dispensers as follows:
   1. Stainless-steel exterior, front and sides.
   2. Air-cooled compressor.
   3. Insulated storage bin with agitator.
   4. Cube-type ice.
   5. Dispensing area located between 813 and 1016 mm (32 and 40 inches) above the floor.
   6. Ice dispenser.
   7. Accessories:
      a. Stainless-steel stand with 152 mm (6 inch) stainless-steel legs.
      b. Water filter with 0.1-L/s (1.67-gpm) maximum flow rate.
SPEC WRITER NOTE: Select capacity according to anticipated use; actual use should not exceed 80 percent of capacity of unit.
B. Automatic Ice Making and Dispensing Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>K3010</td>
<td>226-kg (500-lb) ice production</td>
</tr>
<tr>
<td></td>
<td>45-kg (100-lb) bin storage</td>
</tr>
<tr>
<td>K3020</td>
<td>113-kg (250-lb) ice production</td>
</tr>
<tr>
<td></td>
<td>27-kg (60-lb) bin storage</td>
</tr>
</tbody>
</table>

2.2 AUTOMATIC ICE MAKING AND ICE AND WATER DISPENSING STATIONS

A. General Requirements: Automatic ice makers and dispensers as follows:
   1. Stainless-steel exterior, front and sides.
   2. Air-cooled compressor.
   3. Insulated storage bin with agitator.
   4. Cube-type ice.
   5. Dispensing area located between 813 and 1016 mm (32 and 40 inches) above the floor.
   6. Ice dispenser.
   7. Water dispenser.
   8. Accessories:
      a. Stainless-steel stand with 152 mm (6 inch) stainless-steel legs.
      b. Water filter with 0.1-L/s (1.67-gpm) maximum flow rate.

   **SPEC WRITER NOTE:** Select capacity according to anticipated use; actual use should not exceed 80 percent of capacity of unit.

B. Automatic Ice Making and Ice and Water Dispensing Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>CAPACITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>K3030</td>
<td>113-kg (250-lb) ice production</td>
</tr>
<tr>
<td></td>
<td>27-kg (60-lb) bin storage</td>
</tr>
<tr>
<td>K3040</td>
<td>226-kg (500-lb) ice production</td>
</tr>
<tr>
<td></td>
<td>45-kg (100-lb) bin storage</td>
</tr>
</tbody>
</table>

2.3 REFRIGERATORS, FREEZERS, AND DUAL-TEMPERATURE UNITS, REACH-IN AND PASS-THROUGH

A. General Requirements:
   2. Interior Finish: Stainless steel.
   4. Door Hinge: // As shown on drawings // [ _____ ] //.

6. Accessories:
   a. 152 mm (6 inch) high casters.
   b. Cord and plug.
   c. Stainless-steel back.

B. Shelves: // Three // Four // Five // Six // chrome-plated wire shelves per full section // or three chrome-plated wire shelves per half section //.

C. Tray Slides: Angle type.

D. Mobile Food Tray File: Consisting of loading cart in lower compartment of each refrigerator section and transfer carriages. Locking device automatically locks loading cart in position when placed in refrigerator or on the transfer carriage.

1. Loading Cart:
   a. Material: Frame and slides fabricated from stainless steel or aluminum alloy angles, channels, or bars.
   b. Slides: Minimum of 10 pairs, removable, and adjustable on 25 mm (1 inch) centers. Each pair accommodates one 457 by 660 mm (18 by 26 inch) standard cafeteria tray or pan.

2. Transfer Carriage:
   a. Base Construction: Stainless-steel sheet, angle, channel, or bar frame or platform with channels to guide and retain mobile food rack.
   b. Handle: Inverted-U type, attached to one end of base of cart and located with top a minimum of 914 mm (36 inches) above the floor. Fabricated from tubular stainless steel having an outside diameter of 25 mm (1 inch) and a minimum wall thickness of 1.7 mm (0.065 inch). Attached to cart to permit withdrawal of the trays or pans from either end of the mobile food rack when in place on cart.
   c. Casters: 127 mm (5 inch), ball-bearing swivel casters with neoprene wheels.

E. Temperature:
   1. Normal: 1.6 degrees C (35 degrees F).
   2. Low: -23.3 degrees C (-10 degrees F).
   3. Dual: +1.6 degrees C and -23.3 degrees C (+ 35 and -10 degrees F).

SPEC WRITER NOTE:
1. Select unit style and temperature according to functional requirements.
2. Select number of sections according to operation requirement and available floor space.

F. Reach-in and Pass-Through Refrigerator, Freezer, and Dual-Temperature Units:
<table>
<thead>
<tr>
<th>Model</th>
<th>Temperature</th>
<th>Type</th>
<th>Capacity (cu. m)</th>
<th>Features</th>
</tr>
</thead>
<tbody>
<tr>
<td>K3600</td>
<td>Low</td>
<td>Reach-in</td>
<td>0.6</td>
<td>Tray slides</td>
</tr>
<tr>
<td>K3610</td>
<td>Low</td>
<td>Reach-in</td>
<td>0.6</td>
<td>Shelves</td>
</tr>
<tr>
<td>K3620</td>
<td>Low</td>
<td>Pass-through</td>
<td>0.6</td>
<td>Tray slides</td>
</tr>
</tbody>
</table>
| K3630 | Low         | Pass-through | 0.6             | Upper Compartment: Tray slides  
Lower Compartment: Mobile food-tray file with loading cart and two transfer carriages |
<p>| K3640 | Dual        | Reach-in     | 0.6             | Tray slides                                                             |
| K3650 | Dual        | Pass-through | 0.6             | Tray slides                                                             |
| K3700 | Normal      | Reach-in     | 0.6             | Tray slides                                                             |</p>
<table>
<thead>
<tr>
<th>Model</th>
<th>Type</th>
<th>Use</th>
<th>Specification Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>K3710</td>
<td>Normal</td>
<td>Reach-in</td>
<td>0.6 cu. m (20 cu. ft.) One section Two compartments</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Upper Compartment:</strong> Tray slides</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Lower Compartment:</strong> Mobile food-tray file with loading cart and one transfer carriage</td>
</tr>
<tr>
<td>K3720</td>
<td>Normal</td>
<td>Reach-in</td>
<td>0.6 cu. m (20 cu. ft.) One section</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Shelves</td>
</tr>
<tr>
<td>K3740</td>
<td>Normal</td>
<td>Pass-through</td>
<td>0.6 cu. m (20 cu. ft.) One section Two compartments</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tray slides</td>
</tr>
<tr>
<td>K3750</td>
<td>Normal</td>
<td>Pass-through</td>
<td>0.6 cu. m (20 cu. ft.) One section Two compartments</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Upper Compartment:</strong> Tray slides</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Lower Compartment:</strong> Mobile food-tray file with loading cart and one transfer carriage</td>
</tr>
<tr>
<td>K3760</td>
<td>Normal</td>
<td>Pass-through</td>
<td>0.6 cu. m (20 cu. ft.) One section</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Shelves</td>
</tr>
<tr>
<td>K3800</td>
<td>Normal</td>
<td>Reach-in</td>
<td>1.3 cu. m (45 cu. ft.) Two sections</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Tray slides</td>
</tr>
<tr>
<td>K3810</td>
<td>Normal</td>
<td>Reach-in</td>
<td>1.3 cu. m (45 cu. ft.) Two sections</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Upper Compartment:</strong> Tray slides</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>Lower Compartment:</strong> Mobile food-tray files with loading cart and two transfer carriages per compartment</td>
</tr>
<tr>
<td>K3820</td>
<td>Normal</td>
<td>Reach-in</td>
<td>1.3 cu. m (45 cu. ft.) Two sections</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Shelves</td>
</tr>
<tr>
<td>Model</td>
<td>Type</td>
<td>Model Code</td>
<td>Capacity</td>
</tr>
<tr>
<td>--------</td>
<td>------------</td>
<td>------------</td>
<td>----------</td>
</tr>
<tr>
<td>K3840</td>
<td>Normal</td>
<td>Pass-through</td>
<td>45 cu. ft.</td>
</tr>
<tr>
<td>K3850</td>
<td>Normal</td>
<td>Pass-through</td>
<td>1.3 cu. m</td>
</tr>
<tr>
<td>K3860</td>
<td>Normal</td>
<td>Pass-through</td>
<td>1.3 cu. m</td>
</tr>
<tr>
<td>K3900</td>
<td>Normal</td>
<td>Reach-in</td>
<td>1.8 cu. m</td>
</tr>
<tr>
<td>K3910</td>
<td>Normal</td>
<td>Reach-in</td>
<td>1.8 cu. m</td>
</tr>
<tr>
<td>K3920</td>
<td>Normal</td>
<td>Reach-in</td>
<td>1.8 cu. m</td>
</tr>
<tr>
<td>K3940</td>
<td>Normal</td>
<td>Pass-through</td>
<td>1.8 cu. m</td>
</tr>
<tr>
<td>K3960</td>
<td>Normal</td>
<td>Pass-through</td>
<td>1.8 cu. m</td>
</tr>
</tbody>
</table>

2.4 REFRIGERATORS AND FREEZERS, ROLL-IN AND ROLL-THROUGH

A. General Requirements:
2. Interior Finish: Stainless steel.
3. Doors: Full height with locks.
4. Door Hinge: // As indicated on drawings // [ _____ ] //.
6. Accessories:
   a. Cord and plug.
   b. Stainless-steel back.

B. Loading Racks: With minimum of 20 pairs of slides and four 127 mm (5 inch) high swivel casters.
   1. Slides: Removable and adjustable on 25 mm (1 inch) centers. Each pair accommodates one
      457 by 660 mm (18 by 26 inch) tray or pan, or two 356 by 457 mm (14 by 18 inch) trays or
      pans.

C. Temperature:
   1. Normal: 1.6 degrees C (35 degrees F).
   2. Low: -23.3 degrees C (-10 degrees F).

   SPEC WRITER NOTE:
   1. Select unit style and temperature according to
      functional requirements.
   2. Select number of sections according to operation
      requirement and available floor space.

C. Roll-in and Roll-Through Refrigerator and Freezer Units:

<table>
<thead>
<tr>
<th>SYMBOL</th>
<th>TEMPERATURE</th>
<th>STYLE</th>
<th>SIZE</th>
<th>LOADING RACKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>K3660</td>
<td>Low</td>
<td>Roll-in</td>
<td>2 cu. m (70 cu. ft.) Two sections</td>
<td>Two</td>
</tr>
<tr>
<td>K3657</td>
<td>Low</td>
<td>Roll-through</td>
<td>2 cu. m (70 cu. ft.) Two sections</td>
<td>Two</td>
</tr>
<tr>
<td>K3680</td>
<td>Low</td>
<td>Roll-in</td>
<td>2.8 cu. m (100 cu. ft.) Three sections</td>
<td>Three</td>
</tr>
<tr>
<td>K3690</td>
<td>Low</td>
<td>Roll-through</td>
<td>2.8 cu. m (100 cu. ft.) Three sections</td>
<td>Three</td>
</tr>
<tr>
<td>K3781</td>
<td>Normal</td>
<td>Roll-through</td>
<td>1 cu. m (35 cu. ft.) One section</td>
<td>-</td>
</tr>
<tr>
<td>K3790</td>
<td>Normal</td>
<td>Roll-in</td>
<td>1 cu. m (35 cu. ft.) One section</td>
<td>One</td>
</tr>
<tr>
<td>K3880</td>
<td>Normal</td>
<td>Roll-through</td>
<td>2 cu. m (70 cu. ft.)</td>
<td>Two sections</td>
</tr>
<tr>
<td>-------</td>
<td>--------</td>
<td>--------------</td>
<td>----------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>K3881</td>
<td>Normal</td>
<td>Roll-through</td>
<td>2 cu. m (70 cu. ft.)</td>
<td>Two sections</td>
</tr>
<tr>
<td>K3890</td>
<td>Normal</td>
<td>Roll-in</td>
<td>2 cu. m (70 cu. ft.)</td>
<td>Two sections</td>
</tr>
<tr>
<td>K3980</td>
<td>Normal</td>
<td>Roll-through</td>
<td>2.8 cu. m (100 cu. ft.)</td>
<td>Three sections</td>
</tr>
<tr>
<td>K3981</td>
<td>Normal</td>
<td>Roll-through</td>
<td>2.8 cu. m (100 cu. ft.)</td>
<td>Three sections</td>
</tr>
<tr>
<td>K3990</td>
<td>Normal</td>
<td>Roll-in</td>
<td>2.8 cu. m (100 cu. ft.)</td>
<td>Three sections</td>
</tr>
<tr>
<td>K3391</td>
<td>Normal</td>
<td>Roll-in</td>
<td>2.8 cu. m (100 cu. ft.)</td>
<td>Three sections</td>
</tr>
</tbody>
</table>

PART 3 – EXECUTION

3.1 INSTALLATION
A. Install self-contained refrigeration equipment level and plumb; arranged for safe and convenient operation; with access clearances required for maintenance and cleaning; and according to manufacturer’s written instructions.

SPEC WRITER NOTE: Retain paragraph below if required for project location.

B. Install seismic restraints for equipment.

3.2 CLEAN-UP
A. At completion of the installation, clean and adjust self-contained refrigeration equipment as required to produce ready-for-use condition.

B. Where stainless-steel surfaces are damaged during installation procedures, repair finishes to match adjoining undamaged surfaces.

3.3 INSTRUCTIONS
Instruct personnel and transmit operating instructions in accordance with requirements in Section 01010, GENERAL REQUIREMENTS.

--- END ---
PART 1   GENERAL

1.01   REFERENCES

A. Federal Specifications:
   1. FS W-R-101F - Domestic Electric Ranges.
   2. FS AA-R-0211H - Household Mechanical Refrigerator (Electric, Self-Contained).
   3. FS WW-P-541/5B - Plumbing Fixtures (Sinks, Kitchen, Service, and Laundry Trays).

B. Underwriter's Laboratories (UL).

C. ETL Testing Laboratories (ETL).

1.02   SUBMITTALS

A. Waiver of Submittals: "The Waiver of Certain Submittal Requirements" in Section 01330 does not apply to this Section.

B. Product Data: Catalog sheets, specifications, rough-in drawings, and installation instructions.

C. Contract Closeout Submittals:
   1. Operation and Maintenance Data: Deliver 2 copies, covering the installed products, to the Director's Representative.
   2. Warranty: Copy of specified warranty.

1.03   QUALITY ASSURANCE

A. Components of unit kitchens for which Underwriters' Laboratories, Inc. (UL) provides product listing service, shall be listed and bear the listing mark.

B. Unit kitchen shall be the product of a single manufacturer.

1.04   WARRANTY

A. Manufacturer's Warranty: Five year warranty for the sealed refrigeration system.

1.05   MAINTENANCE

A. Special Tools: One key for each stop valve.

PART 2   PRODUCTS

2.01   MANUFACTURED UNITS

A. Type A Unit Kitchen: Compact kitchen assembly consisting of sink, electric oven, electric range, refrigerator, range hood, sink utility light, backsplasher, endsplashers (recessed unit only), base and wall cabinets.
   1. Free Standing Unit: Model E84SC by Dwyer Products Corp., Michigan City, IN.
2. Recessed Unit (Built in on 3 sides): Model E87EC by Dwyer Products Corp., Michigan City, IN.

B. Type B Unit Kitchen: Compact kitchen assembly consisting of sink, electric oven, electric range, refrigerator, range hood, sink utility light, backsplasher, endsplashes (recessed unit only), base and wall cabinets.
1. Free Standing Unit: Model E69SC by Dwyer Products Corp., Michigan City, IN.
2. Recessed Unit (Built in on 3 sides): Model E72EC by Dwyer Products Corp., Michigan City, IN.

C. Type C Unit Kitchen: Compact kitchen assembly consisting of sink, electric oven, electric range, refrigerator, range hood, sink utility light, backsplasher, endsplashes (recessed unit only), base and wall cabinets.
1. Free Standing Unit: Model E60SC by Dwyer Products Corp., Michigan City, IN.
2. Recessed Unit (Built in on 3 sides): Model E63EC by Dwyer Products Corp., Michigan City, IN.

D. Type D Unit Kitchen: Compact kitchen assembly consisting of sink, electric oven, electric range, refrigerator, range hood, sink utility light, backsplasher, endsplashes (recessed unit only), base and wall cabinets.
1. Free Standing Unit: Model E51SC by Dwyer Products Corp., Michigan City, IN.
2. Recessed Unit (Built in on 3 sides): Model E54EC by Dwyer Products Corp., Michigan City, IN.

E. Type E Unit Kitchen: Compact kitchen assembly consisting of sink, electric range, refrigerator, range hood, sink utility light, backsplasher, endsplashes (recessed unit only), base and wall cabinets.
1. Free Standing Unit: Model E39SC by Dwyer Products Corp., Michigan City, IN.
2. Recessed Unit (Built in on 3 sides): Model E42EC by Dwyer Products Corp., Michigan City, IN.

F. Type F Unit Kitchen: Compact kitchen assembly consisting of sink, microwave oven, electric range, refrigerator, ice maker, range hood, sink utility light, backsplasher, endsplashes (recessed unit only), base and wall cabinets.
1. Free Standing Unit: Model NC57SC by Dwyer Products Corp., Michigan City, IN.
2. Recessed Unit (Built in on 3 sides): Model NC60EC by Dwyer Products Corp., Michigan City, IN.

2.02 COMPONENTS

A. Sink/Range Countertop: Constructed of one piece 14 gage seamless titanium steel with acid resistant porcelain finish, 4 inch high integral backsplash with return ends, embossed drainboard with 3-1/2 inch drain punching capable of accommodating a garbage disposal unit.
1. Supply Fitting: Chrome plated brass single handle washerless mixing faucet with swing spout and aerator.
2. Supplies: 1/2 inch ips brass, with key operated angle stops, and cast brass escutcheons.
3. Drain Assembly: Stainless steel removable strainer basket with neoprene stopper, 1-1/2 inch tubing tailpiece, 1-1/2 inch cast brass non-adjustable P trap, and 1-1/2 inch ips brass trap nipple with cast brass escutcheon.

B. Cabinet Construction:
2. Cabinet Trim Pieces: 22 gage steel.
   a. Backsplasher: Complete with cutout for wall receptacle.
b. Endsplashes: Right and left ends.
c. Base Section Filler Pieces: Right and left ends, mounted under countertop return ends.

3. Doors and Drawer Fronts: Double faced type, reinforced and sound deadened.
4. Adjustable Shelves: Steel with rolled edges.
5. Doors: Complete with concealed hinges.

C. Range Hood: 24 inch ductless type with light.

D. Sink Utility Light: 18 inch undercabinet fluorescent fixture with convenience outlet.

E. Electric Oven Unit: One piece porcelain liner with rounded corner interior, oven door with broiler stop, two tubular oven units for uniform bake or high broiler, built-in utensil drawer, oven heat control with signal light, and full width removable drip tray.

F. Electric Range Unit: Minimum 3 microtube units (minimum 4600 total watts), heat switches with infinite heat selection, and removable reflector bowls.

G. Electric Range Unit: Minimum 2 microtube units (minimum 2500 total watts), heat switches with infinite heat selection, and removable reflector bowls.

H. Upright Refrigerator:
1. Minimum Storage Volume: 12.0 cu ft.
2. Refrigerator Features: Magnetic door gasket, adjustable shelves, full height storage, interior light, two flex-grid ice cube trays, one piece seamless plastic liner, cycle defrost, crisper drawer, utility storage drawer, and egg storage and butter keeper.

I. Undercounter Refrigerator:
2. Refrigerator Features: Magnetic door gasket, shelves, full height storage, interior light, two flex-grid ice cube trays, one piece seamless plastic liner, and push button defrost.

J. Microwave Unit: Built-in under cabinet type, approximately 24 inches wide with minimum 0.8 cu ft capacity.

K. Icemaker Unit: Built-in undercounter type approved by National Sanitation Foundation, one piece molded polyethylene liner, controls to vary ice cube thickness from 3/8 inch to 3/4 inch, 35 lb storage bin capacity, and minimum 40 lb ice capacity every 24 hours.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install the Work of this section in accordance with the manufacturer's printed installation instructions.

3.02 ADJUSTING AND CLEANING

A. Flush supply piping and traps, and clean strainers.

B. Adjust stops for proper delivery.
C. Clean and polish unit kitchen and trim. Leave stickers and warning labels intact.

END OF SECTION
PART 1 GENERAL

1.1 SECTION INCLUDES
   A. Solid composite casework for cabinet doors.
   B. Solid composite casework privacy panels.

1.2 SUBMITTALS
   A. Submit in accordance with Section 01330.
   B. Submit four samples, 4"x 4", of each color and thickness of material used.

1.3 REGULATORY REQUIREMENTS
   A. Accessibility Requirements: Comply with the requirements for the accessibility of the physically disabled of the appropriate jurisdiction and ADA Accessibility guidelines for Buildings and Facilities.
   B. Surface Burning Requirements: The panels to have the following surface burning characteristics and smoke generation values per U.L. Classification and labeling in accordance with ASTM E-84 tests and shall be self-extinguishing.
      1. Flame spread: 25 for 3/4" thick panels; 30 for 1/2" thick panels.
      2. Smoke developed: 70 for 3/4" thick panels; 85 for 1/2" thick panels.

1.4 WARRANTY
   A. Solid composite materials to be warranted against delamination for 10 years. The factory authorized cabinet fabricator, product installer and material manufacturer must sign the Warranty documents and submit a copy to the Contractor.
   B. Other materials and workmanship covered in this section shall carry a one year warranty from the date of installation acceptance.

1.8 MATERIALS
   A. Cabinet doors shall be constructed of Phenolic Virtuon solid composite panels.
   B. Hinges, handles, drawer slides and other hardware to be supplied as specified by Architect.

PART 2 PRODUCTS

2.1 MANUFACTURERS
   A. These specifications are based on panels manufactured by Trespa North America, Ltd., or equal.
2.1 MATERIALS

A. Cabinet doors shall be constructed of phenolic, “Virtuon”, or equal, solid composite panels. Panel finish to be “Satin”.

B. Cabinet hardware shall be furnished and installed as required to provide a complete casework installation conforming to WIC’s requirements for institutional grade 1. Finish to be brushed stainless steel.

C. Hinges: Prameta # 99632 Flat Hinge by Grass - 270° opening.

D. Door and Drawer Locks: National Lock #8102 or Olympus Lock. Provide metal strike plates to protect against particleboard rip out. Provide two keys for each lock.

E. Keying: Verify keying requirements with Project Manager prior to start of work.

F. Handles: Wire pulls at interior doors only: Sugatsune oval CHMC #DBL96BCR.

G. Drawer Guides – Accuride full extension.

2.3 CONSTRUCTION

A. Construction and design to develop maximum strength and rigidity in each sectional unit. Each sectional unit to be completely fabricated ready for placement in the casework and equipment assembly. Each cabinet to be a complete integral rigid unit within itself to permit relocation at any subsequent time.

B. The cabinet shall incorporate full overlay design in which posts and rails are concealed behind the doors and drawer heads. The door and drawer heads shall create a .125" horizontal reveal. There shall be a .0625" vertical reveal at the edge of each cabinet creating a .125" vertical reveal at the end of each cabinet when two cabinets are set in place next to each other.

C. Base cabinets to be constructed to achieve an industry standard height of 30" or 36" including the counter top.

D. Each cabinet to be assembled with stainless-steel machine-threaded screws. Vertical and horizontal members shall be mechanically fastened. Exposed edges on cabinet components, doors and drawer heads to be polished to a satin smooth finish. Tops shall have a “steep bevel-back” exposed edge. Underside of toe space shall be enclosed. Notch adjustable shelves to receive shelf rest and form a positive lock feature.

E. Component Thickness Schedule

1. Cabinet sides and bottoms: 0.5" (13mm)
2. Door and drawer heads: 0.5" (13mm)
3. Horizontal rail supports: 0.5" (13mm)
4. Cabinet backs: 0.31" (8mm)
5. Wall cabinet backs: 0.25" (6mm)
6. Cabinet shelves: 0.5" (13mm)
7. Work surfaces: 0.5" (13mm)

F. Drawer and cupboard units:

1. Each base cabinet shall consist of drawers or cupboard doors or a combination thereof as shown in drawings.
2. All base cabinets, unless specified in drawings otherwise, shall have removable back panels from the inside of the cabinet, for access to the pipe spaces to the rear of the cabinet. If cabinet is located in the corner of an assembly and access to the pipe space is required to the side of the cabinet, removable panels shall be provided in the side of the cabinet also. All removable panels shall be easily removed without the use of tools or the removal of screws.

3. Cupboard units to be provided with an adjustable shelf. Shelf clips to engage shelf in such a way as to avoid slippage and movement of shelf.

4. Sectional units shall have 4" (101.6mm) high by 3" (76.2mm) deep toe space members, unless otherwise noted on drawings.

5. Drawers shall have full box construction and be fabricated of ½" thick solid composite phenolic resin material. Drawer bottoms shall be matching ¼" material. Drawer fronts shall be attached to drawer box using duel directional adjustment hardware.

G. Wall and floor storage cabinets and cases shall match in design and construction the sectional units as specified previously.

H. Sectional units, cabinets and cases to be located on the floor shall be equipped with leveling devices that are easily adjustable, to compensate for unevenness in the floor.

2.4 COLOR

A. Color to be selected by Architect from Manufacturer’s standard Virtuon, or equal, metallic color pallet.

2.5 SOURCE QUALITY CONTROL

A. Fabricated work surfaces shall comply with all current codes and regulations. Tops and shelves shall have uniform thickness (+0.03") and flatness (maximum difference of 0.03") for 10-foot span.

B. Panels to be U.L. registered and labeled for quality consistency.

C. Chemical Resistance: Evaluation of chemical resistance is based on SEFA’s (Scientific Equipment and Fixture Association) standard list of 49 chemicals / concentrations, their required methods of testing and their minimum acceptable results as a means of establishing a minimum acceptable level of performance for all exposed and semi-exposed surfaces.

D. Panels to have screw pullout strength minimums per following chart (lbs.):
E. Uniform load to cause no more than 1/4" deflection at center of the span:

<table>
<thead>
<tr>
<th>Thickness</th>
<th>12&quot; x 24&quot;</th>
<th>12&quot; x 36&quot;</th>
<th>12&quot; x 48&quot;</th>
<th>24&quot; x 36&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/4&quot; panels:</td>
<td>35</td>
<td>10</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>5/16&quot; panels:</td>
<td>85</td>
<td>25</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>3/8&quot; panels:</td>
<td>170</td>
<td>50</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>1/2&quot; panels:</td>
<td>370</td>
<td>110</td>
<td>45</td>
<td>220</td>
</tr>
<tr>
<td>5/8&quot; panels:</td>
<td>690</td>
<td>210</td>
<td>85</td>
<td>410</td>
</tr>
<tr>
<td>3/4&quot; panels:</td>
<td>1,400</td>
<td>400</td>
<td>170</td>
<td>800</td>
</tr>
<tr>
<td>1&quot; panels:</td>
<td>2,600</td>
<td>780</td>
<td>330</td>
<td>1,500</td>
</tr>
</tbody>
</table>

F. Performance Requirements:

1. Modulus of elasticity: 1,500,000-psi minimum.
3. Compressive strength: 24,000-psi minimum.
4. Weight: 93 lbs. per cubic foot maximum.
5. Flame spread (ASTM E-84): Class 1A (25).
7. Will not support micro-organic growth.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install cabinets as manufactured by this specification as per approved shop drawings.

3.2 PROTECTION

A. After installation, the General Contractor shall protect the casework from damage. They shall be kept free from paint, plaster, cement scratches, or any other destructive forces.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
   A. This Section includes the following:
      1. Commercial metal kitchen.

1.3 DEFINITIONS
   A. Double compartment sink with steel reinforced fan shaped pitched drainboards.

1.4 SUBMITTALS
   A. Product Data: For the following:
      1. Stainless steel counter and sinks.
   B. Shop Drawings: For countertops. Include plans, elevations, details, and attachments to other work. Show materials, finishes, hardware, edge and backsplash profiles, cutouts for plumbing fixtures, and methods of joining countertops.
   C. Samples for Initial Selection: Manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available for each type of material exposed to view.
   D. Product Certificates: Signed by manufacturers of casework certifying that products furnished comply with requirements.

1.5 QUALITY ASSURANCE
   A. Source Limitations for Cabinets: Obtain cabinets through one source from a single manufacturer.
   B. Product Designations: Drawings indicate size, configurations, and finish material of casework by referencing designated manufacturer's catalog numbers. Other manufacturers' casework of similar sizes, similar door and drawer configurations, same finish material, and complying with the Specifications may be considered. Refer to Division 1 Section "Substitutions."

1.6 PROJECT CONDITIONS
A. Environmental Limitations: Do not deliver or install kitchen casework until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature and relative humidity at occupancy levels during the remainder of the construction period.

B. Established Dimensions: Where kitchen casework is indicated to fit to other construction, establish dimensions for areas where casework is to fit. Coordinate construction to ensure that actual dimensions correspond to established dimensions. Provide fillers and scribes to allow for trimming and fitting.

C. Field Measurements: Where kitchen casework is indicated to fit to existing construction, verify dimensions of existing construction by field measurements before fabrication and indicate measurements on Shop Drawings. Provide fillers and scribes if necessary.

D. Field Measurements for Countertops: Verify dimensions of countertops by field measurements after base cabinets are installed but before countertop fabrication is complete. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Corners Limited.
2. E-Z Shelving Systems, Inc.
3. Spokane Steel.

2.2 MATERIALS

A. Steel Sheet: ASTM A 366 matte finish, suitable for exposed applications, and stretcher leveled or roller leveled to stretcher-leveled flatness.

B. Galvanized Steel Sheet: ASTM A 653, G90 coating designation; commercial quality; zinc-coated by the hot-dip process; stretcher leveled; phosphatized.

C. Electrolytic Zinc-Coated Steel Sheet: ASTM A 591, with Class C zinc coating, mill phosphatized.

D. Stainless-Steel Sheet: ASTM A 666, Type 302 or 304, stretcher-leveled flatness.

2.3 SHELVING

A. Shelving Units: Provide open shelving consisting of posts, shelves, and connectors of size, material, and assembly to comply with MH 28.1 for the following evenly distributed shelf load:


B. Shelving Unit Bracing: Provide as required for stability and load-carrying capacity.

1. Bracing: Per manufacturer's recommendations.
C. Post Base: Per manufacturer’s recommendations.

D. Post Base: Per manufacturer’s recommendations.

E. Shelves: Adjustable over the entire height of the post and as follows:
   1. Manufacturer’s standard steel wire.

F. Shelf Quantities: Per drawings.

2.4 SHELVING ACCESSORIES

A. Label Holder: Acrylic, clip on to front edge of shelf.

B. Shelf Inlay: Acrylic mat with reinforced edges.

C. Shelf Divider: Extending from top to bottom of shelf.

D. Security Shelf Connector: Tamper resistant for each post-to-shelf connection as required by Owner.

E. Storage Basket: Edge-of-shelf-mounted wire basket, 13-3/8 by 5 by 7 inches as required by Owner.

2.5 FABRICATION

A. Fabricate metal storage shelving square and rigid with posts plumb and true, and shelves flat and free of dents or distortion. Fabricate exposed metal edges free of sharp edges and burrs. Fabricate connections to form a rigid structure, free of buckling and warping.

B. Fabricate shelves from one-piece steel sheet.

2.6 FINISHES, GENERAL

A. Comply with NAAMM’s “Metal Finishes Manual for Architectural and Metal Products” for recommendations for applying and designating finishes.

B. Finish all steel surfaces and accessories, except prefinished stainless-steel and chrome-plated surfaces.

2.7 STEEL SHEET FINISHES

A. Surface Preparation: Clean surfaces of dirt, oil, grease, and other contaminants that could impair paint bond. Remove mill scale and rust, if present, from uncoated steel.

B. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer’s standard baked-enamel finish consisting of a thermosetting topcoat. Comply with paint manufacturer’s instructions for applying and baking to achieve a minimum dry film thickness of 1.1 mils on posts and shelves.
   1. Color and Gloss: As indicated by manufacturer’s color and gloss designations.
2.8 STAINLESS-STEEL FINISHES

A. Stainless-Steel Sheet: Remove or blend tool and die marks and stretch lines into finish. Grind and polish surfaces to produce uniform, directional textured polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.

B. Bright, Cold-Rolled, Unpolished Finish: No. 2B finish applied to shelf.

C. Bright, Directional Polish: No. 4 finish applied to post.

D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.9 SINK MATERIALS

A. Elkay Sturdibilt Scullery Sink: Model SSC8200LR, #14 gauge, type 304 stainless steel scullery sink. Compartments 14" deep. Square corner welded construction. Full length 8" high backsplash with 45 degree sloped top; 1-1/2" wide sloping top channel rims. Integral drainboards, sink compartments pitched to drain. Exposed surfaces polished to a satin finish. Sink supported on four LK251 stainless steel, 1-5/8" O.D. tubular legs, #18 gauge wall thickness. Adjustable bullet shaped feet.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install sink and countertop as per manufacturer's written instructions with no variations in flushness of adjoining surfaces; use concealed shims. Where casework abuts other finished work, scribe and cut for accurate fit. Provide filler strips, scribe strips, and moldings in finish to match casework face.

3.2 INSTALLATION

A. General: Comply with metal storage shelving manufacturer's written installation instructions, unless more stringent requirements apply.

B. Install metal storage shelving level, plumb, square, and true.

C. Anchor shelves to construction by method recommended by manufacturer's written instructions.

D. Install shelves at spacing indicated or, if not indicated, at equal spacing in each unit.

E. Install bracing as recommended by manufacturer and as required for stability, extending and fastening members to supporting structure.

3.3 CLEANING

A. Clean finish floor over which metal storage shelving is to be installed:
B. Clean stainless steel areas on exposed and semiexposed surfaces. Touch up factory-applied finishes to restore damaged or soiled areas.

END OF SECTION
SECTION 12485
FOOT GRILLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes recessed foot grilles and frames.

B. Related Sections includes Division 3 Section "Cast-in-Place Concrete" for slab depression for recessed foot grilles and frames.

1.3 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide foot grilles and frames capable of withstanding the following loads and stresses:

1. Uniform floor load of 300 lbf/sq. ft.
2. Wheel load of 350 lb per wheel.

1.4 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for foot grilles and frames.

B. Shop Drawings: Show the following:

1. Divisions between grille sections.
2. Perimeter floor moldings.

C. Samples for Verification: For each type of product indicated.

1. Foot Grille: 12-inch- square assembled sections.
2. Frame Members: 12-inch- long Sample of each type and color.

D. Maintenance Data: For foot grilles and frames to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain foot grilles and frames through one source from a single manufacturer.

B. Accessibility Requirements: Provide installed foot grilles that comply with Section 4.5 in the U.S. Architectural & Transportation Barriers Compliance Board's "Americans with Disabilities Act (ADA), Accessibility Guidelines for Buildings and Facilities (ADAAG)."

1.6 PROJECT CONDITIONS

A. Field Measurements: Indicate measurements on Shop Drawings.
1.7 COORDINATION

A. Coordinate size and location of recesses in concrete to receive foot grilles and frames.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Balco, Inc.
2. C/S Group.
4. Reese Enterprises, Inc.

2.2 MATERIALS

A. Aluminum Sheet: ASTM B 209 (ASTM B 209M), alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with not less than strength and durability properties of Alloy 5005-H15.

B. Extruded Aluminum: ASTM B 221 (ASTM B 221M), Alloy 6061-T6 or Alloy 6063-T5, T6, or T52 as standard with manufacturer. Coat surface of frame in contact with cementitious materials with manufacturer’s standard protective coating.

2.3 FOOT GRILLES

A. General: Provide manufacturer’s standard foot-grille assemblies consisting of treads of type and profile indicated, interlocked or joined together by cross members, and with support legs (if any) and other components needed to produce a complete installation.


C. Lockdown: Hidden.

2.4 FRAMES

A. Provide manufacturer’s standard frames of size and style for grille type, for permanent recessed installation in subfloor, complete with installation anchorages and accessories. Unless otherwise indicated, fabricate frame of same material and finish as grilles.

2.5 FABRICATION

A. Shop fabricate foot grilles to greatest extent possible in sizes as indicated. Unless otherwise indicated, provide each grille as a single unit; do not exceed manufacturer’s recommended maximum sizes for units that are removed for maintenance and cleaning. Where joints in grilles are necessary, space symmetrically and away from normal traffic lanes.
B. Fabricate frame members in single lengths or, where frame dimensions exceed maximum available lengths, provide minimum number of pieces possible, with hairline joints equally spaced and pieces spliced together by straight connecting pins.

2.6 FINISHES, GENERAL

A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

2.7 ALUMINUM FINISHES

A. Mill finish.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and floor conditions for compliance with requirements for location, size, minimum recess depth, and other conditions affecting installation of foot grilles and frames.

B. Examine roughing-in for drainage piping systems to verify actual locations of piping connections before foot grille and frame and drain pan installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install recessed foot grilles and frames and drain pans to comply with manufacturer's written instructions at locations indicated and with top of foot grilles and frames in relationship to one another and to adjoining finished flooring as recommended by manufacturer. Set foot-grille tops at height for most effective cleaning action. Coordinate top of foot-grille surfaces with doors that swing across grilles to provide clearance under door.

3.3 PROTECTION

A. After completing frame installations, provide temporary filler of plywood or fiberboard in foot-grille recesses and cover frames with plywood protective flooring. Maintain protection until construction traffic has ended and Project is near Substantial Completion.

END OF SECTION
PART 1 GENERAL

1.1 SUMMARY

A. Furnish and install venetian blinds as indicated on the drawings and specified.

1.2 SUBMITTALS

A. Product Data: Submit manufacturer's data and catalog cuts.
B. Material Samples: Submit manufacturers color samples and catalog cuts.

PART 2 PRODUCTS

2.1 HORIZONTAL VENETIAN BLINDS

A. Subject to compliance with specified requirements, provide products of Levolor Lorentzen, Inc., "or equal" products of one of the following:
   1. Hunter Douglas
   2. Mark Window Products
   3. Spring Window Fashions

B. Levolor Riviera or equal horizontal blinds; aluminum slats supported by braided ladders; pull cords to raise and lower slats; crash-proof cord locks to set slats at selected heights; tilters to tilt slats to desired angles; include valances.

C. Slat supports shall be of braided polyester yarn and dimensionally stabilized. Vertical components shall furnish maximum strength and flexibility with minimum stretch. Braided ladders shall support slats parallel, straight, and equally spaced to ensure proper tilt control and closure of slats. Distance between end ladder and end of slats shall not exceed 7 inches. Distance between braided ladders shall not exceed 23 inches. Horizontal component, or rungs, shall consist of not less than 2 crossed cables inter-braided with vertical components.

D. Slats shall be aluminum alloy, one inch wide (0.984 inch plus 0.003 or minus 0.300 inch). They shall be furnished with undercoat and baked-on enamel finish, in selected color. Slats shall be formed to concave/convex shape.

E. Head channels shall be 0.025 inch thick tomized steel, U-shaped, one inch high x 1-9/16 inches wide with flanged edges and shall be furnished with a baked-on enamel finish. Hardware shall be enclosed in metal head. Both end braces shall be furnished with adjustable tabs. Operating hardware shall be machine-clinched to head to ensure perfect alignment.

F. Tomized steel end brackets with riveted locking covers shall be finished to match head channels. Intermediate support brackets shall be furnished where required.

G. Tilt controls shall consist of enclosed worms and gear tilting mechanisms, which prevent slat-drift from selected angle.
H. Bottom rail shall be of 0.031 inch tempered steel formed after coating and shall be provided with color compatible molded plastic end caps.

I. Cords shall be of adequate diameter, braided of high-strength synthetic fibers, and with cores to provide minimum stretch, maximum strength, abrasion resistance and flexibility.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install blinds as recommended by their manufacturer, and as detailed in locations indicated. Furnish and install necessary parts and perform adjustments required to provide a complete, rigid and properly operating installation. Corners and surfaces shall be free from burrs and sharp edges.

B. Unless otherwise indicated, blinds shall be top-suspended, installed singly over each sash and between jambs or mullions, heads set flush with wall or trim, and shall not interfere with operation of sash or sash hardware. Where recessed installation is not indicated, blinds shall be installed over the casing, overlapping casings not less than 1-3/8 inches at sill, 1-3/4 inches at jambs and one inch at top.

C. Brackets shall securely fasten headrails and shall provide for easy removal of headrails. Blinds shall be securely fastened by sheet metal screws through back into headrails at side channels.

D. Brackets shall be fastened with galvanized or cadmium-plated pan-head all-purpose screws, oval-head wood screws, toggle bolts or appropriate fasteners as required.

3.2 INSTALLATION TOLERANCES

A. Maximum Variation of Gap at Perimeter: 1/4 inch.

B. Maximum Offset from Level: 1/8 inch.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY
A. This Section includes manually operated, vertical louver blinds with PVC vanes.
B. Related Sections include Division 6 Section "Miscellaneous Carpentry" for wood blocking and grounds for mounting vertical louver blinds and accessories.

1.3 SUBMITTALS
A. Product Data: For each type of product indicated.
B. Shop Drawings: Show fabrication and installation details for vertical louver blinds and motorized operators. Wiring Diagrams: Power, system, and control wiring.
C. Samples for Initial Selection: For each type of vertical louver blind indicated. Include similar Samples of accessories involving color selection.
D. Samples for Verification: For each type of vertical louver blind indicated.
   1. Vane: Not less than 12 inches long.
   2. Vertical Louver Blind: Full-size unit, not less than 16 inches wide by 24 inches long.
   3. Valance: Full-size unit, not less than 12 inches wide.
   4. Cornice: Full-size unit, not less than 12 inches long.
E. Window Treatment Schedule: For vertical louver blinds. Use same designations indicated on Drawings.
F. Product Certificates: For each type of vertical louver blind, signed by product manufacturer.
G. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for each type of vertical louver blind.
H. Maintenance Data: For vertical louver blinds to include in maintenance manuals.

1.4 QUALITY ASSURANCE
A. Source Limitations: Obtain vertical louver blinds through one source from a single manufacturer.
B. Fire-Test-Response Characteristics: Provide vertical louver blinds with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify materials with appropriate markings of applicable testing and inspecting agency. Flame-Resistance Ratings: Passes NFPA 701.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Product Standard: Provide vertical louver blinds complying with WCSC A 100.1.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver vertical louver blinds in factory packages, marked with manufacturer and product name, fire-test-response characteristics, lead-free designation, and location of installation using same designations indicated on Drawings and in a window treatment schedule.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install vertical louver blinds until construction and wet and dirty finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where vertical louver blinds are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units’ operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
   1. Vertical Louver Blinds: Before installation begins, for each size, color, texture, pattern, and gloss indicated, full-size units equal to 5 percent of amount installed, but no fewer than 10 units.
   2. Vanes: Before installation begins, furnish quantity of full-size units equal to 5 percent of amount of each type, color, and size installed.

PART 2 - PRODUCTS

2.1 VERTICAL LOUVER BLINDS, PVC VANES

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
   2. Levolor, a Newell Rubbermaid Company.
   4. Springs Window Fashions Division, Inc.
B. Rail System: Headrail. Extruded aluminum; long edges returned or rolled; channel-shaped, enclosing operating mechanisms. Color: As selected by Architect from manufacturer's standard color range.

C. Vanes: Lead-free, UV-stabilized, integrally colored, opaque, permanently flexible, extruded PVC that will not crack or yellow; with flat profile and not less than 3/8-inch overlap when vanes are rotated fully closed. Nominal Vane Width: 3-1/2 inches.

D. Vane Directional Control: Manual with nickel-plated metal bead chain.


F. Draw and Stack Position: Center split, controls left.

G. Cord-Tensioner Mounting: Wall.


I. Louver Bottom: Connecting or spacing chains.

J. Mounting: Wall mounting, permitting easy removal and replacement without damaging blind or adjacent surfaces and finishes; with spacers and shims required for blind placement and alignment indicated. Provide intermediate support brackets if end support spacing exceeds spacing recommended by manufacturer for weight and size of blind.

K. Stack Release: Permitting stacked vanes to be moved away from stacking position for total access to glazed opening.

L. Colors, Textures, Patterns, and Gloss: As selected by Architect from manufacturer's full range.

2.2 VERTICAL LOUVER BLIND FABRICATION

A. Product Description: Vertical louver blind consisting of equally spaced, synchronized vanes and rail system with self-aligning carrier mechanisms, carriers, traverse and vane directional mechanisms and controls, and installation hardware.

B. Concealed Components: Noncorrodible or corrosion-resistant-coated materials. Louver Directional and Traversing Control Mechanisms: With permanently lubricated moving parts.

C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings as follows, measured at 74 deg F: Blind Units Installed outside Jambs: Width and length as indicated, with terminations between blinds of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

D. Installation Brackets: Designed for easy removal and reinstallation of blind, for supporting headrail, valance, and operating hardware, and for hardware position and blind mounting method indicated.
E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to blind hardware and adjoining construction; type designed for securing to supporting substrate; and supporting blinds and accessories under conditions of normal use.

F. Color-Coated Finish: For metal components exposed to view, unless anodized or plated finish is indicated. Apply manufacturer’s standard baked finish complying with manufacturer’s written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

G. Component Color: Provide exposed-to-view metal and plastic matching or coordinating with vane color, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, accurate locations of connections to building electrical system, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install vertical louver blinds level and plumb and aligned with adjacent units according to manufacturer’s written instructions, and located so exterior vane edges in any position are not closer than 2 inches to interior face of glass. Install intermediate support as required to prevent deflection in headrail. Allow clearances between adjacent blinds and for operating glazed opening’s operation hardware, if any.

B. Head Mounted: Install headrail on face of opening head.

3.3 ADJUSTING

A. Adjust vertical louver blinds to operate smoothly, easily, safely and free of binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean vertical louver blind surfaces after installation, according to manufacturer’s written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that vertical louver blinds are without damage or deterioration at time of Substantial Completion.

C. Replace damaged vertical louver blinds that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION
SECTION 12494
ROLLER SHADES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes roller shades.
B. Related Sections includes Division 6 Section "Miscellaneous Carpentry" for wood blocking and grounds for mounting roller shades and accessories.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include styles, material descriptions, construction details, dimensions of individual components and profiles, features, finishes, and operating instructions.
B. Shop Drawings: Show location and extent of roller shades. Include elevations, sections, details, and dimensions not shown in Product Data. Show installation details, mountings, attachments to other work, operational clearances, and relationship to adjoining work.
C. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
   1. Ceiling suspension system members and attachment to building structure.
   2. Ceiling-mounted or penetrating items including light fixtures, air outlets and inlets, speakers, sprinklers, recessed shades, and special moldings at walls, column penetrations, and other junctures of acoustical ceilings with adjoining construction.
   3. Shade mounting assembly and attachment.
   4. Size and location of access to shade operator and adjustable components.
   5. Minimum Drawing Scale: 1/4 inch = 1 foot.
D. Samples for Initial Selection: For each colored component of each type of roller shade indicated. Include similar Samples of accessories involving color selection.
E. Samples for Verification:
   1. Complete, full-size operating unit not less than 16 inches wide for each type of roller shade indicated.
   2. Shade Material: Not less than 12-inch- square section of fabric, from dye lot used for the Work, with specified treatments applied. Show complete pattern repeat. Mark top and face of material.
F. Window Treatment Schedule: For roller shades. Use same designations indicated on Drawings.
G. Product Certificates: For each type of roller shade, signed by product manufacturer.

H. Qualification Data: For Installer.

I. Product Test Reports: For each type of roller shade.

J. Maintenance Data: For roller shades to include in maintenance manuals. Include the following:
   1. Methods for maintaining roller shades and finishes.
   2. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
   3. Operating hardware.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

B. Source Limitations: Obtain roller shades through one source from a single manufacturer.

C. Fire-Test-Response Characteristics: Provide roller shade band materials with the fire-test-response characteristics indicated, as determined by testing identical products per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction: Flame-Resistance Ratings: Passes NFPA 701.

D. Product Standard: Provide roller shades complying with WCMA A 100.1.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver shades in factory packages, marked with manufacturer and product name, fire-test-response characteristics, lead-free designation, and location of installation using same designations indicated on Drawings and in a window treatment schedule.

1.6 PROJECT CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operable glazed units' operation hardware throughout the entire operating range. Notify Architect of discrepancies. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1.7 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Before installation begins, for each size, color, texture, and pattern indicated, full-size units equal to 5 percent of amount installed.
1.8 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty: Written warranty, signed by roller shade manufacturer agreeing to repair or replace shades that fail in materials or workmanship within specified warranty period. Failures include, but are not limited to, hardware, chain, or shadecloth. Warranty Period: Non-depreciating, Twenty-five year limited warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ROLLER SHADES

A. Basis-of-Design Product: Subject to compliance with requirements, provide MechoShade Systems, Inc.; "Mecho/5 System" or a comparable product by one of the available manufacturers. Provide shades at all locations designated as RS on Drawings.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers of products that may be incorporated into the Work include, but are not limited to, the following:
   1. Draper Inc.
   3. Levolor; Levolor-Kirsch Window Fashions; a Newell Rubbermaid Company.
   4. Verosol USA, Inc.; OEM Shades Inc.

   1. Material Width: As required to match window module.
   3. Trim: As selected by Architect from manufacturer's available range for style and color.
   4. Material Pattern and Color: As selected by Architect from manufacturer's available range.

D. Rollers: Electrogalvanized or epoxy primed steel or extruded-aluminum tube of diameter and wall thickness required to support and fit internal components of operating system and the weight and width of shade band material without sagging; designed to be easily removable from support brackets; with removable spline fitting integral channel in tube for attaching shade material. Provide capacity for one roller shade band(s) per roller, unless otherwise indicated on Drawings.

E. Direction of Roll: Regular, from back of roller.

F. Mounting Brackets: Galvanized or zinc-plated steel.
G. Pocket-Style Headbox: U-shaped, formed-steel sheet or extruded aluminum; long edges returned or rolled; with a bottom cover consisting of slot opening of minimum dimension to allow lowering and raising of shade and a removable or an openable, continuous metal access panel concealing shade roller, brackets, and operating hardware and operators within.

H. Bottom Bar: Steel or extruded aluminum, with plastic or metal capped ends. Provide concealed, by pocket of shade material, internal-type bottom bar with concealed weight bar as required for smooth, properly balanced shade operation.

I. Audiovisual Light-Blocking Shades: Designed for eliminating all visible light gaps when shades are fully closed; fabricated from blackout shade band material with pocket and bottom bar extended and formed for light-tight joints among shade components and between shade components and adjacent construction. Comply with the following:

1. Room Darkening Shadecloth: MechoShade Systems, Inc., “0700 Series,” blackout material, washable and color fast laminated and embossed vinyl coated fabric, 0.012-inch (.0.30 mm) thick blackout material, seighing 0.81 lbs. Per square yard, with a minimum of 62 threads per square inch.
2. Material Width: As required to match window module.
4. Trim: As selected by Architect from manufacturer's available range for style and color.
5. Material Pattern and Color: As selected by Architect from manufacturer's available range.
6. Side Channels and Perimeter Seals: Manufacturer's standard design for eliminating light gaps when shades are closed.
7. Shade Band Retention System: Manufacturer's standard design for guiding shade band material through range of travel and holding shade band flat with edges of material within side channels.
8. Location: Provide at Conference Room 2A.07.

J. Mounting: Recessed in ceiling pocket mounting permitting easy removal and replacement without damaging roller shade or adjacent surfaces and finishes.

K. Hold-Down Brackets and Hooks or Pins: Manufacturer's standard for anchoring roller shade bottom in place and keeping shade band material taut.

L. Shade Operation: Manual; with continuous-loop bead-chain, clutch, and cord tensioner and bracket lift operator.

1. Position of Clutch Operator: Right side of roller, as determined by hand of user facing shade from inside, unless otherwise indicated on Drawings.
2. Clutch: Capacity to lift size and weight of shade; sized to fit roller or provide adaptor.
3. Loop Length: Length required to make operation convenient from floor level.
5. Cord Tensioner Mounting: Sill.
6. Operating Function: Stop and hold shade at any position in ascending or descending travel.

M. Location: Provide at openings where indicated as “RS” in Drawings.
2.2 ROLLER SHADE FABRICATION

A. Product Description: Roller shade consisting of a roller, a means of supporting the roller, a flexible sheet or band of material carried by the roller, a means of attaching the material to the roller, a bottom bar, and an operating mechanism that lifts and lowers the shade.


C. Unit Sizes: Obtain units fabricated in sizes to fill window and other openings, measured at 74 deg F. Shade Units Installed Outside Jambs: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

D. Installation Brackets: Designed for easy removal and reinstallation of shade, for supporting roller, and operating hardware and for hardware position and shade mounting method indicated.

E. Installation Fasteners: No fewer than two fasteners per bracket, fabricated from metal noncorrosive to shade hardware and adjoining construction; type designed for securing to supporting substrate; and supporting shades and accessories under conditions of normal use.

F. Color-Coated Finish: For metal components exposed to view, apply manufacturer's standard baked finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

G. Colors of Metal and Plastic Components Exposed to View: As selected by Architect from manufacturer's full range, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions, and located so shade band is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.
3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain roller shades. Refer to Division 1 Section Demonstration and Training."
PART 1   GENERAL

1.1 SUMMARY

A. Furnish and install interior roller-screen window shades and accessories with the following characteristics:


5. Accessories: Provide the following:


   b. Fascia Filler: Transition piece to cover mullions for continuous appearance.

6. Selection Samples: Submit 3 x 5-inch shadecloth and liner sample swatches indicating manufacturer’s full range of colors and patterns available for initial selection.

PART 2   PRODUCTS

2.1 WINDOW SHADES

A. Single-Fabric Shadecloth, visually opaque, as manufactured by MechoShade Systems Inc.(or equal). Provide single thickness non-ravelling 0.030-inch thick vinyl fabric, vinyl yarn comprised of polyester and reinforced vinyl, in colors selected from manufacturer’s available range.

B. Shade roller: Extruded-aluminum tube 6063-T5 alloy, with a minimum wall thickness of 0.065 inch and an internal keyway to receive manual drive or tubular motor where required. The tube shall be extruded with two fabric-mounting channels designed so that the shadecloth does not disengage from the tube itself. Shade rollers shall be reversible for left- or right-hand operation.

C. Fascia: Provide one-piece extruded aluminum 6063-T5 alloy with average thickness of 0.062 inches, SnapLoc clipped to the brackets without the use of glue, magnetic strip, or screws and with concealed fastening.

2.2 MANUAL CHAIN OPERATION

A. General: Bi-directional clutch and bead-chain mechanism with adjustable brake to permit:

   1. Static mode with infinite shop positions as required, Single-mode shade operators shall not be acceptable. Chain to fall closest to window side, rear of shade.
2. **Sprocket**: One-piece, injection-molded, high-density Delrin capable of full engagement with stainless-steel bead chain qualified to match the pitch of the sprocket.

3. **Chain**: Qualified No. 10 stainless steel, 90-lb. test. Nickel-plated brass-bead or steel-bead control-loop chain and plastic-bead chain are not acceptable.

4. **Brake Mount**: Vibration-proof steel and vibration-resistant nylon locking nut to maintain selected braking friction.
   a. Brake adjustment shall be concealed within the shade operating tube; with vibration-resistant locking-nut assembly.

5. **Disc Brake**: Self-adjusting linear disc break with concealed-tension adjustment device.
   a. System shall consist of a compensation spring with two friction-absorbing nylon washers on 1 1/4" steel shaft that provides continuous, uniform, compensating brake pressure on the one-piece-sprocket, brake-drive component with a braking surface of not less than 2.89 square inches.
   b. Provide a compression spring which also acts as a vibration absorber.

### PART 3 EXECUTION

#### 3.1 INSTALLATION

A. Install units to comply with the Manufacturer's instructions for the type of mounting and operation required. Provide units plumb, true, and securely anchored in place with recommended hardware and accessories to provide smooth operation without binding.

B. Adjust units for smooth operation. Adjust shade and shadecloth to hang flat without buckling or distortion. Replace any units or components which do not hang properly or operate smoothly.

C. Demonstrate operation method and instruct City's personnel in the proper operation and maintenance of the window shade systems.

**END OF SECTION**
SECTION 12614
MULTIPLE USE FIXED SEATING

PART 1 GENERAL

1.1 SUMMARY
A. Furnish and install multiple use fixed seating as indicated on the drawings and specified, including the following:
   1. Fixed strip table, no modesty panels or end panels, plastic laminate finish.
   2. Chairs: Pedestal mounted tilt swivel seating, non-upholstered molded plastic seat shell.

1.2 SUBMITTALS
A. Shop Drawings: Submit Shop Drawings prepared from field measurements indicating layout of seating units, chair sizes and table.
B. Product Data: Submit product data for multiple fixed seating.
C. Material Samples: Submit color charts and Sample materials indicating manufacturer's full color range of standard colors, finishes, patterns and texture available for each exposed material.
D. Certificates: Submit product certificates signed by manufacturer of seating, certifying that products comply with specified requirements.

1.3 QUALITY ASSURANCE
A. Comply with the following as a minimum requirement:
   1. NEMA LD 3 - High Pressure Decorative Laminates.
   2. ASTM A 36 - Carbon Structural Steel.
   3. ASTM A 591 - Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Mass Applications.
   4. ASTM D 635 - Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
B. Qualifications of Installer: A minimum of 5 years experience installing and servicing seating similar in kind, quality, and extent indicated.

1.4 DELIVERY, STORAGE AND HANDLING
A. Deliver seating in manufacturer's unopened cartons clearly labeled with manufacturer's name and contents.
B. Store seating in dry location protected from damage and soiling under environmental conditions acceptable to manufacturer.
C. Protect seating from damage.
PART 2   PRODUCTS

2.1   MULTIPLE USE FIXED SEATING

A.  Subject to compliance with specified requirements, multiple use fixed seating shall be the product of one of the following (or equal):

B.  Model Numbers (Irwin Seating, or equal):
   1.  900 Series Strip Table
   2.  650 Series Tilt/Swivel Chairs, No. 6 Shell

C.  Steel Plates, Shapes, and Bars:  Conform to ASTM A 36.

D.  Electrolytic Zinc-Coated Steel Sheet:  Conform to ASTM A 591, commercial and drawing quality, Coating Class C, chemically treated for baked-enamel finish; 0.0396 inch minimum thickness unless otherwise indicated.

E.  Tamperproof Expansion Anchors:  Provide tamperproof expansion anchors (internally threaded tubular expansion anchor); and machine bolts of the type and size selected by manufacturer to suit substrate and installation conditions indicated.

F.  Seat Assembly, Plastic:
   1.  Steel: Steel shall be furnished with smooth surfaces, be of sufficient gage thickness, and designed to withstand strains of normal use and abuse.
   2.  Plastic: Plastic shall be high impact-resistant, HDPE polyethylene with ultraviolet light inhibitors to retard fading. Plastic shall have a burn rate of one foot per minute when tested in accordance with ASTM D 635 or the Department of Transportation Motor Vehicle Safety Standard No. 302. Concern for the environment requires that molded plastic parts be designed to be recyclable and shall be clearly designated with the recycle symbol on each piece.

G.  Metal parts:  Exposed metal parts shall be powder coated with an epoxy powder coat finish. This powder coated finish shall be installed by electrostatic means to a thickness of 3 mils, and shall provide a durable coating having a 4H pencil hardness. Powder coated metal parts shall be treated with a 5-stage bonderization process for superior adhesion, and after coating shall be oven baked for proper flow of the epoxy powder to result in a more durable finish. Colors shall be as selected from manufacturer’s standard colors.

H.  Plastic parts:  Color of plastic shall be as selected from manufacturer’s standard color range.

I.  Hardware: Assembly hardware shall be tamper-resistant. Threaded components utilize the standard thread configuration, and standard drive sizes.

2.2   FABRICATION

A.  Fabricate seating units in contoured form for maximum comfort, furnishing materials that are carefully selected to be free of defects, objectionable projections, or irregularities. Smoothly round corners, edges, and exposed fasteners, to present least possible snagging and pinching hazards.
B. Floor Mounting: Fabricate seating units for anchorage to floor, with standards manufactured to conform to floor while maintaining seat and back in the same angular relationship to standards throughout.

C. Tubular Steel Standards: Fabricate standards of heavy gage rectangular steel tubing securely welded to steel-mounted plate, with seat, and back connections welded to tubing.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install multiple use fixed seating according to manufacturer's installation instructions in locations as indicated on Drawings.

B. Seats shall be fastened to concrete floor by means of 2 expansion bolts of 1/4 inch per standard which are set in hole drilled a minimum depth of 1-1/4 inches.

C. Standards: Anchored with not less than 2 anchoring devices of sizes and types required to produce seating free from instability under actual use.

END OF SECTION
SECTION 12690
ENTRANCE MATS

PART 1 - GENERAL

1.01 DESCRIPTION: Provide recessed entrance mats and accessories, complete.

1.02 SUBMITTALS:

   A. Samples: Submit samples of perimeter vinyl and carpet treads.
   B. Shop Drawings: Submit showing size and location of mat and complete installation details.
   C. Maintenance Materials: Provide and deliver extra carpet treads, not less than 5 of each length.
   D. Manufacturer's published technical data fully describing entrance mat materials, construction, and recommended installation directions.
   E. Manufacturer's published instructions for maintenance care, cleaning, and repair of entrance mat.

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING: Deliver materials in original unbroken packages, containers, or bundles bearing name of manufacturer, and complete material identification. Store in dry ventilated locations. Handle by methods that prevent damage, soiling, and contamination.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS:

   Cactus Mat Manufacturing Co.
   (626) 443-9369

   Arden Architectural Specialties, Inc.
   (408) 727-3034

2.01 MATERIALS:

   A. Roll-up carpet tread mat, 3/8 inch thick, constructed of aluminum rails and thermoplastic hinges, set into recessed frame. Rails shall be fitted with carpet strips in color as selected.
   B. Mitered aluminum frame, set into recess in floor with top of frame flush with floor, anodized finish.

PART 3 - EXECUTION

3.01 PREPARATION:

   A. Cleaning: Clean concrete floor slabs of all oil, grease, waxes, curing compounds, dust, dirt, debris, paint, and other deleterious substances.
B. Leveling: Make floor slab true to level and plane within a tolerance of 1/8" in 10-feet. Test floor areas both ways with a 10-foot straightedge and repair high and low areas exceeding allowable tolerance. Remove high areas by power sanding, stone rubbing or grinding, chipping off and filling with leveling compound, or equivalent method. Fill low areas with leveling compound. Repair and level the surfaces having abrupt changes in plane, such as trowel marks or ridges, whether or not within the allowable tolerance. Again clean areas where repairs are performed.

3.02 INSTALLATION:

A. Install even and provide flush and uniform transitions to adjacent floor surfaces.

B. Treadrails: Shall be continuously locked in a ball socket arrangement. Independent vinyl hinges between treadrails are unacceptable.

C. Carpet Treads: Shall be mechanically locked into treadrails and fastened at each end to prevent movement or slippage.

D. Spacing: Maximum spacing between edges of treadrails is to be 3/6".

3.03 CLEAN-UP: After installation is completed, clean up all dirt and debris, remove spots and soiling with proper cleaner.

3.04 INSTRUCTION: Instruct personnel in maintenance of the installed entrance mat at time and location designated.

3.05 COMPLETED INSTALLATIONS: Clean and free of loose material, and defects and matching the quality of the approved sample installation. Installation not complying with these requirements, as determined, will be rejected. Contractor shall remove rejected portions and install new conforming materials at no additional contract cost and as approved.

END OF SECTION
SECTION 133411
PRE-FABRICATED CONTROL BOOTHS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY
A. This Section includes prefabricated steel control booths.
B. Related Sections include the following:
   1. Division 3 Section "Cast-in-Place Concrete" for concrete islands and curbing.
   2. Division 5 Section "Metal Fabrications" for pipe bollards to protect control booths.
   3. Division 16 Sections for electrical wiring and connections for control booths.

1.03 PERFORMANCE REQUIREMENTS
A. Structural Performance: Provide control booths capable of withstanding the effects of gravity loads, wind loads (based on Uniform pressure) and stresses within the limits as noted under the Structural General Notes.
B. Seismic Performance: Provide control booths capable of withstanding the effects of earthquake motions determined according to City of Los Angeles Building Code, 2002 Edition.
C. Thermal Movements: Provide control booths that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, over stressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

1.04 SUBMITTALS
A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for control booths.
B. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
C. Samples for Initial Selection: For control booths with factory-applied color finishes.
D. Samples for Verification: For exposed control booth finishes, in manufacturer's standard sizes.
E. Product Test Reports: Based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified testing agency, for control booth performance.

F. Maintenance Data: For control booths to include in maintenance manuals.

G. Warranties: Special warranties specified in this Section.

1.05 QUALITY ASSURANCE

A. Source Limitations: Obtain control booths through one source from a single manufacturer.

B. Product Options: Information on Drawings and in Specifications establishes requirements for system's aesthetic effects and performance characteristics. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction. Performance characteristics are indicated by criteria subject to verification by one or more methods including preconstruction testing, field testing, and in-service performance.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of control booths and are based on the specific system indicated. Refer to Division 1 Section "Substitutions and 'or Equal' Submittal." Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.

D. Welding: Qualify procedures and personnel according to the following:

1. AWS D1.1, "Structural Welding Code--Steel."
2. AWS D1.3, "Structural Welding Code--Sheet Steel."

E. Regulatory Requirements: Where control booths are indicated to comply with accessibility requirements, comply with FED-STD-795, "Uniform Federal Accessibility Standards."

1. Provide work counter located within required reach ranges.
2. Provide hardware that does not require tight grasping, pinching, or twisting of the wrist, and that operates with a force of not more than 5 lbf.

F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

G. Safety Glass: Category II materials complying with testing requirements in 16 CFR 1201. Subject to compliance with requirements, permanently mark safety glass with certification label of the Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.
1.06 PROJECT CONDITIONS

A. Field Measurements: Verify actual locations of walls, columns, and other construction contiguous with control booths by field measurements before fabrication and indicate measurements on Shop Drawings.

1.07 COORDINATION

A. Coordinate installation of anchorages for control booths. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.08 WARRANTY

A. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace wall panels that show evidence of deterioration of factory-applied finishes within specified warranty period. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.
2. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.
3. Basis-of-Design Product: The design for each type of prefabricated control booth indicated is based on the product named. Subject to compliance with requirements, provide either the named product or a comparable product by one of the other manufacturers specified.

2.02 MATERIALS

A. Aluminum: Alloy and temper recommended by aluminum producer and manufacturer for type of use and finish indicated, and as follows:


B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B.

C. Zinc-Coated (Galvanized) Steel Sheet: ASTM A 653/A 653M, commercial quality, G90 coating designation; mill phosphatized.
D. Galvanized, Rolled Steel Tread Plate: ASTM A 786/A 786M, rolled from steel plate complying with ASTM A 572/A 572M, Grade 55; hot-dip galvanized according to ASTM A 123/A 123M.

E. Steel Structural Tubing: ASTM A 500, Grade B, hot-dip galvanized according to ASTM A 123/A 123M.

F. Steel Mechanical Tubing: ASTM A 513, welded steel mechanical tubing, hot-dip galvanized according to ASTM A 123/A 123M.

G. Stainless-Steel Sheet: ASTM A 666, Type 304.

H. Plastic Laminate: NEMA LD 3, HGS or HGL grade.

I. Plywood: DOC PS 1, Exterior grade.

J. Particleboard: ANSI A208.1, Grade M-2.

K. Clear Tempered Float Glass: ASTM C 1048, Kind FT, Condition A, Type I, Class 1, Quality q3.

L. Anchorages: Anchor bolts, hot-dip galvanized according to ASTM A 153/A 153M.

2.03 PREFABRICATED CONTROL BOOTHs, GENERAL

A. General: Provide a complete, integrated set of mutually dependent components that form a completely assembled, prefabricated control booth, ready for installation on Project site. Control booths shall be capable of withstanding structural and other loads indicated, thermally induced movement, and exposure to weather without failure or infiltration of water into booth interior. Include structural framing, roof and wall panels, door(s), windows, and accessories complying with requirements indicated.

2. Doors: Swinging door on back.

B. Fixed Windows: Extruded-aluminum sash frames glazed with 3-mm-thick, clear tempered float glass.

1. Finish: Clear anodic.
2. Corner Shape: Square.

C. Horizontal Sliding Windows: Extruded-aluminum sash frames glazed with 3-mm-thick, clear tempered float glass. Equip windows with cam locks, weatherstripping, and manufacturer’s standard ball-bearing rollers.

1. Finish: Clear anodic.
2. Provide insect screens for each window.
3. Corner Shape: Square.
D. Single Hung, Vertical Sliding Windows: Extruded-aluminum sash frames glazed with 3-mm-thick, clear tempered float glass. Equip windows with cam locks and weatherstripping:
   1. Finish: Clear anodic.
   2. Provide insect screens for each window.

E. Work Counters: Full width of control booth, reinforced; with 16-inch- wide cash drawer below each counter, and an access opening for electrical cords at each rear corner of counter.
   1. Material: 0.079-inch- thick, galvanized steel sheet.
   2. Depth: 25 inches.
   3. Finish: Manufacturer’s standard paint finish.

F. Electrical Power Service: 125-A, 120/240-V ac, single-phase, 3-wire service with 8-16 circuit breaker panel; located under one end of work counter. Run copper wiring in 1/2-inch EMT conduit. Provide one 120-V GFCI power receptacle(s).

G. Lighting Fixtures: Two ceiling-mounted fluorescent light fixture(s), 48 inches long, with acrylic lens and two 40-W lamps in each fixture. Provide single-pole switch mounted adjacent to door to control lighting fixture.

H. Heating Unit: Wall-mounted, thermostatically controlled, 110-V, 1500-W electric heater with fan-forced operation, and with capacity of not less than 5000 Btuh. Enclose heater in enameled steel cabinet.

I. Cooling Unit: Wall-mounted, thermostatically controlled, air-conditioning unit with cooling capacity of not less than 13,500 Btuh. Enclose cooling unit in enameled-steel cabinet.

J. Accessories: Provide the following for each control booth:
   1. Ventilation fan.
   2. Intercom.
   3. Traffic control lights.

2.04 PREFABRICATED STEEL CONTROL BOOTHS

A. Basis-of-Design Product: The design for each type of prefabricated control booth indicated is based on Par-Kut International, Inc., Model 75HC control booth or a comparable product by one of the Available Manufacturers:

B. Available Manufacturers:
   1. B.I.G. Enterprises, Inc.
   2. Parking Booth Company, Inc.

C. Structural Framework: Fabricated from 2-by-2-by-0.0747-inch steel structural or mechanical tubing. Connect framework by welding.
D. Base/Floor Assembly: 2-inch-high assembly consisting of perimeter frame welded to structural framework of booth. Fabricate frame from 2-by-2-inch galvanized-steel structural tubing; 0.0966-inch-thick, C-shaped steel channels; or structural-steel angles. Include anchor clips fabricated from 1/4-inch-thick steel plate, predrilled and welded to base exterior.

E. Floor Finish: 12 gauge galvanized steel tread plate.

F. Wall Panel Assembly: Assembly consisting of exterior face panel fabricated from 0.079-inch-thick, galvanized steel sheet; and interior face panel fabricated from 0.052-inch-thick, galvanized steel sheet; with 2-inch-thick, rigid fiberglass or polystyrene board insulation in cavity between exterior and interior face panels. Thermal Resistance Value (R-Value): R-10.

G. Flat Roof/Ceiling Assembly: Consisting of exterior roof panels, interior ceiling panels, and insulation between exterior and interior panels; sloped to drain at booth perimeter.
   1. Exterior Roof Panel: Fabricated from 0.079-inch-thick, galvanized steel sheet; with painted finish, continuously welded seams, and full-perimeter gutter.
   2. Interior Ceiling Panel: Fabricated from 0.079-inch-thick, galvanized steel sheet; with fiberglass insulation in cavity between ceiling and roof. Thermal Resistance Value (R-Value): R-17.
   3. Canopy Fascia: Fabricated from 0.079-inch-thick galvanized steel sheet, of manufacturer's standard design.
      a. Height: 6 inches.
      b. Overhang: 3 inches beyond face of walls below.
   4. Roof scuppers.

H. Swinging Door: 1-3/4 inches thick; tubular-frame design fabricated from galvanized steel; with top half of door glazed. Equip door with deadlock, three butt hinges, closer, and full weather stripping.
   1. Glazing: Fixed unit with 3-mm-thick, clear tempered float glass.
   2. Deadlock: Mortised, with lever handle and removable cylinder capable of being master keyed.

I. Finish: Finish exposed metal surfaces, including structural framework, walls, canopy, and ceiling with rust-inhibitive primer and one finish coat of industrial air-dry acrylic enamel. Color: Match Architect's samples.

2.05 FABRICATION

A. Fabricate control booths completely in factory.

B. Preglaze windows and doors at factory.

C. Prewire control booths at factory, ready for connection to service at Project site.

D. Fabricate control booths with removable lifting eye centered in roof.

2.06 FINISHES
A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Finishes: Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.

D. Galvanized Steel Sheet Finishes: Clean surfaces with nonpetroleum solvent so surfaces are free of oil and other contaminants. After cleaning, apply a conversion coating suited to the organic coating to be applied over it. Clean welds, mechanical connections, and abraded areas, and apply galvanizing repair paint specified below to comply with ASTM A 780.

   2. Air-Dried Enamel Finish: Apply manufacturer's standard enamel finish complying with manufacturer's written instructions for surface preparation including pretreatment, application, baking, and minimum dry film thickness.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

   1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
   2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Set control booths plumb and aligned. Level base plates true to plane with full bearing on concrete bases.

B. Fasten control booths to concrete bases with expansion anchors.

C. Connect electrical power service to power distribution system according to requirements specified in Division 16.

3.03 ADJUSTING AND CLEANING

A. Adjust doors, operable windows, and hardware to operate smoothly, easily, properly, and without binding. Confirm that locks engage accurately and securely without forcing or binding.

B. Lubricate hardware and other moving parts.
C. After completing installation, inspect exposed finishes and repair damaged finishes.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes pre-engineered, operable car wash system.

B. Related work:
   1. Division 3 for cast-in-place concrete
   2. Division 5 for metal fabrications.
   3. Division 15 for plumbing piping.
   4. Division 16 for electrical requirements and materials.

1.2 DEFERRED APPROVAL REQUIREMENTS

A. Submit drawings and calculations to authorities having jurisdiction for approval, and pay fees incurred thereby before start of installation.

1.3 SUBMITTALS:

A. Data:
   1. Submit complete catalog data and catalog cuts of each type of equipment.
   2. Provide complete installation instructions for each type of equipment.

B. Shop drawings:
   1. Submit shop drawings showing the following:
      a. Dimensions of each item.
      b. Method of installation
      c. Details as follows:
         1) Details of construction.
         2) Anchorage to building structure.
         3) Method of assembling sections.
         4) Critical installation clearances.
         5) Location and installation of hardware and accessories.
         6) Size, shape and thickness of materials, joints and connections.
7) Indicate manufacturer recommended seismic anchorage details for Title 24 compliance.

   d. Relationship of adjoining work.

   C. Test reports: Submit 6 copies of all test reports in booklet form to the City Engineer not less than 30 days prior to the date of completion.

   D. Operation and maintenance manuals: Submit copies of operations and maintenance manuals on each item. Each set shall be permanently bounded and shall have a hard cover. Label the covers “OPERATION AND MAINTENANCE INSTRUCTIONS”, name and location of facility, name of Contractor, and contact number. Instructions shall include, but not be limited to the following Items.

      1. Start-up and shut-down instructions.
      2. Equipment maintenance requirements
      3. Capability of servicing equipment by local firm listing name, address, and telephone number, and name of authorized service representative.

   E. Certificate of test and compliance. Submit report of field test operation of equipment. Submit certificate of compliance with requirements of the Specifications for each item.

1.4 QUALITY ASSURANCE

   A. Manufacturer’s qualifications:

      1. Material and car wash equipment shall be the standard products of a manufacturer regularly engaged in the manufacture of the products and shall duplicate items that have been in satisfactory use in similar facilities for at least 5 years prior bid opening date.

      2. All major accessories and appurtenances shall be supplied by the same manufacturer.

      3. Equipment shall be supported by a service organization that is reasonably convenient to the site.

   B. Manufacturer’s service:

      1. Obtain the services of the manufacturer’s representative experienced in the installation, adjustment and operation of the car wash equipment specified.

      2. The representative shall supervise the installation, adjustment and testing of the equipment.

   C. Installer’s qualifications: Equipment shall be installed by its manufacturer or firm with a minimum of 5 years experience with pre-engineered car wash systems installation, and be acceptable to the manufacturer.

1.5 HANDLING:

   A. Deliver material in manufacturer’s original packaging.

   B. Identify contents, manufacturer, brand name and applicable standards.
C. Store materials inside building, on pallets, under protective covering, and protect from weather, moisture, open flames and sparks. Store and handle in manner to prevent damage and marring of finish. Protect finished surface from damage.

1.6 MAINTENANCE

A. Furnish one set of special tools, calibration devices, and instruments required for operation, calibration and maintenance of equipment.

PART 2 - PRODUCTS

2.1 COMPONENTS AND SYSTEMS

A. Equipment by Econocraft Worldwide Car Wash Manufacturer, Inc., ECW-5 Touch Drive Thru car wash system, or equal.

B. Components:

1. **Air compressor**: 7.5 hp compressor by Ingersol Rand, Model No. ECWING7.5

2. **Sensor**: Dual Electrical Eye Activation Sensor, Model No. ECW806.

3. **Single leg arch**: Model No. ECW700/780, constructed of 10-gage square tubing, Type 304 stainless steel, 2 in. x 2 in. Stainless steel water plumbing, brass water nozzles, schedule 80 clear acrylic foam generator tubes. One water line and one foam line.

4. **Front to Back 4 Basket Mitter with wrap around**: Model No. ECW095 constructed of 10-gage, Type 304 stainless steel, tubing. Equipment height of 10 ft., vertical clearance of 92 in., tunnel length free standing, width 12 ft., braided hose, 78 in. brush height, 12 in. core.

5. **Free standing Baby Rocker**: Model No. ECW420. Constructed of 4" by 4", 10 gauge stainless steel square tubing, #304. Free standing configuration, with free cross over arch for Baby Rocker, Model No. ECW420COA.

6. **Final Rinse Arch**: Model No. ECW712. Constructed of 2' x 2", 10 gauge stainless steel square tubing, #304. 1 GPM brass nozzles, with check valve and one water line.

7. **Spot Free Rinse Arch**: Model No. ECW712. Constructed of 2' x 2", 10 gauge stainless steel square tubing, #304 finish. One water line spot free rinse with check valve and one gpm brass nozzles.

8. **Sport Free Rinse**: Model No. RO-3000. 3000 gallon per day capacity without storage tank. Automatic membrane backflush, water stabilizer, one cu.ft. carbon filter with auto backflush, 2 HP repressurization pump with freshwater bypass.


13. Motor Control Center/ PCL Controller: Model No. ECWMOT. 48” x 36” wall mounted M.C.C. 208 volt, pre-wired at factory. Housed in a 12/13 type protective steel enclosure, with large forward opening doors.


16. Steel Rolling Guide Rail with Steel Tire Plate: Model No. ECWGUIDE.


18. One and one half inch water Solenoid Manifold, model No. ECW723, ¾” 110v 60 HZ standard.

C. Bolts to attach equipment to concrete slab or masonry shall be stainless steel.

2.2 COMPONENT AND SYSTEM GENERAL REQUIREMENTS

A. Pumps and motors shall have the manufacturer's name, address, type or style, model or serial number, and catalog number on a stainless steel plate permanently secured to the item of equipment.

B. Belts, chains, couplings and other moving parts shall be completely enclosed by guards to prevent accidental personal injury. Guards shall be removable or so arranged as to allow access to equipment for maintenance.

C. Electric motors shall have UL label fixed to exterior surface.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, surfaces, and supports under which the work of this Section will be installed.

B. Verify correct dimensions, piping, wiring and anchor bolt locations.

C. Correct conditions detrimental to the proper and timely completion of this work before proceeding with installation.

3.2 CAR WASH SYSTEM INSTALLATION

A. Install electrical equipment to meet applicable Codes.

B. Provide clearances in accordance with NEC Article 110-16.

C. Provide 3-120v, 20 amp circuit breakers lighting panel to M.C.C.
D. Provide NEMA 3R disconnect switch for main switch, 208v 200amps, 3 phase.

E. Install remainder of equipment plumb, level, with tight, flush joints, securely attached to supports in compliance with approved submittals, Code seismic regulations, and the manufacturer’s instructions.

3.3 FIELD QUALITY CONTROL

A. Perform field tests and provide labor, equipment required for same:

1. The City Engineer will witness field tests and conduct field inspections.

2. Notify City Engineer 7 days prior notice of the dates and times for acceptance tests.

3. After completion of the installation and as soon as practical, conduct a leakage test on all vessels. The vessels shall be filled with water and left standing for 24 hours. Leaks encountered shall be repaired and the vessel shall be retested until proven liquid-tight.

4. Provide written report of tests.

5. Correct deficiencies found shall be rectified and work affected by such deficiencies shall be completely retested at the Contractor’s expense.

B. After completion of the installation and as soon as practical, an operating test of the pre-engineered car wash system and all equipment shall be performed to demonstrate that the systems function properly.

1. Issue written report.

2. Tests shall include the manufacturer’s recommended tests for equipment vibration, horizontal and vertical alignment and structural integrity.

3. After completion of the test, adjust the system for proper operation in accordance with the manufacturer’s instructions and the operating and maintenance instructions.

3.4 TRAINING

A. Training:

1. Conduct a training course for the operating staff as designated by the City Engineer.

2. The training period shall consist of 2 work days comprised of 7 hours each training day. The training shall be after the system is functionally completed but prior to final acceptance tests.

3. The field instructions shall cover all items contained in the Operating and Maintenance Instructions, as well as demonstrations of routine maintenance operations.

3.5 TOUCHUP
A. Upon completion restore abraded surfaces to original condition with the same paint used for shop priming and painting.

END OF SECTION
PART 1 GENERAL

1.1 DESCRIPTION

This section specifies the engineering, furnishing and installation of electric (drum type) dumbwaiters, consisting of AC call-send operation, signal system, car leveling device, power operated car doors // and hoistway doors // and manual car and hoistway doors. //

1.2 QUALITY CONTROL

A. Approval by the Contracting Officer is required of products or services of proposed manufacturer, suppliers and installers, and will be based upon submission by Contractor of certification that:
   1. Manufacturer regularly and presently manufactures dumbwaiter equipment as one of his principal products.
   2. Installer has technical qualifications of at least three years experience, trained supervisory and installation personnel, and facilities to install specified items. Approval will not be given, however, where the experience record on either government, municipal, or commercial projects is one of unsatisfactory performance.
   3. Manufacturer's product submitted has been in satisfactory and efficient operation on three installations similar to this project for not less than three years. Submit list of installations: include names and addresses of the Medical Center and Medical Center Administrators thereof.
   4. There is a permanent service organization maintained or trained by manufacturer which will render satisfactory service to this installation within two hours or receipt of notification that service is needed. Submit name and address of service organization.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. Federal Specifications (Fed. Spec.):

   FF-S-325 .......................................Shield, Expansion; Nail, Expansion; and
   INT AMD 3 .....................................Nail, Drive Screw (Devices, Anchoring, Masonry)
   J-C-30B(1) ..................................Cable And Wire, Electrical (Power, Fixed Installation)
   J-C-580B(1) .............................Cord, Electrical And Wire, Electrical (0-to 600-Volt Service)
   QQ-S-698 .................................Steel Sheet And Strip, Low Carbon
QQ-S-766D ................................Steel, Stainless And Heat Resisting, Alloys, Plate, Sheet And Strip
RR-W-410D ..................................Wire Rope And Strand
TT-E-489H .................................Enamel, Alkyd, Gloss, Low Voc Content
W-S-610E .................................Splice Connectors

C. American Society for Testing and Materials (ASTM):
   Section 01 2001-200 ..............Iron and Steel Products
D. American Society of Mechanical Engineers (ASME):
   A17.2-2001 ............................Inspectors Manual for Electric Elevators
E. National Fire Protection Association (NFPA):
   2002..or current code ..............National Electrical Code (NEC)
   252-2003 ...............................Fire Tests of Door Assemblies
F. Underwriters Laboratories, Inc. (UL):
   486A-97 Ninth Edition ..............Safety Wire Connectors and Soldering Lugs
G. National Electrical Manufacturers Association (NEMA)
H. Institute of Electrical and Electronic Engineers (IEEE)
I. Gauges:
   Sheet and Plates - U.S. Standard
   Wire - American Wire Gauge (AWG)

1.4 SUBMITTALS
A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
B. Before executing any work, furnish information sufficient to fully comply with contract requirements of proposed items. Such information shall include, as required, Manufacturer's Name, Trade Names, Model or Catalog Number, Nameplate Data (size, capacity, rating), and corresponding specification reference (Federal or project specification number and paragraph):
   1. Samples:
      a. One of stainless steel, 51 mm x 1.2 mm (2 inches x 4 inches)
      b. Do not submit other samples of materials specified unless specifically requested after submission of manufacturer's name. In case such samples are furnished pursuant to request, adjustments in contract price and time will be made as provided in Clause 3. General Provisions, (Construction Contract) Standard Form 23A.
C. Shop Drawings:
   1. Complete dimensioned layout of dumbwaiter in plan and elevation, showing the machine, controller, car, car sling, sheaves, supporting beams, guide rails, buffers, reactions at points of support, weights of principal parts, top and bottom clearances, overtravel of the car, number and size of hoisting ropes.
2. Complete drawings of car showing details of construction and location of all car equipment.
3. Cuts or drawings showing details of signal and car equipment.
4. Cuts or drawings showing details of guide shoes.
5. Cuts or drawings and description of power car and hoistway door operation.

D. Materials Data:
Submit the name of manufacturer and type or style designation of the following for approval:
1. Controllers
2. Hoistway doors
3. H.P. and R.P.M. of hoist motor
4. Electric power door operator
5. Hoistway door interlocks and electric contacts
6. Certified maximum loads and striking speed of car buffers
7. Ultimate breaking strength and allowable working load of hoisting ropes.

1.5 WIRING DIAGRAMS
A. Provide three complete sets of field wiring and straight line wiring diagrams showing all electrical circuits in the hoistway, as well as the machine room. In the event field modifications are found necessary during installation, diagrams shall be revised to include all corrections made prior to and during the final inspection. Corrected diagrams shall be delivered to the Resident Engineer within 30 days of final acceptance.

B. Provide the following information relating to the specific type of microprocessor controls installed:
1. Owner's information manual, containing general data on major components, maintenance, and adjustment.
2. Complete wiring diagrams needed for field troubleshooting, adjustment, repair and/or replacement of components. Diagrams shall be base diagrams, containing all changes and additions made to the equipment during the design and construction period.
3. Changes made during the warranty period shall be noted on the drawings in adequate time to have the finalized drawings reproduced for mounting in the machine room no later than six months prior to the expiration of the warranty period.

1.6 ADDITIONAL EQUIPMENT
Additional equipment required to operate specified equipment manufactured and proposed for this installation shall be furnished and installed. The cost of such equipment shall be included in the base bid.

1.7 PERFORMANCE STANDARDS
A. The dumbwaiters shall be capable of meeting the highest standards of the industry and specifically the following: Contract speed shall mean speed in the UP direction with full capacity load in the car. Speed variation under any load condition, regardless of direction, shall be no more than ten (10) percent.
B. Floor Accuracy: Accuracy shall be maximum 6 mm (1/4 inch) above or below the floor, regardless of load condition.

1.8 WARRANTY

A. Subject all labor and materials furnished in connection with dumbwaiter system to terms of "Warranty of Construction" articles of Section 01001, "GENERAL CONDITIONS", except that warranty period shall concur with length of maintenance contract. Warranty shall commence upon final inspection and completion of performance test and upon full acceptance of the installation.

B. If it becomes evident during the warranty period that the devices are not functioning properly or in accordance with specification requirements, or, if in the opinion of the Contracting Officer, excessive maintenance and attention must be employed to keep device operating, remove device and install new device meeting all requirements as part of work until satisfactory operation of installation is obtained. Period of warranty shall start anew from date of completion of new installation performed in accordance with foregoing requirements.

PART 2 PRODUCTS

2.1 MANUFACTURED PRODUCTS

A. Materials, devices and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items. Items not meeting this requirement but meet technical specifications, and the merits of which can be established through reliable test reports or physical examination of representative samples will be considered.

B. When two or more units of same class of materials, services, devices or equipment are required, these units shall be products of one manufacturer.

C. Manufacturers of equipment assemblies which include components made by others shall assume complete responsibility for the final assembled unit.

1. All components of an assembled unit shall be products of same manufacturer.

2. Parts which are alike shall be the product of a single manufacturer.

3. Components shall be compatible with each other and with the total assembly for the intended service.

D. Welding at the project site shall be made by welders and welding operators who have previously qualified and been certified by test as prescribed in American Welding Society Publication AWS D1.1 to perform the type of work required.

E. Motor nameplates shall state manufacturer's name, rated horsepower, speed, volts, amperes and other characteristics required by NEMA standards, and be securely attached to the item of equipment in a conspicuous location.
F. Where key-operated switches or key-operated cylinder locks are furnished in conjunction with any component of this dumbwaiter installation, furnish 4 keys for each individual switch or lock. Attach each key to a tag bearing a stamped or etched legend identifying its purpose. Tags shall be engraved. Imprint “Property of U.S. Government” on reverse side of tag. Barrel keys not acceptable.

2.2 MATERIALS

A. Where stainless steel is specified, it shall be corrosion resisting steel complying with QQ-S-766, Class 302 or 304, Condition A with Number 4 finish (150 grit) on exposed surfaces. Stainless steel shall have the grain of belting in the direction of the longest dimension and all surfaces shall be perfectly smooth and without waves. During erection, all stainless steel surfaces shall be protected by suitable material.

B. Where cold rolled steel is specified, it shall be low-carbon steel rolled to stretcher leveled standard finishes, complying with QQ-S-698.

2.3 CAPACITY, SPEED, TRAVEL

A. Each dumbwaiter shall have the capacity to lift the rated load at rated speed exclusive of the weight of entire car and cable, all as specified in the following schedule:

<table>
<thead>
<tr>
<th>DUMBWAITER SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dumbwaiter Number</td>
</tr>
<tr>
<td>Overall Car Size</td>
</tr>
<tr>
<td>Rated Load - kg(pounds)</td>
</tr>
<tr>
<td>Rated Speed - m/s(fpm)</td>
</tr>
<tr>
<td>Total Travel - m/s(fpm)</td>
</tr>
<tr>
<td>Floor Designations</td>
</tr>
<tr>
<td>Number of Stops</td>
</tr>
<tr>
<td>Number of Openings</td>
</tr>
<tr>
<td>Car Gate Size and Type</td>
</tr>
</tbody>
</table>

B. Actual dumbwaiter speed shall not vary more than 10% above, nor more than 10% below specified speed.

2.4 POWER SUPPLY
For power supply in each machine room see Section, "ELECTRICAL CIRCUITS (GENERAL)" and drawings. It shall be the electrical contractor's responsibility to supply the labor and materials for the installation of the following (1) a feeder from the power source indicated on the drawing to each dumbwaiter controller, (2) a fused disconnect or shunt trip circuit breaker for each controller, (3) power wiring between the fused disconnect or shunt trip circuit breaker and the controller and, (4) power circuits for dumbwaiter signal and control systems as indicated on the drawings from the indicated source to each dumbwaiter controller. The dumbwaiter controller, motor, power, and signal wiring from the controller to the machine shall be supplied and installed by the Dumbwaiter Contractor.

2.5 GROUNDING

Provide equipment grounding. Ground conductors, supports, controller enclosure, motors, platform and car frames, and other non-current conducting metal enclosures for electrical equipment in accordance with NEC. The ground wires shall be copper, insulated and sized as required by NEC. Bond the grounding wires to each of the pull boxes, junction boxes, cabinets and other enclosures through which the wires pass.

2.6 CONDUIT

A. Unless otherwise specified or approved, install all electrical conductors, except traveling cable connections to the dumbwaiter, in rigid zinc-coated steel aluminum conduit electrical metallic tubing. All raceways completely embedded in concrete slabs, walls or floor fill shall be rigid steel conduit. No rigid conduit or electrical metallic tubing shall be smaller than 19 mm (3/4-inch) electrical trade size. However, where permitted by NEC, 13 mm (1/2-inch) trade size conduit and electrical metallic tubing may be used only for tap connections. An auxiliary gutter may be used between controller, starter and similar apparatus in the dumbwaiter machine room. Fully protect self-supporting connections, where approved, from abrasion or other mechanical injury. Flexible metal conduit of not less than 9 mm (3/8-inch) trade size may be used, not exceeding 457 mm (18-inches) in length for short connections between risers and limit switches, interlocks and for the applications permitted by the NEC.

B. All conduits terminating in steel cabinets, junction boxes, wireways, switch boxes, outlet boxes and similar locations shall have approved insulating bushings. If the bushings are constructed completely of insulating materials, install a steel lock nut under the bushing. At ends of conduits not terminating in steel cabinets or boxes, protect the conductors with terminal fittings having an insulated opening for the conductors.

C. Conduit and EMT fittings and connections using set screws for indentations as a means of attachment shall not be used.

D. Provide terminal boxes for the flexible conduit and wiring connections to the hoisting motor.

E. Connect motors and other equipment subject to movement, vibration or removal to the conduit or EMT systems with flexible steel conduit.
2.7 CONDUCTORS
A. Unless otherwise specified, conductors, exclusive of traveling cables, shall be stranded or solid coated annealed copper in accordance with J-C-30 for either type RMW or THW. Where 16 and 18 AWG are permitted by NEC, either single conductor cable in accordance with J-C-580 for Type TF, or multiple conductor cable, may be used provided the insulation of single conductor cable and outer jacket of multiple conductor cable is flame retardant and moisture resistant. Multiple conductor cable shall have color coding or other suitable identification for each conductor. Conductors for control board wiring, including wiring between main circuit resistors and control boards, shall be in accordance with NEC. No joints or splices will be permitted in wiring except at outlets. Tap connectors may be used in wireways provided they meet all UL requirements.
B. All wiring must test free from short circuits or ground. Insulation resistance between external conductors and between conductors and ground shall be not less than one megohm.
C. Where size of conductors is not given, capacity shall be such that maximum current shall not exceed limits prescribed by NEC.

2.8 TRAVELING CABLES
A. Traveling cables from junction box on dumbwaiter to junction box in hoistway or to controller shall consist of flexible traveling cables conforming with requirements of NEC. Equip junction boxes in hoistway and on dumbwaiter with terminal blocks. All connections to terminal blocks shall be made with either terminal eyelet connections or pressure wire connectors of the clamp type that meet UL 486 requirements for stranded wire. Terminal blocks shall have permanent indelible identifying numbers for each connection. Cables shall be anchored to avoid strain on individual terminal connections. Flame and moisture resistant outer covering must remain intact between junction boxes and abrupt bending or twisting producing distortion of cable will not be allowed. Cables shall be free from any possible contact with hoistway structure, dumbwaiter or other equipment. Where necessary, provide suitable shields or pads to protect the cables.
B. Provide 10 percent but not less than 4 spare conductors in each traveling cable.

2.9 CONTROLLERS
A. UL/CSA labeled controller: Compartment: Securely mount all assemblies, power supplies, chassis switches, relays, etc., on a substantial, self-supporting steel frame. Completely enclose equipment and provide means to prevent overheating.
B. Relay Design: Magnet operated with contacts of design and material to insure maximum conductivity, long life and reliable operation without overheating or excessive wear. Provide wiping action and means to prevent sticking due to fusion. Contacts carrying high inductive currents shall be provided with arc deflectors or suppressors.
C. Identify each device on panels by name, letter or standard symbol, which shall be neatly stencil painted (or otherwise marked) in an approved indelible and legible manner. Coordinate identification markings with identical markings on wiring diagrams. Mark the proper ampere rating adjacent to each fuse holder.

2.10 CONTROL SYSTEM

Dumbwaiters shall have AC drive control and motor control, suitable for the operation specified and capable of providing smooth, comfortable acceleration, retardation and dynamic braking, limiting the difference in speed between full load and no load to not more than 10% of the contract speed.

2.11 GEARED DRUM MACHINE

A. The geared drum machine shall be of the single worm and gear type, with motor, spring applied and electrically released brake, sheave, pedestal mounted in proper alignment on a sound isolated steel plate. Mount machine in top or bottom of hoistway.

B. Operate hoisting motor or geared drum machine with alternating current control shall be the reversible direct current type, designed to meet the required high-starting torque with low-starting current. Rate the motor for 50 degrees C. rise, 60-minute rated motors and have sufficient capacity to operate dumbwaiter with rated load at rated speed without overheating.

C. The hoisting machine brake shall be a electromagnetic drum or disc type, electrically released and spring applied.

2.12 SHEAVES

A. Overhead sheaves shall be securely mounted on overhead beams in proper alignment with the drum:

1. Deflector sheave bearings shall be the same as specified for hoisting machine, except that sheave bearings of the anti-friction bearing metal type with grease cup lubrication may be used for deflector sheaves and overhead sheaves used with machine mounted below.

2. Overhead deflector sheaves shall be provided with a substantial metal basket type guard mounted below the sheave. Guard shall be securely fastened to sheave beams.

2.13 DUMBWAITER MACHINE BEAMS

Machine beams, shall be in accordance with applicable requirements of ASME A17.1. Furnish and install necessary structural steel beams or other steel members required for support of dumbwaiter machine, sheaves, rope hitches, buffers and other dumbwaiter equipment shall be furnished and installed. Bearing plates and anchors shall be provided as required to mount beams securely in place. Provide structural steel tower to support entire dumbwaiter installation on pit floor.

2.14 GUIDE RAILS
A. Car and counterweight guide rails shall be of planed steel or cold rolled "T" Rails conforming in all respects with ASME A17.1. There shall be a guide rail at each side of the car. Guide rails shall be securely fastened to the brackets or other supports.

1. Guide rails shall weigh not less than 12.0 kg/m (8 pounds) per linear foot).
2. Support guide rails at each floor and provide intermediate brackets and support where fastenings are over 2440 mm (8 feet) apart.
3. Ends of guide rails shall form matched joints fitted with fish plates. Each fish plate bolt shall be fitted with a split spring steel lock washer.
4. Guide rails shall extend from channels on pit floor to the underside of the concrete slab or grating at top of hoistway with a maximum deviation of 3 mm (1/8-inch) from plumb in all directions. Provide a minimum of 19 mm (3/4-inch) clearance between bottom of rails and top of pit channels.
5. Guide rail anchorages in pit shall be made in a manner that will not reduce the effectiveness of the pit waterproofing.
6. Where concrete beams or concrete walls are indicated for supports of guide rail brackets, fastenings shall be made with suitable concrete inserts or self-drilling shell bolt anchors. Where steel framing is provided, the brackets shall be fastened directly to the steel, either by bolts, nuts and lock washers or by welding.
7. If used, self-drilling bolt anchors shall be furnished and installed in accordance with FF-S-325, Group III, Type 1. Except that in lieu of holding requirements with proof-test loads given in Table T, the safe working loads shall be based on a safety factor of 4:1.
8. Guide rails shall be clean and free of any signs of rust or abrasions before final inspection.
9. Shims used in aligning rails shall be inserted in such a manner that if the bolts become loose, the shims shall not fall out.
10. Provide backing if necessary to meet code.

2.15 GUIDE SHOES

The guide shoes shall be adjustable renewable dry type made from nylon or other approved non-metallic material for quiet operation.

2.16 CAR BUFFERS

Provide spring buffer for car and one spring buffer for counterweight. Buffers shall be in accordance with the ASME A17.1. Permanently fasten to each buffer a metal plate showing stroke and load rating. Buffer anchorage shall not puncture pit waterproofing.

2.17 HOISTING ROPES

A. Provide dumbwaiter with hoisting ropes sufficient in size to provide at least the required factor of safety in accordance with ASME A17.1. Ropes shall be special traction steel, non-preformed, conforming to Fed. Spec. RR-W-410 with minimum nominal diameter of one quarter inch.
1. Ends of hoistway rope shall be turned back and socketed or fastened with U-bolt clamps so that shackle rod assemblies will permit tension in ropes to be readily equalized. For non-preformed rope, 3 sizings shall be provided at each side of cut in the rope.

2. Where hoisting ropes pass around sheaves on car and counterweight, provide suitable guard on each sheave to prevent the ropes from jumping out of grooves in case of an accident, and to prevent injury to maintenance personnel working near sheaves.

3. Hoisting Rope Data Tags: Attach metal data tag to one hoisting rope fastening to the dumbwaiter. Tag shall bear data as required by ASME A17.1.

B. For dumbwaiters terminating above an occupied space, provide a broken rope safety device on car, and counterweight which will prevent the car and counterweight from falling if the ropes should break. Provide a switch on safety which will stop the machine when the safety is in operation.

2.18 TERMINAL STOPS
A. Provide terminal stopping devices for dumbwaiter as follows:
   1. Mount normal stopping switch on dumbwaiter or in hoistway to slow speed of car and bring it to automatic stop at terminal landings. Device shall permit operation of car in reverse direction.
   B. Mount final limit switches at top and bottom of hoistway which will be operated by car if it travels beyond terminal stops. Switches shall be independent of other stopping devices, positively operated, cut off power from hoisting motor and brake and prevent operation of car in either direction. Pin all final limits and brackets to prevent movement.

2.19 CAR LEVELING
A. Provide dumbwaiter with leveling devices that will automatically stop and maintain the car in position within 6 mm (1/4-inch) level of each floor of which the dumbwaiter has been dispatched.
B. Leveling device, within its zone, shall be independent of operating device.
C. Leveling device, functioning through vacuum tubes or photo-electric tubes is not acceptable.

2.20 STOP SWITCH
Provide in pit of dumbwaiter, an enclosed stop switch readily accessible from pit access door. Each switch shall be manually opened and closed with red operating handles or buttons conspicuously and permanently marked "STOP". Switches shall be positively opened mechanically and opening shall not be solely independent on springs.

2.21 OPERATING STATIONS AND CONTROL PANEL
A. Operating stations and control panels shall be flush mounted, stainless steel:
   1. Bevel all faceplates on side, top and bottom edges with a 15-degree bevel.
   2. Fasten all faceplates with non-corrosive spanner head or bristol head white metal tamperproof screws.
3. Operating pushbuttons in faceplates shall be designed so that pressure on contacts shall be independent of pressure on operating pushbutton.

4. Each switch and operating device shall have indelible 1/4-inch high legends to indicate its identity and position.

B. Provide at each floor served by dumbwaiter a complete set of operating pushbuttons with 13mm (1/2-inch) numbers in the face of the button corresponding to the floors served. Pushbuttons shall not protrude beyond the faceplates when in normal position. Call registered lights located within or behind the buttons shall illuminate the floor numeral corresponding to the call registered. Also provide an "In Use" light in this panel to show when dumbwaiter is in operation or that a door is open.

2.22 CALL-AND-SEND OPERATION FOR DUMBWAITERS

System shall permit car to be dispatched or called at any floor. Car shall be dispatched from landing by manually closing hoistway door and pressing button at that landing corresponding to floor to be served. Car door shall close automatically and car shall start automatically and proceed to destination, provided interlocked circuits have been established. Car shall be called to such landing by pressing button at floor to be served. Car door shall close automatically provided hoistway door at landing where car is standing has been closed. Car shall start automatically, provided interlock circuits have been established and shall proceed to destination. Car door shall open automatically after car has stopped at landing. Landing pushbuttons shall be ineffective during travel of car through hoistway and for sufficient time after car has stopped to allow automatic opening of car door and manual hoistway door.

2.23 SIGNAL LANTERNS

Provide a lantern over each landing entrance, or near each entrance where directed, except at central station landing. The hall lantern fixture shall be of stainless steel with glass or plastic lens. Lens shall be illuminated from rear by a lamp of proper intensity shielded to illuminate lens only. Lanterns shall be connected to signal in advance of approach of dumbwaiter at a landing. Lantern shall be extinguished when the car leaves the landing. Each lantern shall contain a single stroke chime so connected that when dumbwaiter arrives at a landing, the chime shall sound momentarily.

2.24 HOISTWAY ENTRANCES

A. Each entrance shall be required size with door of the bi-parting vertical sliding type.

1. Frame shall be not less than No. 16-gauge stainless steel, coated inside, with 4.8 mm (3/16-inch) thick sound isolation mastic compound assembled at corners and secured with smoothly dressed welded joints. Truckable sill shall be rigidly anchored and not less than No. 12-gauge stainless steel and shall be set true, straight and level, with hoistway edges plumb over each other. Reinforce sill with two steel angles full length. Sill shall be grouted full length after installation.
2. Door guides shall be non-corrosive metal. Weight and method of fastening to frames and hoistway-wall, above and below, shall conform to standard practice of dumbwaiter manufacturer. Provide gibs, struts from floor-to-floor chains, and steel sheaves with sealed ball or roller bearings. Provide guides and stops for door travel.

3. Door panels shall be flush hollow metal construction and bear a 1-1/2 hour Underwriters' "B" label, according to NFPA 252, one inch thick, of not less than No. 16-gauge stainless steel on both sides. Panels shall be reinforced. Interior of panels shall be filled with fireproof material. Upper door section shall be fitted with a neoprene non-movable minimum diameter one-inch door astragal. A hand pull shall be secured to the upper door section.

4. The top section of the door panel shall be equipped with a glass vision panel of 6 mm (1/4-inch) thick wire glass not less than 76 mm (3-inches) or more than 100 mm (4-inches) in diameter.

2.25 ELECTRIC INTERLOCK
Hoistway doors shall be equipped with true electric interlocks of design that dumbwaiter shall be inoperative if any door is open, and door cannot be opened except at landing at which car has stopped. Mechanism shall be so arranged so door is securely locked before electric contact is made. Mount retiring cam on car to operate locks. Interlock will not be accepted unless it has successfully met requirements of ASME A17.1.

2.26 CAR SLING
Construct car frames of structural shapes, ASTM A36, rigidly bolted and welded together of adequate strength to support car with rated load and to conform to ASME A17.1.

2.27 CAR ENCLOSURE
A. Car shall be constructed of a minimum No. 14 gauge stainless steel except car bottom shall be a minimum No. 10 gauge stainless steel. The car is to be formed with smooth returned edges at the entrances, welded or bolted and rigidly braced. Construction shall conform to ASME A17.1. Car bottom of car enclosure, car doors and door guides shall be arranged and reinforced to withstand the impacts and concentrated loads which will result from loading. Provide car with one removable center shelf of No. 16-gauge stainless steel.

1. The dumbwaiter car shall be provided with automatically power operated vertical sliding car doors.

2. Provide flush car light fixture with lamp recessed in top of car ceiling. Light shall be connected to illuminate automatically when car arrives at landing and hoistway door is opened, and shall automatically extinguish when hoistway door is closed.

3. Provide metal nameplate in car showing name of manufacturer as required by ASME A17.1, rated load in pounds, in stamped, etched or raised letters and numerals.
B. A service demand bell with a 76 mm (3-inch) diameter gong shall be provided on the dumbwaiter car. Bell shall be arranged to sound when a pushbutton is pressed while the car is standing at a floor with the door open. Bell shall be connected to a bell ringing transformer of proper capacity. Transformer shall be connected through fuses to the elevator power service in machine room.

C. Dumbwaiter Cabs:
   1. Interior and exterior steel surfaces shall be parkerized or given equivalent rust resistant treatment before finish is applied.
   2. Exterior faces of car doors shall be given one finish coat of oil base paint of medium gray color.

D. Surfaces of door frames, door panels, interior cab surfaces, etc., that become damaged or marred from any cause shall be restored to original condition in a satisfactory manner before final acceptance of work.

PART 3 EXECUTION

3.1 PREPARATION

A. Examine work of other trades on which the work of this Section depends. Report defects to Resident Engineer in writing which may affect the work of this trade or equipment operation dimensions from site for preparation of shop drawings.

B. Ensure that shafts and openings for moving equipment are plumb, level and in line, and that pit is to proper depth, waterproofed and drained with necessary access doors.

C. Before fabrication, take necessary job site measurements, and verify where work is governed by other trades. Check measurement of space for equipment, and means of access for installation and operation. Obtain dimensions from site for preparation of shop drawings.

D. Ensure the following preparatory work, provided under other Sections, has been proper.
   1. Supply of electric feeder wires to the terminals of the dumbwaiter control panel, including circuit breaker. Provision of hoistway outlets for car light and for light in the pit and outlets in machine room for light furnishing of electric power for testing and adjusting dumbwaiter equipment.
   2. Machine space enclosed and protected from moisture, with self closing, self locking door.

E. Supply for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.

3.2 INSTALLATION

A. Perform work with competent mechanics skilled in this work and under the direct supervision of the elevator contractor's experienced foreman.

B. Set hoistway entrances in alignment with car openings, and true with plumb sill lines.

C. Install machinery, guides, controls, car and all equipment and accessories in accordance with manufacturer's instructions, applicable codes and standards, to provide a quiet, smooth operating installation, free from side sway, oscillation or vibration.
D. Isolate and dampen machine vibration with properly sized sound-reducing anti-vibration pads.

3.3 CLEANING

Prior to final acceptance, remove protection from finished or ornamental surfaces, and clean and polish surfaces with regard to type of material.

3.4 SPACE CONDITIONS

Attention is called to overhead clearance, pit clearances, overall space in hoistway, and construction conditions at building site in connection with dumbwaiter work. Addition or revision of space requirements, or construction changes that may be required for the complete installation of the dumbwaiters, must be arranged for and obtained by the Contractor, subject to approval of Contracting Officer. Include cost of such changes in bid, and form a part of the contract. Provide proper, satisfactory code legal installation of equipment as a whole, including all construction, accessories and devices in connecting with elevator, mechanical and electrical work specified herein.

3.5 ARRANGEMENT OF EQUIPMENT

Clearance around dumbwaiter, mechanical and electrical equipment shall comply with applicable provisions of NEC. Arrange equipment in machine room so that major equipment components can be removed for repair or replacement without dismantling or removing other equipment in the area.

3.6 WORKMANSHIP AND PROTECTION

A. All installation shall be made in a first class, neat and skillful manner by mechanics experienced in the trade involved. All details of the installation shall be mechanically and electrically correct. All materials and equipment shall be new and without imperfections.

B. Recesses, cutouts, slots, holes, patching, grouting, refinishing and the like to accommodate installation of equipment shall be included in the contractor's work. All new holes in concrete shall be core drilled.

C. No structural members shall be cut or altered. Work in place which is damaged or defaced shall be restored equal to original condition.

D. Finished work shall be straight, level and plumb, with true, sharp surfaces and lines. All machinery and equipment shall be protected against dirt, water or mechanical injury. At final completion, all work shall be thoroughly cleaned and delivered in perfect unblemished condition.

E. Grease gun fittings shall be pressure relief type.

F. Exposed gears, sprockets, drum machines, etc., shall be guarded from accidental contact in accordance with ASME A17.1.

3.7 PRE-TESTS AND TESTS

A. Pretest, as per specifications the dumbwaiters and related equipment, in the presence of the Resident Engineer for proper operation before requesting final inspection.

1. Tests shall be conducted in the presence of and witnessed by a certified elevator inspector.
2. Government shall furnish electric power including necessary current for starting, testing, and operating machinery of each dumbwaiter.

C. If required by the Department of Veterans Affairs Resident Engineer, inspection shall be conducted at other than normal working hours.

1. Contractor shall furnish the following test instruments and materials on-site and at the designated time of inspection: Properly marked testing weights, voltmeter, amp probe, thermometers, stop watch, direct reading tachometer, and a means of two-way communication.
2. If during the inspection process the Department of Veterans Affairs representative determines the need, the following instruments should be available within a four (4) hour period: Megohm meter, vibration meter, sound meter and a light meter.

D. Inspection shall be made of workmanship and equipment furnished and installed for compliance with specification.

E. Speed Test: The actual speed of the dumbwaiter shall be determined in both directions of travel with full contract load and no load in the elevator. Speed test shall be made before the full load run test and after the full load run test. Speed shall be determined by applying a tachometer to the car hoisting ropes. The actual measured speed of the elevator with all loads in either direction shall be within 10% of specified rated speed:

1. Full speed runs shall be quiet and free from vibration and sway. When cars are standing at the floor with doors open, they shall remain fully stopped with hoisting machine brake applied.

F. Car Leveling Test:

1. Elevator car leveling devices shall be tested for accuracy of leveling at all floors with no load in car and with contract load in car, in both directions of travel. Accuracy of floor leveling shall be within plus or minus 6 mm (1/4-inch) of level with any landing floor for which the stop has been initiated (with a definite range of distance in advance of the landing) regardless of load in car or direction of travel. The car leveling device shall automatically correct over travel as well as under travel and shall maintain the car floor within plus or minus 6 mm (1/4-inch) of level with the landing floor regardless of change in load.

G. Brake Test: The action of the brake shall be prompt and a smooth stop shall result in down direction with no load up to and including 100 percent of contract load in the car. Up travel not required.

H. Operating and Signal System: The elevator shall be operated by the operating devices provided and the operation signals and automatic floor leveling shall function in accordance with requirements specified. Starting, stopping and leveling shall be smooth and comfortable without appreciable steps of acceleration and deceleration. Stopping shall be without bumps or jars.
I. If any equipment fails test requirements and a reinspection is required, the Contractor shall be responsible for cost of reinspection, including salaries, transportation expenses, and other expenses incurred by the representatives of the Contracting Officer.

3.8 PAINTING AND FINISHING

A. Machine, Controller, Structural, Etc.:
   1. Dumbwaiter machine, motors, controllers and the like shall be factory painted with manufacturer's standard finish and color.
   2. Numbers 51 mm (2-inches) high designating dumbwaiter machine, controllers, selectors and numbers on crossheads of dumbwaiter shall be painted or otherwise applied as required by ASME A17.1. Colors of numbers shall contrast with colors of surfaces to which they are applied.
   3. Surfaces (except contact surfaces of working parts) of dumbwaiter items, such as controllers, car frames, underside of car guide rails, rail brackets and surfaces of conduits, outlet boxes and junction boxes, shall be given approved prime coat, body coat and finish coat of machine enamel.

B. Hoistway Entrances of Dumbwaiters:
   1. Exposed metal parts on hoistway side of entrances shall be given one field coat of oil base paint of medium gray.
   2. Metal work, including built-in or hidden work and structural metal (except stainless steel entrance frames and surfaces to receive baked enamel finish) shall be given approved prime coat in shop and one field coat of oil base medium gray paint.

C. Hoist machines, motors, and the like shall be factory painted with manufacturer's standard finish and color.
   1. Controllers, selectors, sheaves, car frames and platforms, beams, rails and buffers, except their machined surfaces, door operators, cams, brackets and all other uncoated ferrous metal items shall be painted not less than one approved factory prime coat.
   2. Upon completion of installation, and prior to final inspection, all equipment shall be thoroughly cleaned of grease, oil, cement, plaster, and other debris. All equipment, except that otherwise specified as to architectural finish, shall then be given two coats of paint of approved color.

3.9 INSTRUCTION OF PERSONNEL

A. Provide competent instructions to train VA personnel in maintenance and operation of the equipment and accessories installed under this contract for a period of not less than (4) four hours. Instruction shall commence after completion of all work and at such time as directed by the Resident Engineer.
B. In addition to oral instruction, furnish and deliver written instructions in triplicate relative to care and operation of all equipment and accessories to the Resident Engineer in independently bound folders. Written instructions shall include correct and legible wiring diagrams, nomenclature sheet of all electrical apparatus including location of each device, complete and comprehensive sequence of operation, complete replacement parts list with descriptive literature and identification and diagrammatic cuts of equipment and parts. Information shall also include electrical operation characteristics of all circuits, fields, relays, timers, regulators, and electronic devices, as well as RPM values and related characteristics for all rotating equipment.

C. Provide any supplementary instruction for care of new equipment that may become necessary because of changes, modifications or replacement of equipment or operation under requirements of paragraph entitled "WARRANTY".

3.10 INSPECTIONS AND MAINTENANCE

A. Furnish complete maintenance and inspection service on entire dumbwaiter installation for a period of 52 weeks after completion and acceptance of the dumbwaiter installation by the Resident Engineer. This maintenance service shall begin concurrently with the one year warranty. Maintenance work shall be performed by skilled dumbwaiter personnel directly employed by the same company that installed the dumbwaiter equipment specified herein.

B. The maintenance service shall include the following:

1. Monthly systematic examination of equipment.
2. Furnishing all lubricants, cleaning materials and parts required.
3. Cleaning, lubricating, adjusting, repairing and replacing of all parts as necessary to keep the equipment in first-class condition and proper working order.
4. Equalizing tension, shortening or removing of hoisting ropes where necessary.
5. Maintain the operational system to the standards specified hereinafter including any changes or adjustments required to meet varying conditions of hospital occupancy.
6. Maintain smooth starting and stopping and accurate leveling at all times.

C. Maintenance service shall not include the performance of any work required as a result of improper use, accidents or negligence for which the contractor is not directly responsible.

D. Service and emergency personnel shall report to the Resident Engineer or his authorized representative upon arrival at the hospital and again upon completion of the required work. A copy of the work ticket containing a complete description of the work performed shall be given to the Resident Engineer.

E. The contractor shall maintain a log in the door panel of the controller. The log shall list the date and time of all monthly examinations and all trouble calls. Fully describe each trouble call, including the nature of the call, necessary correction performed or parts replaced.

END OF SECTION
PART 1 GENERAL

1.1 DESCRIPTION

This section specifies the engineering, furnishing and installation of electric (geared traction) dumbwaiters, consisting of AC Variable Voltage, Variable Frequency control, call-send operation, signal system, car leveling device, and power operated car and hoistway doors and manual hoistway doors.

1.2 QUALITY CONTROL

A. Approval by the Contracting Officer is required of products or services of proposed manufacturer, suppliers and installers, and will be based upon submission by Contractor of certification that:

1. Manufacturer regularly and presently manufactures dumbwaiter equipment as one of his principal products.

2. Installer has technical qualifications of at least three years experience, trained supervisory and installation personnel, and facilities to install specified items. Approval will not be given, however, where the experience record on either government, municipal, or commercial projects is one of unsatisfactory performance.

3. Manufacturer's product submitted has been in satisfactory and efficient operation on three installations similar to this project for not less than three years. Submit list of installations: include names and addresses of the Medical Center and Medical Center Administrators thereof.

4. There is a permanent service organization maintained or trained by manufacturer which will render satisfactory service to this installation within two hours or receipt of notification that service is needed. Submit name and address of service organization.

1.3 APPLICABLE PUBLICATIONS
A. The publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.

B. Federal Specifications (Fed. Spec.):

- FF-S-325 .................................... Shield, Expansion; Nail, Expansion; And
- INT AMD 3 ................................. Nail, Drive Screw (Devices, Anchoring, Masonry)
- J-C-30B(1).................................. Cable And Wire, Electrical (Power, Fixed Installation)
- J-C-580B(1)................................ Cord, Electrical And Wire, Electrical (0-to 600-Volt Service)
- QQ-S-698 .................................. Steel Sheet And Strip, Low Carbon
- QQ-S-766D .................................. Steel, Stainless And Heat Resisting, Alloys, Plate, Sheet And Strip
- RR-W-410D .................................. Wire Rope And Strand
- TT-E-489H ................................. Enamel, Alkyd, Gloss, Low Voc Content
- W-S-610E .................................. Splice Connectors

C. American Society for Testing and Materials (ASTM):

- Section 01 2001-2002 .................. Iron and Steel Products

D. American Society of Mechanical Engineers (ASME):

- A17.2-2001 ................................. Inspectors Manual for Electric Elevators

E. National Fire Protection Association (NFPA):

- 70-2002 or current code National Electrical Code (NEC)
- 252-2003 ................................. Fire Tests of Door Assemblies

F. Underwriters Laboratories, Inc. (UL):


G. National Electrical Manufacturers Association (NEMA)

H. Institute of Electrical and Electronic Engineers (IEEE)

I. Gauges:

- Sheet and Plates - U.S. Standard
Wire - American Wire Gauge (AWG)

1.4 SUBMITTALS

A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.

B. Before executing any work, furnish information sufficient to fully comply with contract requirements of proposed items. Such information shall include, as required, Manufacturer's Name, Trade Names, Model or Catalog Number, Nameplate Data (size, capacity, rating), and corresponding specification reference (Federal or project specification number and paragraph).

2. Samples:

a. One of stainless steel, .51 mm x 1.2 mm (2 inches x 4 inches).

b. Do not submit other samples of materials specified unless specifically requested after submission of manufacturer's name. In case such samples are furnished pursuant to request, adjustments in contract price and time will be made as provided in Clause 3. General Provisions, (Construction Contract) Standard Form 23A.

C. Shop Drawings:

1. Complete dimensioned layout of dumbwaiter in plan and elevation, showing the machine, controller, car, car sling, sheaves, supporting beams, guide rails, buffers, reactions at points of support, weights of principal parts, top and bottom clearances, overtravel of the car, number and size of hoisting ropes.

2. Complete drawings of car showing details of construction and location of all car equipment.

3. Cuts or drawings showing details of signal and car equipment.

4. Cuts or drawings showing details of guide shoes.

5. Cuts or drawings and description of power car/and hoistway doors/door operation.

D. Materials Data:
Submit the name of manufacturer and type or style designation of the following for approval:
1. Controllers

2. Hoistway doors

3. H.P. and R.P.M. of hoist motor

4. Electric power door operator

5. Hoistway door interlocks and electric contacts

6. Certified maximum loads and striking speed of car buffers

7. Ultimate breaking strength and allowable working load of hoisting ropes.

1.5 WIRING DIAGRAMS

A. Provide three complete sets of field wiring and straight line wiring diagrams showing all electrical circuits in the hoistway, as well as the machine room. In the event field modifications are found necessary during installation, diagrams shall be revised to include all corrections made prior to and during the final inspection. Corrected diagrams shall be delivered to the Resident Engineer within 30 days of final acceptance.

B. Provide the following information relating to the specific type of microprocessor controls installed:

1. Owner's information manual, containing general data on major components, maintenance, and adjustment.

2. Complete wiring diagrams needed for field troubleshooting, adjustment, repair and/or replacement of components. Diagrams shall be base diagrams, containing all changes and additions made to the equipment during the design and construction period.

3. Changes made during the warranty period shall be noted on the drawings in adequate time to have the finalized drawings reproduced for mounting in the machine room no later than six months prior to the expiration of the warranty period.

1.6 ADDITIONAL EQUIPMENT
Additional equipment required to operate specified equipment manufactured and proposed for this installation shall be furnished and installed. The cost of such equipment shall be included in the base bid.

1.7 PERFORMANCE STANDARDS

A. The dumbwaiters shall be capable of meeting the highest standards of the industry and specifically the following: Contract speed shall mean speed in the UP direction with full capacity load in the car. Speed variation under any load condition, regardless of direction, shall be no more than ten (10) percent.

B. Floor Accuracy: Accuracy shall be maximum 6 mm (1/4 inch) above or below the floor, regardless of load condition.

1.8 WARRANTY

A. Subject all labor and materials furnished in connection with dumbwaiter system to terms of "Warranty of Construction" articles of Section 01001, "GENERAL CONDITIONS", except that warranty period shall concur with length of maintenance contract. Warranty shall commence upon final inspection and completion of performance test and upon full acceptance of the installation.

B. If it becomes evident during the warranty period that the devices are not functioning properly or in accordance with specification requirements, or, if in the opinion of the Contracting Officer, excessive maintenance and attention must be employed to keep device operating, remove device and install new device meeting all requirements as part of work until satisfactory operation of installation is obtained. Period of warranty shall start anew from date of completion of new installation performed in accordance with foregoing requirements.

PART 2 PRODUCTS

2.1 MANUFACTURED PRODUCTS

A. Materials, devices and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items. Items not meeting this requirement but meet technical specifications, and the merits of which can be established through reliable test reports or physical examination of representative samples will be considered.
B. When two or more units of same class of materials, services, devices or equipment are required, these units shall be products of one manufacturer.

C. Manufacturers of equipment assemblies which include components made by others shall assume complete responsibility for the final assembled unit.

1. All components of an assembled unit shall be products of same manufacturer.

2. Parts which are alike shall be the product of a single manufacturer.

3. Components shall be compatible with each other and with the total assembly for the intended service.

D. Welding at the project site shall be made by welders and welding operators who have previously qualified and been certified by test as prescribed in American Welding Society Publication AWS D1.1 to perform the type of work required.

E. Motor nameplates shall state manufacturer's name, rated horsepower, speed, volts, amperes and other characteristics required by NEMA standards, and be securely attached to the item of equipment in a conspicuous location.

F. Where key-operated switches or key-operated cylinder locks are furnished in conjunction with any component of this dumbwaiter installation, furnish 4 keys for each individual switch or lock. Attach each key to a tag bearing a stamped or etched legend identifying its purpose. Tags shall be engraved. Imprint "Property of U.S. Government" on reverse side of tag. Barrel keys are not acceptable.

2.2 MATERIALS

A. Where stainless steel is specified, it shall be corrosion resisting steel complying with QQ-S-766, Class 302 or 304, Condition A with Number 4 finish (150 grit) on exposed surfaces. Stainless steel shall have the grain of belting in the direction of the longest dimension and all surfaces shall be perfectly smooth and without waves. During erection, all stainless steel surfaces shall be protected by suitable material.
B. Where cold rolled steel is specified, it shall be low-carbon steel rolled to stretcher leveled standard finishes, complying with QQ-S-698.

2.3 CAPACITY, SPEED, TRAVEL

A. Each dumbwaiter shall have the capacity to lift the rated load at rated speed exclusive of the weight of entire car and cable, all as specified in the following schedule:

<table>
<thead>
<tr>
<th>DUMBWAITER SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dumbwaiter Number</td>
</tr>
<tr>
<td>Overall Car Size</td>
</tr>
<tr>
<td>Rated Load - kg(pounds)</td>
</tr>
<tr>
<td>Rated Speed - m/s(fpm)</td>
</tr>
<tr>
<td>Total Travel - m/s(fpm)</td>
</tr>
<tr>
<td>Floor Designations</td>
</tr>
<tr>
<td>Number of Stops</td>
</tr>
<tr>
<td>Number of Openings</td>
</tr>
<tr>
<td>Car Gate Size and Type</td>
</tr>
</tbody>
</table>

B. Actual dumbwaiter speed shall not vary more than 10% above, nor more than 10% below specified speed.

2.4 POWER SUPPLY

A. For power supply in each machine room see Section, "ELECTRICAL CIRCUITS (GENERAL)" and drawings. It shall be the electrical contractor's responsibility to supply the labor and materials for the installation of the following (1) a feeder from the power source indicated on the drawing to each dumbwaiter controller, (2) a fused disconnect or shunt trip circuit breaker for each controller, (3) power wiring between the fused disconnect or shunt trip circuit breaker and the controller and, (4) power circuits for dumbwaiter signal and control systems as indicated on the drawings from the indicated source to each dumbwaiter controller. The dumbwaiter controller, motor, power, and signal wiring from the controller to the machine shall be supplied and installed by the Dumbwaiter Contractor.

2.5 GROUNDING
A. Provide equipment grounding. Ground conductors, supports, controller enclosure, motors, platform and car frames, and other non-current conducting metal enclosures for electrical equipment in accordance with NEC. The ground wires shall be copper, insulated and sized as required by NEC. Bond the grounding wires to each of the pull boxes, junction boxes, cabinets and other enclosures through which the wires pass.

2.6 CONDUIT

A. Unless otherwise specified or approved, install all electrical conductors, except traveling cable connections to the dumbwaiter, in rigid zinc-coated steel / aluminum conduit/ electrical metallic tubing/ metal wireways/. All raceways completely embedded in concrete slabs, walls or floor fill shall be rigid steel conduit. No rigid conduit or electrical metallic tubing shall be smaller than 3/4-inch electrical trade size. However, where permitted by NEC, 1/2-inch trade size conduit and electrical metallic tubing may be used only for tap connections. An auxiliary gutter may be used between controller, starter and similar apparatus in the dumbwaiter machine room. Fully protect self-supporting connections, where approved, from abrasion or other mechanical injury. Flexible metal conduit of not less than 3/8-inch trade size may be used, not exceeding 18-inches in length for short connections between risers and limit switches, interlocks and for the applications permitted by the NEC.

B. All conduits terminating in steel cabinets, junction boxes, wireways, switch boxes, outlet boxes and similar locations shall have approved insulating bushings. If the bushings are constructed completely of insulating materials, install a steel lock nut under the bushing. At ends of conduits not terminating in steel cabinets or boxes, protect the conductors with terminal fittings having an insulated opening for the conductors.

C. Conduit and EMT fittings and connections using set screws for indentations as a means of attachment shall not be used.

D. Provide terminal boxes for the flexible conduit and wiring connections to the hoisting motor.

E. Connect motors and other equipment subject to movement, vibration or removal to the conduit or EMT systems with flexible steel conduit.

2.7 CONDUCTORS
A. Unless otherwise specified, conductors, exclusive of traveling cables, shall be stranded or solid coated annealed copper in accordance with J-C-30 for either type RMW or THW. Where 16 and 18 AWG are permitted by NEC, either single conductor cable in accordance with J-C-580 for Type TF, or multiple conductor cable, may be used provided the insulation of single conductor cable and outer jacket of multiple conductor cable is flame retardant and moisture resistant. Multiple conductor cable shall have color coding or other suitable identification for each conductor. Conductors for control board wiring, including wiring between main circuit resistors and control boards, shall be in accordance with NEC. No joints or splices will be permitted in wiring except at outlets. Tap connectors may be used in wireways provided they meet all UL requirements.

B. All wiring must test free from short circuits or ground. Insulation resistance between external conductors and between conductors and ground shall be not less than one megohm.

C. Where size of conductors is not given, capacity shall be such that maximum current shall not exceed limits prescribed by NEC.

2.8 TRAVELING CABLES

A. Traveling cables from junction box on dumbwaiter to junction box in hoistway or to controller shall consist of flexible traveling cables conforming with requirements of NEC. Equip junction boxes in hoistway and on dumbwaiter with terminal blocks. All connections to terminal blocks shall be made with either terminal eyelet connections or pressure wire connectors of the clamp type that meet UL 486 requirements for stranded wire. Terminal blocks shall have permanent indelible identifying numbers for each connection. Cables shall be anchored to avoid strain on individual terminal connections. Flame and moisture resistant outer covering must remain intact between junction boxes and abrupt bending or twisting producing distortion of cable will not be allowed. Cables shall be free from any possible contact with hoistway structure, dumbwaiter or other equipment. Where necessary, provide suitable shields or pads to protect the cables.

B. Provide 10 percent but not less than 4 spare conductors in each traveling cable.

2.9 CONTROLLERS

A. UL/CSA labeled controller: Compartment: Securely mount all assemblies, power supplies, chassis switches, relays, etc., on a substantial, self-supporting steel frame. Completely enclose equipment and provide means to prevent overheating.
B. Relay Design: Magnet operated with contacts of design and material to insure maximum conductivity, long life and reliable operation without overheating or excessive wear. Provide wiping action and means to prevent sticking due to fusion. Contacts carrying high inductive currents shall be provided with arc defectors or suppressors.

C. Identify each device on panels by name, letter or standard symbol, which shall be neatly stencil painted (or otherwise marked) in an approved indelible and legible manner. Coordinate identification markings with identical markings on wiring diagrams. Mark the proper ampere rating adjacent to each fuse holder.

D. Provide 3 overload relays, one in each power line. Test overload device at final inspection.

2.10 CONTROL SYSTEM

A. Dumbwaiters shall have AC drive control and motor control, suitable for the operation specified and capable of providing smooth, comfortable acceleration, retardation and dynamic braking, limiting the difference in speed between full load and no load to not more than 10% of the contract speed.

2.11 GEARED MACHINES

A. The geared traction machines for Dumbwaiters shall be of the single worm and gear, single-wrap traction type, with motor, spring applied and electrically released brake, sheave, pedestal mounted in proper alignment on a sound isolated steel plate. Mount machine in top or bottom of hoistway.

B. Hoisting motor of geared traction machines with alternating current control shall be designed to meet the required high-starting torque with low-starting current. Rate the motor for 50 degrees C. rise, 60-minute rated motors and have sufficient capacity to operate dumbwaiter with rated load at rated speed without overheating.

C. The hoisting machine brake shall be the //drum brake type// //disk brake type//, with the capacity to stop and hold down a traveling dumbwaiter with 125 percent of rated load.
D. Furnish vibration isolating machine foundation for machines mounted over the hoistway. Isolation foundation shall effectively prevent the transmission of machine vibration and sound to the building structure. Location and deflection characteristics of the isolation units shall be such as to produce approximately uniform and non-excessive loading on the units under all operating conditions. The foundation shall incorporate positive means to prevent lateral displacement in any direction of the machine.

2.12 SHEAVES

A. Overhead sheaves shall be securely mounted on overhead beams in proper alignment with the traction sheave, two-to-one idler sheaves in counterweight head frame or car crosshead respectively.

B. Deflector sheave bearings shall be the same as specified for hoisting machine, except that sheave bearings of the anti-friction bearing metal type with grease cup lubrication may be used for deflector sheaves and overhead sheaves used with machine mounted below, and two-to-one car and counterweight idler sheaves.

C. Overhead deflector sheaves shall be provided with a substantial metal basket type guard mounted below the sheave. Guard shall be securely fastened to sheave beams.

D. Provide two-to-one idler sheaves on car and counterweight with a suitable metal guard which will effectively prevent foreign objects falling between ropes and sheave grooves, prevent ropes jumping off grooves in case of accident, and prevent accidental fouling by, or injury to workmen on top of the car.

2.13 DUMBWAITER MACHINE BEAMS

A. Machine beams, shall be in accordance with applicable requirements of ASME A17.1. Furnish and install necessary structural steel beams or other steel members required for support of dumbwaiter machine, sheaves, rope hitches, buffers and other dumbwaiter equipment shall be furnished and installed. Bearing plates and anchors shall be provided as required to mount beams securely in place.

2.14 GUIDE RAILS
A. Car and counterweight guide rails shall be of planed steel or cold rolled, 12 kg/m (8 lb./ft.) “T” Rails conforming in all respects with ASME A17.1. There shall be a guide rail at each side of the car. Guide rails shall be securely fastened to the brackets or other supports.

1. Support guide rails at each floor and provide intermediate brackets and support where fastenings are over 2440 mm (8 feet) apart.

2. Ends of guide rails shall form matched joints fitted with fish plates. Each fish plate bolt shall be fitted with a split spring steel lock washer.

3. Guide rails shall extend from channels on pit floor to the underside of the concrete slab or grating at top of hoistway with a maximum deviation of 3 mm (1/8-inch) from plumb in all directions. Provide a minimum of 19 mm (3/4-inch) clearance between bottom of rails and top of pit channels.

4. Guide rail anchorages in pit shall be made in a manner that will not reduce the effectiveness of the pit waterproofing.

5. Where concrete beams or concrete walls are indicated for supports of guide rail brackets, fastening shall be made with suitable concrete inserts or self-drilling shell bolt anchors. Where steel framing is provided, the brackets shall be fastened directly to the steel, either by bolts, nuts and lock washers or by welding.

6. If used, self-drilling bolt anchors shall be furnished and installed in accordance with FF-S-325, Group III, Type 1. except that in lieu of holding requirements with proof-test loads given in Table T, the safe working loads shall be based on a safety factor of 4:1.

7. Guide rails shall be clean and free of any signs of rust or abrasions before final inspection.

8. Shims used in aligning rails shall be inserted in such a manner that if the bolts become loose, the shims shall not fall out.

9. Provide backing if necessary to meet code.

2.15 COUNTERWEIGHTS
A. Provide a counterweight for the dumbwaiter equal to approximately the weight of the complete car and 40 percent of the specified rated load. Middleweights shall be sectional cast iron or steel plates securely held together by structural steel frame.

B. Tie rods shall pass through holes in each middleweight and through holes in frame members above and below sub weights in such a manner as to securely hold middleweights in place.

2.16 CAR AND COUNTERWEIGHT GUIDE SHOES

A. The guide shoes shall be adjustable renewable dry type made from nylon or other approved non-metallic material for quiet operation.

2.17 CAR AND COUNTERWEIGHT BUFFERS

A. Provide spring buffer for car and one spring buffer for counterweight. Buffers shall be in accordance with the ASME A17.1. Permanently fasten to each buffer a metal plate showing stroke and load rating. Buffer anchorage shall not puncture pit waterproofing.

2.18 HOISTING ROPES

A. Provide dumbwaiter with hoisting ropes sufficient in size to provide at least the required factor of safety in accordance with ASME A17.1. Ropes shall be special traction steel, non-preformed, conforming to Fed. Spec. RR-W-410 with minimum nominal diameter of one quarter inch.

1. Ends of hoistway rope shall be turned back and socketed //in individual shackle rods// //wedge type shackles// assemblies that will permit tension in ropes to be readily equalized. For non-preformed rope, 3 sizings shall be provided at each side of cut in the rope.

2. Where hoisting ropes pass around sheaves on car and counterweight, provide suitable guard on each sheave to prevent the ropes from jumping out of grooves in case of an accident, and to prevent injury to maintenance personnel working near sheaves.

3. Hoisting Rope Data Tags: Attach metal data tag to one hoisting rope fastening to the dumbwaiter. Tag shall bear data as required by ASME A17.1.
B. For dumbwaiters terminating above an occupied space, provide a broken rope safety device on car, and counterweight which will prevent the car and counterweight from falling if the ropes should break. Provide a switch on safety which will stop the machine when the safety is in operation.

2.19 TERMINAL STOPS

A. Provide terminal stopping devices for dumbwaiter as follows:

1. Mount normal stopping switch on dumbwaiter or in hoistway to slow speed of car and bring it to automatic stop at terminal landings. Device shall permit operation of car in reverse direction.

B. Mount final limit switches at top and bottom of hoistway which will be operated by car if it travels beyond terminal stops. Switches shall be independent of other stopping devices, positively operated, cut off power from hoisting motor and brake and prevent operation of car in either direction. Pin all final limits and brackets to prevent movement.

2.20 CAR LEVELING

A. Provide dumbwaiter with leveling devices that will automatically stop and maintain the car in position within 6 mm (1/4-inch) level of each floor of which the dumbwaiter has been dispatched.

B. Leveling device, within its zone, shall be independent of operating device.

C. Leveling device, functioning through vacuum tubes or photo-electric tubes is not acceptable.

2.21 STOP SWITCH

A. Provide in pit of dumbwaiter, an enclosed stop switch readily accessible from pit access door. Each switch shall be manually opened and closed with red operating handles or buttons conspicuously and permanently marked "STOP". Switches shall be positively opened mechanically and opening shall not be solely independent on springs.

2.22 OPERATING STATIONS AND CONTROL PANEL
A. Operating stations and control panels shall be flush mounted, stainless steel.

1. Bevel all faceplates on side, top and bottom edges with a 15-degree bevel.

2. Fasten all faceplates with non-corrosive spanner head or bristol head white metal tamperproof screws.

3. Operating pushbuttons in faceplates shall be designed so that pressure on contacts shall be independent of pressure on operating pushbutton.

4. Each switch and operating device shall have indelible 1/4-inch high legends to indicate its identity and position.

B. Provide at each floor served by dumbwaiter a complete set of operating pushbuttons with 13 mm (1/2-inch) numbers in the face of the button corresponding to the floors served. Pushbuttons shall not protrude beyond the faceplates when in normal position. Call registered lights located within or behind the buttons shall illuminate the floor numeral corresponding to the call registered. Also provide an "In Use" light in this panel to show when dumbwaiter is in operation or that a door is open.

2.23 CALL-AND-SEND OPERATION FOR DUMBWAITERS

A. System shall permit car to be dispatched or called at any floor. Car shall be dispatched from landing by manually closing hoistway door and pressing button at that landing corresponding to floor to be served. Car door shall close automatically and car shall start automatically and proceed to destination, provided interlocked circuits have been established. Car shall be called to such landing by pressing button at floor to be served. Car door shall close automatically provided hoistway door at landing where car is standing has been closed. Car shall start automatically, provided interlock circuits have been established and shall proceed to destination. Car door shall open automatically after car has stopped at landing. Landing pushbuttons shall be ineffective during travel of car through hoistway and for sufficient time after car has stopped to allow automatic opening of car door and manual hoistway door.

2.24 SIGNAL LANTERNS
A. Provide a lantern over each landing entrance, or near each entrance where directed, except at central station landing. The hall lantern fixture shall be of stainless steel with glass or plastic lens. Lens shall be illuminated from rear by a lamp of proper intensity shielded to illuminate lens only. Lanterns shall be connected to signal in advance of approach of dumbwaiter at a landing. Lantern shall be extinguished when the car leaves the landing. Each lantern shall contain a single stroke chime so connected that when dumbwaiter arrives at a landing, the chime shall sound momentarily.

2.25 HOISTWAY ENTRANCES

A. Each entrance shall be required size with door of the bi-parting vertical sliding type.

1. Frame shall be not less than No. 16-gauge stainless steel, coated inside, with 4.8 mm (3/16-inch) thick sound isolation mastic compound assembled at corners and secured with smoothly dressed welded joints. Truckable sill shall be rigidly anchored and not less than No. 12-gauge stainless steel and shall be set true, straight and level, with hoistway edges plumb over each other. Reinforce sill with two steel angles full length. Sill shall be grouted full length after installation.

2. Door guides shall be non-corrosive metal. Weight and method of fastening to frames and hoistway-wall, above and below, shall conform to standard practice of dumbwaiter manufacturer. Provide gibs, struts from floor-to-floor chains, and steel sheaves with sealed ball or roller bearings. Provide guides and stops for door travel.

3. Door panels shall be flush hollow metal construction and bear a 1-1/2 hour Underwriters' "B" label, according to NFPA 252, one inch thick, of not less than No. 16-gauge stainless steel on both sides. Panels shall be reinforced. Interior of panels shall be filled with fireproof material. Upper door section shall be fitted with a neoprene non-movable minimum diameter one-inch door astragal. A hand pull shall be secured to the upper door section.

4. The top section of the door panel shall be equipped with a glass vision panel of 6 mm (1/4-inch) thick wire glass not less than 76 mm (3-inches) or more than 100 mm (4-inches) in diameter.

2.26 ELECTRIC INTERLOCK
A. Hoistway doors shall be equipped with true electric interlocks of design that dumbwaiter shall be inoperative if any door is open, and door cannot be opened except at landing at which car has stopped. Mechanism shall be so arranged so door is securely locked before electric contact is made. Mount retiring cam on car to operate locks. Interlock will not be accepted unless it has successfully met requirements of ASME A17.1.

2.27 CAR SLING

A. Construct car frames of structural shapes, ASTM A36, rigidly bolted and welded together of adequate strength to support car with rated load and to conform to ASME A17.1.

2.28 CAR ENCLOSURE

A. Car shall be constructed of a minimum No. 14 gauge stainless steel except car bottom shall be a minimum No. 10 gauge stainless steel. The car is to be formed with smooth returned edges at the entrances, welded or bolted and rigidly braced. Construction shall conform to ASME A17.1. Car bottom of car enclosure, car doors and door guides shall be arranged and reinforced to withstand the impacts and concentrated loads which will result from loading. Provide car with one removable center shelf of No. 16-gauge stainless steel.

1. The dumbwaiter car shall be provided with automatically power operated vertical sliding car doors.

2. Provide flush car light fixture with lamp recessed in top of car ceiling. Light shall be connected to illuminate automatically when car arrives at landing and hoistway door is opened, and shall automatically extinguish when hoistway door is closed.

3. Provide metal nameplate in car showing name of manufacturer required by ASME A17.1, rated load in pounds, in stamped, etched or raised letters and numerals.

B. A service demand bell with a 76 mm (3-inch) diameter gong shall be provided on the dumbwaiter car. Bell shall be arranged to sound when a pushbutton is pressed while the car is standing at a floor with the door open. Bell shall be connected to a bell ringing transformer of proper capacity. Transformer shall be connected through fuses to the elevator power service in machine room.

C. Dumbwaiter Cabs:
1. Interior and exterior steel surfaces shall be parkerized or given equivalent rust resistant treatment before finish is applied.

2. Exterior faces of car doors shall be given one finish coat of oil base paint of medium gray color.

D. Surfaces of door frames, door panels, interior cab surfaces, etc., that become damaged or marred from any cause shall be restored to original condition in a satisfactory manner before final acceptance of work.

PART 3 EXECUTION

3.1 PREPARATION

A. Examine work of other trades on which the work of this Section depends. Report defects to Resident Engineer in writing which may affect the work of this trade or equipment operation dimensions from site for preparation of shop drawings.

B. Ensure that shafts and openings for moving equipment are plumb, level and in line, and that pit is to proper depth, waterproofed and drained with necessary access doors.

C. Before fabrication, take necessary job site measurements, and verify where work is governed by other trades. Check measurement of space for equipment, and means of access for installation and operation. Obtain dimensions from site for preparation of shop drawings.

D. Ensure the following preparatory work, provided under other Sections, has been proper.

1. Supply of electric feeder wires to the terminals of the dumbwaiter control panel, including circuit breaker. Provision of hoistway outlets for car light and for light in the pit and outlets in machine room for light furnishing of electric power for testing and adjusting dumbwaiter equipment.

2. Machine space enclosed and protected from moisture, with self closing, self locking door.

E. Supply for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.

3.2 INSTALLATION
A. Perform work with competent mechanics skilled in this work and under the direct supervision of the elevator contractor's experienced foreman.

B. Set hoistway entrances in alignment with car openings, and true with plumb sill lines.

C. Install machinery, guides, controls, car and all equipment and accessories in accordance with manufacturer's instructions, applicable codes and standards, to provide a quiet, smooth operating installation, free from side sway, oscillation or vibration.

D. Isolate and dampen machine vibration with properly sized sound-reducing anti-vibration pads.

3.3 CLEANING

A. Prior to final acceptance, remove protection from finished or ornamental surfaces, and clean and polish surfaces with regard to type of material.

3.4 SPACE CONDITIONS

A. Attention is called to overhead clearance, pit clearances, overall space in hoistway, and construction conditions at building site in connection with dumbwaiter work. Addition or revision of space requirements, or construction changes that may be required for the complete installation of the dumbwaiters, must be arranged for and obtained by the Contractor, subject to approval of Contracting Officer. Include cost of such changes in bid, and form a part of the contract. Provide proper, satisfactory code legal installation of equipment as a whole, including all construction, accessories and devices in connecting with elevator, mechanical and electrical work specified herein.

3.5 ARRANGEMENT OF EQUIPMENT

Clearance around dumbwaiter, mechanical and electrical equipment shall comply with applicable provisions of NEC. Arrange equipment in machine room so that major equipment components can be removed for repair or replacement without dismantling or removing other equipment in the area.

3.6 WORKMANSHIP AND PROTECTION
A. All installation shall be made in a first class, neat and skillful manner by mechanics experienced in the trade involved. All details of the installation shall be mechanically and electrically correct. All materials and equipment shall be new and without imperfections.

B. Recesses, cutouts, slots, holes, patching, grouting, refinishing and the like to accommodate installation of equipment shall be included in the contractor's work. All new holes in concrete shall be core drilled.

C. No structural members shall be cut or altered. Work in place which is damaged or defaced shall be restored equal to original condition.

D. Finished work shall be straight, level and plumb, with true, sharp surfaces and lines. All machinery and equipment shall be protected against dirt, water or mechanical injury. At final completion, all work shall be thoroughly cleaned and delivered in perfect unblemished condition.

E. Grease gun fittings shall be pressure relief type.

F. Exposed gears, sprockets, selector drums, etc., shall be guarded from accidental contact in accordance with ASME A17.1.

3.7 PRE-TESTS AND TESTS

A. Pretest, as per specifications the dumbwaiters and related equipment, in the presence of the Resident Engineer for proper operation before requesting final inspection.


1. Tests shall be conducted in the presence of and witnessed by a certified elevator inspector.

2. Government shall furnish electric power including necessary current for starting, testing, and operating machinery of each dumbwaiter.

C. If required by the Department of Veterans Affairs Resident Engineer, inspection shall be conducted at other than normal working hours.
1. Contractor shall furnish the following test instruments and materials on-site and at the designated time of inspection: Properly marked testing weights, voltmeter, amp probe, thermometers, stop watch, direct reading tachometer, and a means of two-way communication.

2. If during the inspection process the Department of Veterans Affairs representative determines the need, the following instruments should be available within a four (4) hour period: Megohm meter, vibration meter, sound meter and a light meter.

D. Inspection shall be made of workmanship and equipment furnished and installed for compliance with specification.

E. Speed Test: The actual speed of the dumbwaiter shall be determined in both directions of travel with full contract load and no load in the elevator. Speed test shall be made before the full load run test and after the full load run test. Speed shall be determined by applying a tachometer to the car hoisting ropes. The actual measured speed of the elevator with all loads in either direction shall be within 10% of specified rated speed.

1. Full speed runs shall be quiet and free from vibration and sway. When cars are standing at the floor with doors open, they shall remain fully stopped with hoisting machine brake applied.

F. Car Leveling Test: Elevator car leveling devices shall be tested for accuracy of leveling at all floors with no load in car and with contract load in car, in both directions of travel. Accuracy of floor leveling shall be within plus or minus 6 mm (1/4-inch) of level with any landing floor for which the stop has been initiated (with a definite range of distance in advance of the landing) regardless of load in car or direction of travel. The car leveling device shall automatically correct over travel as well as under travel and shall maintain the car floor within plus or minus 6 mm (1/4-inch) of level with the landing floor regardless of change in load.

G. Brake Test: The action of the brake shall be prompt and a smooth stop shall result in down direction with no load up to and including 100 percent of contract load in the car. Up travel not required.

H. Overload Devices: All overload current protection devices shall be tested within their designed circuitry. Overloads shall not be bench tested.
I. Operating and Signal System: The elevator shall be operated by the operating devices provided and the operation signals and automatic floor leveling shall function in accordance with requirements specified. Starting, stopping and leveling shall be smooth and comfortable without appreciable steps of acceleration and deceleration. Stopping shall be without bumps or jars.

J. If any equipment fails test requirements and a reinspection is required, the Contractor shall be responsible for cost of reinspection, including salaries, transportation expenses, and other expenses incurred by the representatives of the Contracting Officer.

3.8 PAINTING AND FINISHING

A. Machine, Controller, Structural, Etc.:

1. Dumbwaiter machine, motors, controllers and the like shall be factory painted with manufacturer's standard finish and color.

2. Numbers 51 mm (2-inches) high designating dumbwaiter machine, controllers, selectors and numbers on crossheads of dumbwaiter shall be painted or otherwise applied as required by ASME A17.1. Colors of numbers shall contrast with colors of surfaces to which they are applied.

3. Surfaces (except contact surfaces of working parts) of dumbwaiter items, such as controllers, car frames, underside of car guide rails, rail brackets and surfaces of conduits, outlet boxes and junction boxes, shall be given approved prime coat, body coat and finish coat of machine enamel.

B. Hoistway Entrances of Dumbwaiters:

1. Exposed metal parts on hoistway side of entrances shall be given one field coat of oil base paint of medium gray.

2. Metal work, including built-in or hidden work and structural metal (except stainless steel entrance frames and surfaces to receive baked enamel finish) shall be given approved prime coat in shop and one field coat of oil base medium gray paint.

C. Hoist machines, motors, and the like shall be factory painted with manufacturer's standard finish and color.
1. Controllers, selectors, sheaves, car frames and platforms, beams, rails and buffers, except their machined surfaces, door operators, cams, brackets and all other uncoated ferrous metal items shall be painted not less than one factory priming coat.

2. Upon completion of installation, and prior to final inspection, all equipment shall be thoroughly cleaned of grease, oil, cement, plaster, and other debris. All equipment, except that otherwise specified as to architectural finish, shall then be given two coats of paint of approved color.

3.9 INSTRUCTION OF PERSONNEL

A. Provide competent instructions to train VA personnel in the operation of the equipment and accessories installed under this contract for a period of not less than (4) four hours. Instruction shall commence after completion of all work and at such time as directed by the Resident Engineer.

B. In addition to oral instruction, furnish and deliver written instructions in triplicate relative to care and operation of all equipment and accessories to the Resident Engineer in independently bound folders. Written instructions shall include correct and legible wiring diagrams, nomenclature sheet of all electrical apparatus including location of each device, complete and comprehensive sequence of operation, complete replacement parts list with descriptive literature and identification and diagrammatic cuts of equipment and parts. Information shall also include electrical operation characteristics of all circuits, fields, relays, timers, regulators, and electronic devices, as well as RPM values and related characteristics for all rotating equipment.

C. Provide any supplementary instruction for adjustment and care of new equipment that may become necessary because of changes, modifications or replacement of equipment or operation under requirements of paragraph entitled "Warranty of Construction".

3.10 INSPECTIONS AND MAINTENANCE

A. Furnish complete maintenance and inspection service on entire dumbwaiter installation for a period of 52 weeks after completion and acceptance of the dumbwaiter installation by the Resident Engineer. This maintenance service shall begin concurrently with the one year warranty. Maintenance work shall be performed by skilled dumbwaiter personnel directly employed and supervised by the same company that installed the dumbwaiter equipment specified herein.
B. The maintenance service shall include the following:

1. Monthly systematic examination of equipment.

2. Furnishing all lubricants, cleaning materials and parts required.

3. Cleaning, lubricating, adjusting, repairing and replacing of all parts as necessary to keep the equipment in first-class condition and proper working order.

4. Equalizing tension, shortening or removing of hoisting ropes where necessary.

5. Maintain the operational system to the standards specified hereinafter including any changes or adjustments required to meet varying conditions of hospital occupancy.

6. Maintain smooth starting and stopping and accurate leveling at all times.

C. Maintenance service shall not include the performance of any work required as a result of improper use, accidents or negligence for which the contractor is not directly responsible.

D. Service and emergency personnel shall report to the Resident Engineer or his authorized representative upon arrival at the hospital and again upon completion of the required work. A copy of the work ticket containing a complete description of the work performed shall be given to the Resident Engineer.

E. The contractor shall maintain a log in the door panel of the controller. The log shall list the date and time of all monthly examinations and all trouble calls. Fully describe each trouble call, including the nature of the call, necessary correction performed or parts replaced.

END OF SECTION
PART 1-GENERAL

1.1 DESCRIPTION:

A. This section of the specification includes the engineering, furnishing and installation of the complete traction material lift system as described herein and indicated on the drawings.

B. Traction Material lift No. C- shall be geared traction type with central station dispatching, signal system car leveling device, power-operated car and hoistway doors.

1.2 QUALITY CONTROL:

A. Approval by the Contracting Office is required of products or services of proposed manufacturer, suppliers, and installers, and will be based upon submission by Contractor of certification that:

1. Manufacturer regularly and presently manufactures electric traction elevators as one of his principal products.

2. Installer has technical qualifications of at least three years experience, trained supervisory and installation personnel, and facilities to install specified items. Approval will not be given, however, where the experience record on either government, municipal, or commercial projects is one of unsatisfactory performance.

3. Manufacturer's product submitted has been in satisfactory and efficient operation at three installations similar to this project for not less than three years. Submit list of installations; include names and addresses of Medical Centers and Medical Centers Administrators thereof.

4. There is a permanent service organization maintained or trained by manufacturer which will render satisfactory service to this installation within two hours of receipt of notification that service is needed. Submit name and address of service organization.

B. Contracting office retains the right to approve an experience record and service facilities less than those specified when the best interest of the government would be served by such action and objectives of the specifications are fulfilled.

1.3 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Federal Specifications (Fed. Spec.):

J-C-30A(l)...................................Cable and Wire: Electrical (Power, Fixed Installation)
J-C-580B(I) ................................Cord, Flexible and Wire, Fixture (Electrical 0 to 600-volt service).
W-C-596/12D .............................Connector, Plug, Electrical; Connector, Receptacle, Electrical
W-F-406D ................................FF-S-325 .Fittings for Cable, Power, Electrical and Conduit,
Metal Flexible
W-F-408E ................................Fittings for Conduit, Metal, Rigid, (Thick-Wall and Thin-Wall
(EMT) Type)
W-S-610E .................................Splice, Connector
FF-S-325 ....................................Shield, Expansion, Nail, Expansion; and Nail, Drive INT AMD-3
Screw (Devices, Anchoring, Masonry)
QQ-S-766D(5)............................Steel Plates, Sheets, and Strip-corrosion.
WW-C-566C ...............................Conduit, Metal flexible.
WW-C-563A ...............................Conduit, Metal, Rigid: Electrical, Thin-Wall Steel Type (Electrical
Metallic Tubing): Straight Lengths, Elbows, and Bends.
WW-C-581E(3)...........................Conduit, Metal, Rigid; and Coupling, Elbow, and Nipple,
Electrical Conduit: Zinc-coated.

C. American Society of Mechanical Engineers (ASME):
   A17.2-2001.................................Inspectors Manual for Electric Elevators

D. National Fire Protection Association (NFPA):
   70-2002-or current code-National Electrical Code (NEC)
   252-2003 ....................................Fire Test of Door Assemblies

E. American Society for Testing and Materials (ASTM):
   ASTM A1008/A1008M-02 ............Steel, Sheet and Strip, Low Carbon, Structural, High-Strength
   Low-Alloy and High Strength Low-Alloy with Improved Farability

F. Gages:
   For Sheet and Plate: U.S. Standard (USS)
   For Wires: American Wire Gauge (AWG)

G. American Welding Society (AWS):
   D1.1-2002 .................................Structured welding Code - Steel

H. National Electrical Manufacturers Association (NEMA)
   LD3-2000 .................................High-Pressure Decorative Laminates

I. Underwriter’s Laboratories (UL):
   486A-97 ninth Edition ...............Safety Wire Connectors and Soldering Lugs for Use with Copper
   Conductors

1.4 SUBMITTALS
A. In accordance with Section 01340, SAMPLES AND SHOP DRAWINGS shall be submitted separately and apart from materials specified under other Section, and shall be marked "SUBMITTED UNDER SECTION 14132". All submitted drawings and related elevator material should be forwarded to the Contracting Officer.

B. Shop Drawings:
   1. Complete dimensioned layout in plan and section showing the arrangement of equipment and all pertinent details of each elevator unit specified including:
      a. Hoisting machines, controllers, power conversion devices, selectors, governors, and all other components located in machine room.
      b. Car, counterweight, sheaves, supporting beams, guide rails, brackets, buffers, and other components located in hoistway.
      c. Rail bracket spacing and maximum vertical forces on guide rails in accordance with Section 2.23 of ASME A17.1.
      d. Reactions at points of supports and buffer impact loads.
      e. Weights of principal parts.
      f. Top and bottom clearances and overtravel of car and counterweight.
      g. Location of circuit breaker, switchboard panel, shunt trip circuit breaker, light switch, and feeder extension points in the machine room.
   2. Drawings of hoistway entrances and doors showing details of construction and method of fastening to the structural members of the building.
      a. If dry-wall construction is used to enclose hoistway, submit details of interface fastenings between entrance frames and dry-wall.

D. Samples:
   1. One each of stainless steel, 75 mm by 125 mm (3 inches by 5 inches).
   2. One each of color vinyl floor tile.
   3. One each of protection pads, 75 mm by 125 mm (3 inches by 5 inches) (if used).
   4. No other samples of materials specified shall be submitted unless specifically requested after submission of manufacturer's name. In case such samples are furnished pursuant to request, adjustment in contract price and time will be made as provided in Section 01001, GENERAL CONDITIONS.

E. Name of manufacturer, type or style designation, and applicable data of the following equipment shall be shown on the elevator layouts:
   1. Hoisting machine.
   2. Hoisting machine motor, H.P. rating, and R.P.M.
   3. Controllers.
   4. Starters and overload current protection devices.
   5. Car safety device; maximum and minimum rated loads and rated speeds.
6. Governor.
8. Hoistway door interlocks.
9. Car and counterweight buffers; maximum and minimum rated loads, maximum rated striking speed and stroke.
10. Hoist and compensation ropes; ultimate breaking strength, allowable working load, and actual working load.
11. Cab ventilation unit; H.P. rating and C.F.M. rating.

F. Complete construction drawings of elevator car enclosure, showing dimensioned details of construction, fastenings to platform, car lighting, ventilation, ceiling framing, top exits, and location of car equipment.

G. Complete dimensioned detail of vibration-isolating foundations for geared hoistway machines.

H. Dimensioned drawings showing details of:
   1. All signal and operating fixtures.
   2. Car and counterweight guide shoes.
   3. Hoistway door hangers.
   4. Door operator, infrared curtain units.

I. Cuts or drawings showing details of controllers, selectors, and supervisory panels.

J. Furnish certificates as required under: Paragraph "QUALIFICATIONS".

1.5 WIRING DIAGRAMS

A. Provide three complete sets of field wiring and straight line wiring diagrams showing all electrical circuits in the hoistway, as well as the machine room, one set framed under plexiglass or on pivoted hard boards coated with an approved plastic sealer and mounted in each elevator machine room as directed by Resident Engineer. In the event field modifications are found necessary during installation, diagrams shall be revised to include all corrections made prior to and during the final inspection. Corrected diagrams shall be delivered to the Resident Engineer within 30 days of final acceptance.

B. Provide the following information relating to the specific type of microprocessor controls installed:
   1. Owner's information manual, containing general data on major components, maintenance, and adjustment.
   2. System logic description.
   3. Complete wiring diagrams needed for field troubleshooting, adjustment, repair and/or replacement of components. Diagrams shall be base diagrams, containing all changes and additions made to the equipment during the design and construction period.
   4. Changes made during the warranty period shall be noted on the drawings in adequate time to have the finalized drawings reproduced for mounting in the machine room no later than six months prior to the expiration of the warranty period.
1.6 PERFORMANCE STANDARDS
   A. The material lifts shall be capable of meeting the highest standards of the industry and specifically the following:
      1. Contract speed shall mean speed in the UP direction with full capacity load in the car. Speed variation under any load condition, regardless of direction, shall be no more than three (3) percent.
   B. Floor Accuracy: Accuracy shall be maximum 6 mm (1/4 inch) above or below the floor, regardless of load condition.

1.7 WARRANTY
   A. All labor and materials furnished in connection with elevator system and installation of same shall be subject to terms of "Warranty of Construction" articles of Section 01001, GENERAL CONDITIONS, including expendable. Upon receipt of notice from Government of failure of any portion of materials and/or workmanship furnished, affected part or parts shall be replaced promptly with new parts by and at the expense of Contractor. Warranty shall commence upon final inspection and completion of performance test and upon full acceptance of the installation. Warranty shall run concurrently with the maintenance period.
   B. No device shall be acceptable that will not give full satisfaction without excessive maintenance and attention. If it becomes evident during warranty period that device is not functioning properly or in accordance with specification requirements, or if in the opinion of the Contracting Officer, excessive maintenance and attention must be employed to keep device operational, device shall be removed and a new device meeting all requirements shall be installed as part of work until satisfactory operation of installation is obtained. Period of warranty shall start anew for such parts from date of completion of each new installation performed, in accordance with foregoing requirements.

PART 2 - PRODUCTS

2.1 MATERIALS:
   A. Where stainless steel is specified, it shall be corrosion resisting steel with brushed finish on exposed surfaces. Stainless steel shall have the grain of belt in the direction of the longest dimension and surfaces shall be smooth and without waves. During erection, all stainless steel surfaces shall be protected by suitable material.
   B. Where cold rolled steel is specified, it shall be low carbon steel rolled to stretcher leveled standard flatness.

2.2 MANUFACTURED PRODUCTS:
   A. Materials, devices and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items. Items not meeting this requirement, but which otherwise meet technical specification, and the merits of which can be established through reliable test reports or physical examination of representative samples, will be considered.
B. When two or more units of same class of materials, devices, or equipment are required, these units shall be product of one manufacturer.

C. Manufacturers of equipment assemblies which include components made by others shall assume complete responsibility for the final assembled unit.
   1. All components of an assembled unit shall be product of same manufacturer.
   2. Parts which are alike shall be the product of a single manufacturer.
   3. Components shall be compatible with each other and with the total assembly for the intended service.

D. Welding at the project site shall be made by welders; and welding operators who have previously qualified by test as prescribed in American Welding Society Publication to perform the type of work required.

E. Motor nameplates shall state manufacturer's name, rated horsepower, speed, volts, amperes and other characteristics required by NEMA standards, and shall be securely attached to the item of equipment in a conspicuous location.

F. Where key operated switches and/or key operated cylinder locks are furnished in conjunction with any component of the elevator installation, four keys for each individual switch or lock shall be furnished. Each key shall be attached to a tag bearing a stamped or etched legend identifying its purpose. Tags shall be in accordance with “Property of U.S. Government” on reverse side of tag. Barrel keys not acceptable.

2.3 CAPACITY, SPEED, TRAVEL:

A. Each material lift shall have the capacity to lift the live load exclusive of the weight of entire car and plunger, all as specified in the following schedule:

<table>
<thead>
<tr>
<th>MATERIAL LIFT SCHEDULE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material lift Number</td>
</tr>
<tr>
<td>Overall Platform Size</td>
</tr>
<tr>
<td>Rated Load - kg(pounds)</td>
</tr>
<tr>
<td>Rated Speed - m/s(fpm)</td>
</tr>
<tr>
<td>Total Travel - m/s(fpm)</td>
</tr>
<tr>
<td>Number of Stops</td>
</tr>
<tr>
<td>Number of Openings</td>
</tr>
<tr>
<td>Type of Roping</td>
</tr>
<tr>
<td>Entrance Type &amp; Size</td>
</tr>
</tbody>
</table>

B. Actual material lift speed shall not vary more than three (3) percent above nor more than three (3) percent below specified speed.

2.4 POWER SUPPLY:
A. For power supply in the machine room, see specification Division 16, ELECTRICAL and electrical drawings.

B. It shall be the electrical contractor’s responsibility to supply the labor and materials for the installation of the following:
   1. A feeder from the power source indicated on the drawings to the controller.
   2. Shunt trip circuit breaker for the controller located at the strike side of the machine room door. Shall be lockable in the “Off” position.
   3. Power wiring between the shunt trip and the controller.

   SPEC WRITER NOTE: If material lifts are to be connected to auxiliary power supply, include the following paragraph.

4. Power for auxiliary power operation of elevators shall be available from auxiliary power generator, including wiring connection to the elevator control system, and shall be provided by the General Contractor or under Section 16208, ENGINE GENERATORS.

2.5 CONDUIT:
   A. Unless otherwise specified or approved, all electrical conductors, except traveling cable connections to the car, shall be installed in rigid zinc coated steel or aluminum conduit, electrical metallic tubing or metal wireways. Where permitted by NEC, 13mm (1/2 inch) trade size conduits and EMT may be used only for tap connections to interlocks, emergency exits and leveling units. All raceways completely embedded in concrete slabs, walls, or floor fill shall be rigid steel conduits. No rigid conduit or electrical metallic tubing shall be smaller than 19mm (3/4 inch) electrical trade size. An auxiliary gutter may be used between controller, starter, and similar apparatus in the elevator machine room. Self supporting connections, where approved, shall be fully protected from abrasion, or other mechanical injury. Flexible metal conduit not less than 9.5mm (3/8 inch) electrical trade size may be used, not exceeding 457mm (18 inches) in length, for short connections between risers and limit switches, interlocks, and for other applications permitted by the NEC. Flexible heavy duty service cord, type S.O., may be used between fixed car wiring and switches on car doors for safety edges and light ray devices.
   B. Connect motors and other components subject to movement or vibration to the conduit or EMT systems with flexible conduit.
   C. All conduit terminating in steel cabinets, junction boxes, wireways, switch boxes, outlet boxes and similar locations shall have approved insulation bushings. If the bushings are constructed completely of insulation material, a steel locknut shall be installed under the bushing. At ends of conduits not terminating in steel cabinets or boxes, the conductors shall be protected by terminal fittings having an insulated opening for the conductors.
   D. Conduit and EMT fittings and connections using set screws or indentations as a means of attachment shall not be used.
   E. Terminal boxes shall be provided for the conduit and wiring connections to the pump motor.
SPEC WRITER NOTE: If future travel is planned use next paragraph.

F. //Conduit, junction boxes, outlet boxes, etc., shall be sized for future travel requirements.//

2.6 CONDUCTORS:

A. Unless otherwise specified, conductors, exclusive of traveling cables, shall be stranded or solid coated annealed copper in accordance with Fed. Spec. J C 30 for either Type RHW or THW. Where 16 and 18 AWG are permitted by NEC, either single conductor cable in accordance with Fed. Spec. J C 580 for Type TF, and or multi conductor cable, may be used provided the insulation of single conductor cable and outer jacket of multi conductor cable is flame retardant and moisture resistant. Multi conductor cable shall have color coding or other suitable identification for each conductor. Conductors for control boards shall be in accordance with NEC. No joints or splices shall be permitted in wiring except at outlets. Tap connectors may be used in wireways provided they meet all UL requirements.

B. All wiring must test free from short circuits or grounds. Insulation resistance between individual external conductors and between conductors and ground shall be not less than one megohm.

C. Where size of conductors is not given, capacity shall be such that maximum current shall not exceed limits prescribed by NEC.

D. Equipment grounding shall be provided. Ground conduits, supports, controller enclosures, motors, platform and car frames, and all other non-current conducting metal enclosures for electrical equipment in accordance with NEC. The ground wires shall be copper, green insulated and sized as required by NEC. Bond the grounding wires to all junction boxes, cabinets, and wire raceways.

E. Terminal connections for all conductors used for external wiring between various items of elevator equipment shall be solderless pressure wire connectors in accordance with Fed. Spec. W S 610. The Contractor may, at his option, make these terminal connections on No. 10 or smaller conductors with approved terminal eyelets set on the conductor with a special setting tool, or with an approved pressure type terminal block. Terminal blocks using pierce through serrated washers are acceptable.

SPEC WRITER NOTE: If future travel is specified, include paragraph 2.6, F.

F. //Conductors shall be installed from junction box in hoistway to controller for future travel requirements.//

2.7 TRAVELING CABLES:
A. All Conductors to the car shall consist of flexible traveling cables conforming with the requirements of NEC. Traveling cables shall run from the junction box on the car to a junction box in the hoistway or directly to the machine room. Junction boxes in the hoistway and on car shall be equipped with terminal blocks. Terminal blocks having pressure wire connectors of the clasp type that meet UL 486 requirements for stranded wire may be used in lieu of terminal eyelet connections. Terminal blocks shall have permanent indelible identifying numbers for each connection. Cables shall be securely anchored to avoid strain on individual terminal connections. Flame and moisture resistant outer covering must remain intact between junction boxes. Abrupt bending, twisting and/or distortion of the cables shall not be permitted.

B. Provide 10 percent, but not less than 4 spare conductors in each traveling cable.

2.8 CONTROLLERS

A. All controllers required for the control, including dispatching, signals, and door operation of the system, shall be either the floor mounted freestanding type or wall mounted type with NEMA, Type 1, General Purpose Enclosures totally enclosed with hinged doors that lock, fastened rigidly to either the floor or the wall. Controller panels shall be moisture resistant, nonconductive, and noncombustible material of adequate thickness to support components mounted thereon. All switches and relays shall be mounted on front of panel with all controller wiring, enclosed in approved flame retardant, nonconductive duct. Switches and relays may be opened by either restrained compression or leaf type contact springs in lieu of gravity. All similar switch and relay units on controller shall be of the same manufacturer. Connectors between front and rear shall be studs or through-bolt connections. Wiring connections for operation circuits and external control circuits shall be brought to terminal blocks on controller. Circuit connectors for external circuits shall be made with wire connectors or metal eyelets. Pressure type wire connectors shall be in accordance with Fed. Spec. W S 610. Contacts shall be of design and material to insure maximum conductivity, long life, and reliable operation without overheating or excessive wear. All relays and contractors shall be magnet operated. Resistance for solenoids, etc., shall be wire, wound on non combustible insulating material. Controller wiring shall be neatly arranged, readily accessible, easily traced and securely fastened in place. All spare conductors to controller shall be identified.

B. Identify each device and fuse (ampere rating) on panels by name, letter, or standard symbol, in an approved indelible and legible manner on device or panel. Coordinate identification markings with identical markings or wiring diagrams.

C. The elevator contractor shall provide solid state components and printed circuit boards to control the machine and/or signal functions. Complete details of the components and printed circuit boards, together with a complete operational description, shall be submitted for approval prior to manufacturer. The following features shall be incorporated in the design:
1. The electrical connections between the printed circuit boards (modules) and the circuit connectors incorporated in the mounting racks shall be made through individual tabs which shall be an integral part of each module. The tabs shall be nickel-gold plated or other approved metal of equal electrical characteristics. Modules shall be notched so prevent insertion of the modules in the inverted position.

2. Light emitting diode (LEDS) may be used for visual monitoring of individual modules.

3. Components shall have interlocking circuits to assure failsafe operation and to prevent unwarranted elevator movement should any component fail to function properly.

4. Method of wire wrappings for point to point wire connections on the mounting racks shall be submitted for approval.

5. Modules shall be of the type that plug into pre-wired mounting racks. No field wiring or alteration shall be necessary in order to replace defective modules.

6. Any field wiring changes required during construction shall be made only to the mounting rack connection points and not to the individual module circuitry or components. If it becomes necessary to alter individual modules, they shall be returned to the factory where such design changes shall be made and module design records changed so that correct replacement units shall be available.

7. Module boards shall be fabricated from non-conductive, non-corrosive material and shall be of sufficient strength so as to support all components mounted thereon without warping. Mounting racks shall be spaced sufficiently apart to prevent accidental contact between individual modules.

8. All logic symbols and circuitry designations shall be in accordance with ASME Standards.

9. Solid state components shall be designed to operate at a maximum of 110 degrees F.

10. Wiring connections for operating circuits and for external control circuits shall be brought to terminal blocks mounted in an accessible location within the controller cabinet. Terminal blocks using pierce-through serrated washers shall not be acceptable.

SPEC WRITER NOTE: If future travel is planned include the following paragraph.

11. //Controllers shall be provided with wiring and components for additional future travel of ___ floors and approximate ___ feet of travel.//#

2.9 MICROPROCESSOR CONTROL SYSTEM:

Provide solid state components and printed circuit boards to control the hoisting machine and signal functions in accordance with these specifications. Complete details of the components and printed circuit boards, together with a complete operational description, shall be submitted for approval.

2.10 DRIVING TRACTION MACHINE

A. Geared Traction Hoist Machine:
1. Worm geared traction type with motor, brake, gear, drive shaft, deflector sheave, and gear case mounted in proper alignment on an isolated bedplate.

2. Provide hoist machine mounted direct drive, digital, closed-loop velocity encoder.

3. Provide hoist machine drip pans to collect lubricant seepage.

2.11 SHEAVES

A. Provide deflector sheaves with a substantial metal basket type guard mounted below the sheave. Securely fasten guard to sheave beams.

B. Two-to-one idler sheaves on car and counterweight, if used, shall be provided with a metal guard which will effectively prevent foreign objects from falling between ropes and sheave grooves; shall prevent ropes jumping out of grooves in case of accident; and shall prevent accidental contact, by or injury to workmen on top of the car. Fabricate sheave guards from not less than 10 gauge thick steel and install with minimum clearance between guard and cables.

SPEC WRITER NOTE: If hoisting machine is located at bottom of hoistway or offset from hoistway, include Par. C.

//C. Securely mount overhead sheaves on overhead beams in proper alignment with basement traction sheave, car and counterweight rope hitches or sheaves. Provide necessary blocking where sheaves are installed on two or more levels.//

2.12 ELEVATOR MACHINE BEAMS

A. Provide structural steel beams required for direct support of and attachment to building structure of hoist machine, deflector sheaves, overhead sheaves, governor, and rope dead-end hitch assemblies.

B. Provide bearing plates, anchors, shelf angles, blocking, embedment, etc., for support and fastening of machine beams or equipment to the building structure.

SPEC WRITER NOTE: If hoisting machine is located at bottom of hoistway or offset from hoistway, include Par. C.

C. Provide hold-down bolts for offset hoist machines located beside or under hoistway where concrete hold-down pad is provided.//

2.13 GUIDE RAILS:

A. Guide rails shall be planed steel, standard T-Section, securely fastened to building structure with steel brackets by means of bolts and forged steel rail clips. Rails shall weigh not less than 15 pounds per foot. Rails shall conform in all respects with the Code, and shall be located so that the entire car assembly shall be in true balance with the guide rails.

B. Guide rails shall be supported by brackets at each floor. Where fastenings are over 4.3 meters (14 feet) apart, rails shall be reinforced with 229 mm (9 inch) channel backing, or approved equal, to secure the rigidity required for elevator capacity, platform size and method of loading.
C. Fishplate bolts, bracket bolts, and rail clip bolts shall be fitted with split lock washers and drawn up tight. All joints shall be located so as not to interfere with supporting clamps and brackets. Shims used to secure rail alignment shall be designed so that they remain in position, even through the fastening bolts may be loosened.

D. Guide rails shall extend from channels on pit floor to within 76 mm (three inches) of the underside of the concrete slab at the top of the hoistway with a maximum deviation of 3.2 mm (1/8 inch) from plumb in all directions. Provide a minimum of 19 mm (¾ inch) clearance between bottom of rails and top of channels.

E. Guide rail anchorages in pit shall be made in a manner that will not reduce the effectiveness of the pit waterproofing.

F. Guide rails shall be clean and free of any signs of rust or abrasion, and shall be filed to remove all rough edges prior to final inspection. All guide rail joints shall be filed to assure perfectly matching surfaces.

G. For attachment of guide rails in concrete or brick, where steel framing is not available, install approved inserts or bond blocks.

2.14 CAR GUIDE SHOES:
A. Install on car frame four flexible sliding swivel guide shoes, each assembled on a substantial metal base, to permit individual self alignment to the guide rails.

B. Provide each shoe with renewable non-metallic gib of durable plastic material having low coefficient of friction and long wearing qualities, when operated on guide rails receiving infrequent, light applications of rail lubricant. Gibs containing graphite or other solid lubricants are not acceptable.

C. Flexible guide shoes of approved design, other than swivel type, may be used provided they are self-aligning on all three faces of the guide rails.

D. Provide spring take up in car guide shoes for side play between rails.

//E. Provide adjustable roller guides.//

2.15 CAR AND COUNTERWEIGHT BUFFERS
Per ASME A17.1 Code

2.16 COUNTERWEIGHTS
A. Elevator shall be counterweighted to the extent of the weight of the car plus approximately 40 percent of the rated capacity load.

B. Furnish two (2) tie rods with cotter pins and double nuts at top and bottom. Install set collars or other approved means on tie rods to prevent counterweight sub-weights from jumping and/or rattling. Both ends of tie rods shall be visible and accessible.

C. Install counterweight guard in pit in accordance with Rule 2.3.2 of ASME A17.1.

2.17 ASCENDING CAR OVERSPEED PROTECTION
Provide devices for protection of ascending car overspeed and unintended car movement per ASME A17.1 2.19.

2.18 CROSSHEAD DATA PLATE:
Permanently attach a non-corrosive metal data plate to car crosshead. Data plate shall bear information required by Rule 2.16.3 and 2.20.2.1 of ASME A17.1. Such information shall be etched or stamped on plate.

2.19 CAR BUFFERS:
A. Provide a minimum of two spring buffers for each car, in accordance with Rule 7.5.8 of ASME A17.1. Buffers and supports shall be securely fastened to the pit channels, and in the alignment with striker plates on car. Permanently fasten to each buffer a metal plate showing stroke and loading rating. Buffer anchorage shall not puncture pit waterproofing.
B. Buffers shall be designed and installed to provide minimum car runby required by Rule 7.9.2.13 or 7.9.2.14 of ASME A17.1.
C. Pipe stanchions and struts shall be furnished, as required, to properly support the buffer.

2.20 COUNTERWEIGHTS
A. Elevator shall be counterweighted to the extent of the weight of the car plus approximately 40 percent of the rated capacity load.
B. Furnish two (2) tie rods with cotter pins and double nuts at top and bottom. Install set collars or other approved means on tie rods to prevent counterweight sub-weights from jumping and/or rattling. Both ends of tie rods shall be visible and accessible.
C. Install counterweight guard in pit in accordance with Rule 2.3.2 of ASME A17.1.

2.21 HOISTING ROPES
A. Provide elevator with the required number and size of ropes to insure adequate traction for the range of loads with a factor of safety not less than that required by ASME A17.1. Hoisting ropes shall be special 8X19 or 8x25 traction steel type, preformed, conforming to Fed. Spec. RR-W-410 with minimum nominal diameter of 13 mm (1/2 inch). For machines located overhead, 6 by 19 traction steel hoisting ropes may, at the Contractor's option, be used in lieu of 8 by 19 construction.
B. Provide wedge type shackles.
C. Attach a corrosion resistant metal data tag to one hoisting rope fastening of each elevator. Tag shall bear data as required by ASME A17.1 Code.

2.22 GOVERNOR ROPE
A. Rope shall be 6 by 19 or 8 by 19 wire rope, iron or traction steel, uncoated, fiber core, conforming to Fed. Spec. RR-W-410 with minimum nominal diameter of 9.5 mm (.375 inch) having a minimum factor of safety of 5. Tiller rope construction is not acceptable.
B. Under normal operation, rope shall run free and clear of governor jaws, rope guards, and other stationary parts.
C. Securely attach governor rope tag to governor rope releasing carrier. Data tag shall be corrosion-resisting metal and bear data as required by ASME Code A17.1.

SPEC WRITER NOTE: On installation where hoistway does not extend to lowest floor of building and where occupied or accessible space exists under hoistway, specify counterweight safeties.

2.23 CAR // AND COUNTERWEIGHT // SAFETY DEVICE
Type "B" flexible guide clamp.

2.24 SPEED GOVERNOR
Centrifugal type car // and counterweight // driven.

2.25 NORMAL AND FINAL TERMINAL STOPPING DEVICES:
A. Mount normal terminal stopping switch on car or in hoistway to slow speed or car and bring it to an automatic stop level with the terminal landings.
B. Switch, when opened, shall permit operation of car in reverse direction.
C. No normal stopping device other than one mounted on car and activated by cams in hoistway, or mounted in hoistway and activated by cams on car, shall be permitted.

2.26 TOP OF CAR OPERATING DEVICE:
A. The device shall conform to ASME A17.1 and the following:
   1. The device shall be activated by a switch mounted in the device. The switch shall have the "OFF" and "ON" positions permanently marked on the faceplate with 6.4 mm (1/4-inch) letters.
   2. Movement of the elevator shall be accomplished by the continuous pressure on a direction button and a safety button.
   3. Provide an emergency stop toggle type switch as per ASME A17.1.
   4. Provide permanent identifications for the operation of all components in the device.
   5. The device shall be permanently attached to the elevator crosshead, on the side of the elevator which is nearest to the hoistway doors.

2.27 WORKMAN’S LIGHTS AND OUTLETS:
Provide duplex GFCI protected type receptacle and lamp, with wire guards on top of material lift car and beneath the platform. The receptacles shall be in accordance with Fed. Spec. W-C596 for Style D7, 2 pole, 3 wire grounded type rated for 15 amperes and 125 volts.

2.28 CORRIDOR POSITION INDICATOR:
Provide LED digital position indicators directly over hoistway at Central Station landing. Indicator cover plates shall consist of faceplates of stainless steel, and inserted glass or plastic numerals. Numerals shall be not less than 19mm (3/4 inches) high or with engraved numerals on plastic strips installed behind plate glass or plastic cover plate. Cover plates shall be readily removable for re-lamping. Provide in back of each numeral an electric lamp located in light proof compartment to indicate position and direction of motion of car by illuminating proper numeral.
2.29 SIGNAL LANTERNS:

Provide a lantern over each hoistway entrance or near each entrance, where directed, except at Central Station landing, a hall lantern fixture of stainless steel with glass or plastic lenses. Lens shall be illuminated from rear by a lamp of proper intensity, shielded to illuminate lens only. Lanterns shall be connected to signal in advance approach of non-personnel elevator at a landing. Each lantern shall contain a single stroke chime so connected that when a non-personnel elevator arrives at a landing, the chime shall sound momentarily.

2.30 HOISTWAY ENTRANCES

A. Each entrance shall be required size with door of the bi-parting, vertically-sliding type.
   1. Frame shall be not less than No. 16 gauge, stainless steel assembled at corners and secured with smoothly dressed, welded joints. Sill shall be rigidly anchored and not less than No. 11 gauge stainless steel, and, shall be set true, straight and level with hoistway edges plumb over each other. Reinforce sill as indicated on the drawings. Sill shall be grouted full length after installation.
   2. Door guides to provide door position on inside of hoistway shall be metal. Weight and method of fastening to frames and hoistway wall, above and below, shall conform to a standard practice of non-personnel elevator manufacturer. Provide gibs, struts from floor-to-floor, chains, and steel sheaves with sealed ball or roller bearings. Provide guides and stops for door travel.
   3. Door panels shall be flush, hollow metal construction and bear a 1 ½ hour Underwriters' "B" label, one inch thick, of not less than No. 16 gauge stainless steel on both sides. Panels shall be reinforced. Interior of panels shall be filled with fireproof material. Upper door section shall be fitted with a safety non-crushing astragal and a glass vision panel of 6 mm (¼ inch) thick, wire glass not less than three (3) inches nor more than 102 mm (four (4) inches) in diameter.
   4. Door operators shall be heavy duty, DC or AC power operators designed to automatically open vertical sliding, hoistway doors upon arrival of car at each landing. Door shall close automatically upon completion of loading and unloading cycles. Door "opening" and "closing" speed shall be approximately one foot per second. Inherent design, construction and installation of doors and power operator shall be such as to preclude possibility of doors opening until car makes stop at that landing.
   5. Entrances shall be installed and shall be thoroughly protected by plastic and paper covering to prevent injury. Frames shall be furnished with wall anchors to assure additional rigidity.

2.31 ELECTRIC INTERLOCK
Hoistway doors shall be equipped with true electric interlocks of design that non-personnel elevator will be inoperative if any door is open; and, door cannot be opened except at landing at which car has stopped. Mechanism shall be so arranged that door is securely locked before electric contact is made. Mount retiring cam on car to operate locks. Interlock will not be accepted unless it has successfully met requirements of the Code.

2.32 CAR SLING

Construct car frames of structural shapes, ASTM A-36, rigidly bolted and welded together of adequate strength to support car with rated load and to conform to ASME A17.1.

2.33 CAR ENCLOSURES

A. Car shall have width and depth required for contract load and be constructed of minimum 14 gauge, stainless steel except car bottom shall be minimum 10 gauge, stainless steel. Construction shall conform to ASME A17.1. Car bottom shall be arranged and reinforced to provide adequate support for loading and unloading unit and withstand impact of wheeled carts.

1. Provide car entrance with vertical sliding, bi-parting door constructed of sheet panels of stainless steel, guided and connected to each other by cables running over sheaves mounted at top of car. Car door shall be opened automatically and closed automatically by power operator. Provide safety contact, automatic reversing edge on underside of upper door section.

2. Provide a flush car light fixture in car ceiling. Light shall be connected to illuminate automatically when car arrives at landing and hoistway door is opened; and shall be automatically extinguished when hoistway door is closed.

3. Provide metal nameplate in car showing name of manufacturer and, as required by ASME A17.1, rated load in pounds in stamped, etched or raised letters and numerals.

2.34 CAR LEVELING DEVICE

Provide car leveling device for material lift which shall automatically bring car to within 6 mm (1/4 inch), plus or minus, of the floor landing at reduced speed. When the car is traveling in the up direction, the car shall level up to the floor; and when the car is traveling in the down direction, the car shall level down to the floor. The car shall not pass the floor and level back when stopping regardless of direction of travel or load in car. One way leveling augmented with an anti-creep device shall not be acceptable.

2.35 PIT STOP SWITCH

Provide an enclosed stop toggle switch in pit of elevator that is readily accessible from access door to pit. Toggle switch shall be manually opened and closed with red operating handle conspicuously and permanently marked “STOP”, and “RUN”. Switch shall be positively opened mechanically and opening shall not be solely dependent on springs.

2.36 OPERATING STATIONS AND CONTROL PANEL
A. Operating stations and control panels shall be stainless steel, flush mounted in or adjacent to hoistway.
   1. All faceplates shall have all edges beveled at least 15 degrees.
   2. Fasten all faceplates with non-corrosive, spanner head, white metal or bristol head, tamperproof screws.
   3. Operating pushbuttons in faceplates shall be designed so that pressure on contact shall be independent of pressure on operating pushbutton. All pushbuttons shall be of the "non-sticking" type.
   4. Each switch and operating device shall have indelible, 6 mm (¼ inch) high legends to indicate its identity and position.

B. Provide at each floor served by material lift, a complete set of operating pushbuttons with 13 mm (½ inch) numbers in the face of the button corresponding to the floors served. Pushbuttons shall not protrude beyond the faceplate when in normal position. Call register lights located within or behind the buttons, shall illuminate the floor numeral corresponding to the call registered. Also, provide an "In Use" light in this panel to show when material lift is in operation or the door is open.

C. Provide for material lift, a separate control panel at the makeup area and as shown on drawings, containing the following:
   1. Key operated "ON/OFF" service switch.
   2. Call and Send buttons to upper floors.
   3. Door "Open" and "Close" buttons for maintenance purposes and manual operation.
   4. A red-jewel, pilot light to indicate a malfunction in the system.

2.37 CALL AND SEND FLOOR DISPATCHING

A. Dispatch carts from make-up area level to designated Floor and return.
   1. Carts shall be manually placed on material lift platform. Destination button activation shall illuminate that button indicating call registration.

B. Thereafter, the following sequence of events shall take place.
   1. Hoistway and car doors shall automatically close.
   2. Material lift shall proceed to the destination.
   3. Car buzzer shall sound prior to the door's opening:
   4. Hoistway and car doors shall automatically open.
   5. Case cart is manually removed from lift.
   6. Hoistway and car doors shall be closed.
   7. Car shall be returned to the central station floor and answer the next call if one has been placed or remain at this level and park with its hoistway and car doors closed until another dispatch is made.
8. If a cart is not unloaded at the destination floor, an adjustable timer, set at 60 sec. will close the doors starting with a 5 second warning buzzer. The car will return to Central Station with cart.

PART 3—EXECUTION

3.1 PREPARATION
A. Examine work of other trades on which the work of this Section depends. Report defects to Resident Engineer in writing, which may affect the work of this trade or equipment operation.
B. Ensure that shafts and openings for moving equipment are plumb, level and in line.
C. Before fabrication, take necessary job site measurements, and verify where work is governed by other trades. Check measurement of space for equipment, and means of access for installation and operation. Obtain dimensions from site for preparation of shop drawings.
D. Ensure the required preparatory work, provided under other Sections has been properly completed to receive the elevator work.
E. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.

3.2 INSTALLATION
A. Perform work with competent mechanics skilled in this work and under the direct control and supervision of the elevator manufacturer’s experienced foreman.
B. Set hoistway entrances in alignment with car openings, and true with plumb sill lines.
C. Install machinery, guides, controls, car and all equipment and accessories in accordance with manufacturer’s instructions, applicable codes, and standards, to provide a quiet, smooth operating installation, free from sideway, oscillation or vibration.
D. Grout sills and hoistway entrance frames.

3.3 CLEANING
Prior to final acceptance, remove protection from finished or ornamental surfaces, and clean and polish surfaces with due regard to type of material.

3.4 SPACE CONDITIONS
A. Attention is called to overhead clearance, pit clearances, overall space in machine room, and construction conditions at building site in connection with elevator work. Provide proper, satisfactory code legal installation of equipment as a whole, including all construction, accessories and devices in connection with elevator, mechanical and electrical work specified herein.
B. Any construction changes or relocation of equipment, conduit, wiring, etc., required to accomplish the specified elevator installation must be arranged for and obtained by the Contractor, subject to the approval of the Contracting officer. Cost of such changes shall be included in the base bid and shall form a part of the contract.

3.5 WORKMANSHIP AND PROTECTION
A. All installations shall be made in a first class, neat and skillful manner by mechanics experienced in the trade involved. All details of the installation shall be mechanically and electrically correct. All materials and equipment shall be new, and without imperfections.

B. No structural members shall be cut or altered. Work in place which is damaged or defaced shall be restored equal to original condition.

C. Finish work shall be straight, level and plumb, with true, sharp surfaces and lines. All machinery and equipment shall be protected against dirt, water or mechanical injury. At final completion, all work shall be thoroughly cleaned, and delivered in perfect unblemished condition.

3.6 PRE-TEST AND TEST

A. Pre-test, as per specifications, the elevators and related equipment, in the presence of the Resident Engineer for proper operation before requesting final inspection. Conduct final inspection at other than normal working hours, if required by Resident Engineer.

1. Procedure outlined in the "Inspectors' Manual for Electric Elevators, "ASME A17.2.1 shall apply.
   a. Final test shall be conducted in the presence of and witnessed by a certified elevator inspector.
   b. Government shall furnish electric power including necessary current for starting, testing, and operating machinery of each elevator.

2. Contractor shall furnish the following test instruments and materials on-site and at the designated time of inspection: Properly marked testing weights, voltmeter, amp probe, thermometers, direct reading tachometer, and a mean of two-way communication.

3. If during the inspection process the Inspector determines the need, the following instruments should be available within a four-hour period: Megohm meter, vibration meter, sound meter, and a light meter.

B. Inspection shall be made of workmanship and equipment furnished and installed for compliance with specification.

C. Balance Tests: The percent of counterbalance shall be checked by placing test weights in car until the car and counterweight are equal in weight when located at the mid-point of travel. If the actual percent of counter balance does not conform to the specification, the amount of counterweight shall be adjusted until conformance is reached.

D. Full-Load Run Test: Elevators shall be tested for a period of one hour continuous run with full contract load in the car. During the test run, the car shall be stopped at all floors in both directions of travel for a standing period of not less than five nor more than ten seconds per floor.
E. Speed Test: The actual speed of the elevator shall be determined in both directions of travel with full contract load, balance load and no load in the elevator. Speed tests shall be made before the full load run test and after the full load run test. Speed shall be determined by applying a tachometer to the car hoisting ropes or governor rope. The actual measured speed of the elevator with all loads in either direction shall be within 5 percent of specified rated speed.

1. Full speed runs shall be quiet and free from vibration and sway. When cars are standing at the floor with doors open, they shall remain fully stopped with hoisting machine brake applied.

F. Temperature Rise Test: The temperature rise of the hoisting motor, shall be determined during the full load test run. Temperatures shall be measured by the use of thermometers inserted into the various windings. Under these conditions, the temperature rise of the equipment shall not exceed 50 degrees Centigrade above ambient temperature. Test shall be started only when all parts of equipment are within 5 degrees Centigrade of the ambient temperature at time of starting test. Other tests for heat runs on motors shall be as specified in the latest procedure of the Institute of Electrical and Electronic Engineers.

G. Car Leveling Test: Elevator car leveling devices shall be tested for accuracy of leveling at all floors with no load in car, balanced load in car and with contract load in car, in both directions of travel. Accuracy of floor leveling, shall be within plus or minus 6 mm (1/4 inch) of level with any landing floor for which the stop has been initiated regardless of load in car or direction of travel. The car leveling device shall automatically correct over travel as well as under travel and shall maintain the car floor within plus or minus 6 mm (1/4 inch) of level with the landing floor regardless of change in load.

H. Brake Test: The action of the brake shall be prompt and a smooth stop shall result in down direction with no load up to and including 125 percent of contract load in the car. Up travel is not required.

I. Insulation Resistance Test: The elevator's complete wiring system shall be free from short circuits and grounds and the insulation resistance of the system shall be determined by use of MEGGER, at the discretion of the Inspector conducting the test.

J. Overload Devices: All exposed overload current protection devices shall be tested within their designated circuitry. Overloads shall not be bench tested.

K. Safety Devices and governor Tests: The safety devices and governor shall be tested as required by Rule 8.10 of ASME 17.1.

L. Limit Stops:

1. The position of the car when stopped by each of the normal limit stops with no load and with contract load in the car shall be accurately measured. The car shall reach the terminal landings under the above condition.
2. Final position of the elevator relative to the terminal landings shall be determined when the elevator has been stopped by the final limits. The lower limit stop shall be made with contract load in the elevator. Elevator shall be operated at contract speed for both tests. Normal limit stopping devices shall be inoperative for the tests.

M. Oil Buffer Tests: These tests shall be conducted with operating device and limit stops inoperative and with contract load in the elevator for the car buffer and with no load in the elevator for the counterweight buffer. Preliminary test shall be made at the lowest (leveling) speed. Final tests shall be conducted at contract speed. Buffers shall compress and return to the fully extended position without oil leakage.

N. Setting of Car Door Contacts: The position of the car door at which the elevator may be started shall be measured. The distance from full closure shall not exceed that required by ASME A17.1. The test shall be made with the hoistway doors closed or the hoistway door contact inoperative.

O. Setting of Interlocks: The position of the hoistway door at which the elevator may be started shall be measured and shall not exceed ASME A17.1 requirements.

P. Operating and Signal System: The elevator shall be operated by the operating devices provided and the operation signals and automatic floor leveling shall function in accordance with requirements specified. Starting, stopping and leveling shall be smooth and comfortable without appreciable steps of acceleration or deceleration.

Q. Performance of the Elevator supervisory system shall be witnessed and approved by the Resident Engineer or the representative of the Resident Engineer.

R. If any equipment fails test requirements and a reinspection is required, the contractor shall be responsible for cost of reinspection, including salaries, transportation expenses, and other expenses incurred by the representative of the Resident Engineer.

3.7 PAINTING AND FINISHING:

A. Elevator motors and the like shall be factory painted with manufacturer's standard finish and color.

1. Elevator motors, controllers, and crossheads of material lift shall be identified by 4-inch high numerals and letters located by code and as directed. Color of numbers shall contrast with color surfaces to which they are applied.

2. Surface (except contact surfaces of working parts) of elevator items, such as, controllers, car frame, underside of platforms, guide rails, rail brackets, all uncoated ferrous metal items shall be given an approved prime coat.

3. Upon completion of installation and prior to final inspection, all equipment shall be thoroughly cleaned of grease, oil, cement, plaster, and other debris. All equipment, except that otherwise specified as to architectural finish, shall then be given two coats of paint.
4. Paint floor designation numbers not less than four inches high, on hoistway doors, fascias and/or walls as required by Rule 211.4 of the Code. The color of the paint used shall contrast with the color of the surfaces to which it is applied.

B. Hoistway entrances of material lift.
   1. Door panels shall be stainless steel with a brushed finish.
   2. Fascia plates, toe guards, dust covers, hanger covers and other metal work, including built-in or hidden work and structural metal, (except stainless steel entrance frames and surfaces to receive baked enamel finish) shall be given an approved prime coat in the shop, and one field coat of paint of approved color.

3.8 INSTRUCTION OF EMPLOYEES

A. Provide competent instructors to train VA personnel in the operation of all parts of equipment. Instruction on elevator shall be given during regular working hours. Instruction shall commence upon completion of all work required and upon initial operation before final acceptance of work. Instructors shall be qualified representatives, possessing complete knowledge of equipment.

B. Instructors shall be available for one 8-hour working day, minimum, with instruction period directed by the Resident Engineer.

C. In addition to oral instruction, written instructions in triplicate relative to care, adjustment and operation of all parts of equipment shall be furnished and delivered to the Resident Engineer in independently bound folders. Video cassette recording will also be acceptable. Written instructions shall include complete, correct and legible wiring diagrams, nomenclature sheets of all electrical apparatus, including location of each device, complete and comprehensive sequence of operations, complete parts lists with descriptive literature and identification, diagrammatic cuts of equipment and parts, etc. Information shall also include electrical operating characteristics of all circuits, fields, relays, timers and electronic devices, as well as RPM values and related characteristics for all rotating equipment. Provide any supplementary instructions for adjustment and care of new equipment as may become necessary due to changes, modifications and/or replacement of equipment or its operation, under requirements of paragraph entitled, "WARRANTY".

3.9 INSPECTIONS AND MAINTENANCE:

A. Furnish complete maintenance and inspection service on entire elevator installation for a period of (1) one year after completion and acceptance of the elevator installation by the Resident Engineer. This maintenance service shall begin concurrently with the warranty. Maintenance work shall be performed by skilled elevator personnel directly supervised by the same company that installed the elevator equipment specified herein.

B. The maintenance service shall include the following:
   1. Bi-Weekly systematic examination of equipment.
2. Cleaning, lubricating, adjusting, repairing and replacing of all parts as necessary to keep the equipment in first class condition and proper working order.

3. Furnishing all lubricant, cleaning materials and parts required.

4. Equalizing tension, shortening or renewing of hoisting ropes where necessary.

5. The performance standards set forth in this specification, including cycle time and door times shall be maintained at all times.

6. The operational system shall be maintained to the standards specified hereinafter including any changes or adjustments required to meet varying conditions of hospital occupancy.

7. Maintain smooth starting and stopping and accurate leveling at all times.

C. Maintenance service shall not include the performance of any work required as a result of improper use, accidents, or negligence for which the contractor is not directly responsible.

D. Service and emergency personnel shall report to the Resident Engineer or his authorized representative upon arrival at the hospital and again upon completion of the required work. A copy of the work ticket containing a complete description of the work performed shall be given to the Resident Engineer.

E. The contractor shall maintain a log in the machine room. The log shall list the date and time of all weekly examinations and all trouble calls. Each trouble call shall be fully described including the nature of the call, necessary correction performed or parts replaced.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION
A. This section of the specification includes the engineering, furnishing and installation of the complete hydraulic material lift system as described herein and indicated on the drawings.
B. Hydraulic Material lift No. C- shall be oil hydraulic type with central station dispatching, signal system car leveling device, power-operated car and hoistway doors.

1.2 QUALITY CONTROL
A. Approval by the Contracting Office is required of products or services of proposed manufacturer, suppliers, and installers, and will be based upon submission by Contractor of certification that:
1. Manufacturer regularly and presently manufacturers electric oil hydraulic elevators as one of his principal products.
2. Installer has technical qualifications of at least three years experience, trained supervisory and installation personnel, and facilities to install specified items. Approval will not be given, however, where the experience record on either government, municipal, or commercial projects is one of unsatisfactory performance.
3. Manufacturer's product submitted has been in satisfactory and efficient operation at three installations similar to this project for not less than three years. Submit list of installations; include names and addresses of Medical Centers and Medical Centers Administrators thereof.
4. There is a permanent service organization maintained or trained by manufacturer which will render satisfactory service to this installation within two hours of receipt of notification that service is needed. Submit name and address of service organization.
B. Contracting office retains the right to approve an experience record and service facilities less than those specified when the best interest of the government would be served by such action and objectives of the specifications are fulfilled.

1.3 APPLICABLE PUBLICATIONS
A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
B. Federal Specifications (Fed. Spec.):
   J-C-30A(l) ..................................Cable and Wire: Electrical (Power, Fixed Installation)
   J-C-580B(l) ................................Cord, Flexible and Wire, Fixture (Electrical 0 to 600-volt service).
   W-C-596/12D .............................Connector, Plug, Electrical; Connector, Receptacle, Electrical
   W-F-406D...................................FF-S-325 .Fittings for Cable, Power, Electrical and Conduit, Metal Flexible
W-F-408E .................................. Fittings for Conduit, Metal, Rigid, (Thick-Wall and Thin-Wall (EMT) Type)
W-S-610E .................................. Splice, Connector
FF-S-325 .................................. Shield, Expansion, Nail, Expansion; and Nail, Drive INT AMD-3 Screw (Devices, Anchoring, Masonry)
QQ-S-766D(5) ............................ Steel Plates, Sheets, and Strip-corrosion.
WW-C-566C ............................... Conduit, Metal flexible.
WW-C-563A ............................... Conduit, Metal, Rigid; Electrical, Thin-Wall Steel Type (Electrical Metallic Tubing): Straight Lengths, Elbows, and Bends.
WW-C-581E(3) ............................ Conduit, Metal, Rigid; and Coupling, Elbow, and Nipple, Electrical Conduit: Zinc-coated.

C. American Society of Mechanical Engineers (ASME):
   A17.2-2001 .................................. Inspectors Manual for Hydraulic Elevators

D. National Fire Protection Association (NFPA):
   70-2002 or current code ............ National Electrical Code (NEC)
   252-2003 .................................. Fire Test of Door Assemblies

E. American Society for Testing and Materials (ASTM):
   ASTM A1008/A1008M-02 ............ Steel, Sheet and Strip, Low Carbon, Structural, High-Strength Low-Alloy and High Strength Low-Alloy with Improved Farability

F. Gages:
   1. For Sheet and Plate: U.S. Standard (USS)
   2. For Wires: American Wire Gauge (AWG)

G. American Welding Society (AWS):
   D1.1-2002 .................................. Structured welding Code - Steel

H. National Electrical Manufacturers Association (NEMA)
   LD3-2000 .................................. High-Pressure Decorative Laminates

I. Underwriter's Laboratories (UL):
   486A-97 ninth Edition ............... Safety Wire Connectors and Soldering Lugs for Use with Copper Conductors

1.4 SUBMITTALS

A. In accordance with Section 01340 Samples and Shop Drawings shall be submitted separately and apart from materials specified under other Section, and shall be marked "SUBMITTED UNDER SECTION 14133". "All submitted drawings and related elevator material should be forwarded to the Contracting Officer.

B. Shop Drawings:
   1. Complete dimensioned layout of each material lift installation in plan, elevation, and section.
2. Complete layout showing location of storage tank; pump; controller; outside diameter of cylinder; plunger; piping layout and working pressure; clearance of car at top and bottom of hoistway when car makes normal stops at terminals, and clearance of car at bottom of hoistway; car platform; size of car frame members; support assembly and weights of principal parts.

3. Complete drawings of hoistway entrances and doors showing details of construction, and method of fastening to structural members of building:
   a. If dry-wall construction is used to enclose hoistway, submit details of interface fastenings between entrance frames and drywall.

4. Drawing showing methods of fastening conduit or duct systems, fixture boxes, fascia plates, intermediate supports, rail brackets, etc., hoistway construction.

5. Complete drawings of material lift car enclosure, showing dimensioned details of construction, location of car equipment, fastenings to platform, car lighting, and top exit.
   a. Dimensioned drawings showing details of guide shoes.

6. Dimensioned drawings showing details of all signal and car equipment and fixtures.

7. Complete drawings showing details of jack unit.

8. Complete drawings and characteristic curves of elevator pump.

9. Dimensioned drawings and description of operator, photo-electric devices, etc.

10. Complete drawings and characteristic curves of elevator motor.

11. Dimensioned drawings and description of hoistway door hangers.

12. Cuts of drawings of hydraulic fluid scavenger pump system.

13. Complete dimensioned hydraulic fluid storage tank and jack unit.

14. Drawings showing details of controllers, selectors and supervisory panels.

C. Samples and Descriptive Data:

1. Materials shall be submitted separately and apart from materials specified under other Sections, and shall be marked "SUBMITTED UNDER SECTION 14133". In accordance with provisions of Section 01340, SAMPLES AND SHOP DRAWINGS, furnish the following:

2. Before executing any work, furnish information sufficient to evidence full compliance with contract requirements on proposed items. Such information shall include, as required: Manufacturer's Name, Trade Names, Model or Catalog Number, Nameplate Data (size, capacity, rating), and corresponding specification reference (Federal or project specification number and paragraph).

3. Samples:
   a. One each stainless steel, 3-inches by 5-inches.

4. Materials Data: Submit the following applicable for approval on the shop drawings:
   a. Name of manufacturer, type or style designation of controllers.
   b. Name of manufacturer, type or style designation, and size of hydraulic power unit.
c. Name of manufacturer, type or style designation, horsepower and R.P.M. of hydraulic power unit motor.
d. Name of manufacturer, type of style designation of electric control valves, including capacity range.
e. Name of manufacturer, type or style designation of electric power, power door operator.
f. Manufacturer, type or style designation of hoistway door interlocks and electric contacts.
g. Name of manufacturer, type or style designation, stroke certified maximum and minimum loads and maximum striking speed of car buffers.
h. Name of manufacturer, type, material and thickness of self-adhesive tape of cylinder wrap.
i. Name of manufacturer, type of style designation, HP and CFM rating on cab ventilation unit.
j. Name of manufacturer, type or style designation of scavenger line and pump.

D. Certificates:
   1. Furnish certificates as required under Paragraph "QUALITY CONTROL".

1.5 WIRING DIAGRAMS
A. Provide three (3) sets field wiring and straight line wiring diagrams showing all electrical circuits of all elevator equipment. In the hoistway, as well as the machine room, framed under plastic or on pivoted hardboards coated with an approved plastic sealer, and mounted in each elevator machine room as directed by Resident Engineer. In the event field modifications are found necessary during installation, diagrams shall be revised to include all corrections made prior to and during the final inspection.

B. Diagrams shall be delivered to the Resident Engineer within 30 days of final acceptance.

1.6 PERFORMANCE STANDARDS
A. The material lifts shall be capable of meeting the highest standards of the industry and specifically the following:
   1. Contract speed shall mean speed in the UP direction with full capacity load in the car. Speed variation under any load condition, regardless of direction, shall be no more than ten (10) percent.

B. Floor Accuracy
   1. Accuracy shall be maximum 6 mm (1/4 inch) above or below the floor, regardless of load condition.

1.7 WARRANTY
A. All labor and materials furnished in connection with material lift system and installation of same shall be subject to terms of "Warranty of Construction" articles of Section 01001, GENERAL CONDITIONS, including expendable. Upon receipt of notice from Government of failure of any portion of materials and/or workmanship furnished, affected part or parts shall be replaced promptly with new parts by and at the expense of Contractor. Warranty shall commence upon final inspection and completion of performance test and upon full acceptance of the installation. Warranty shall run concurrently with the maintenance period.

B. No device shall be acceptable that will not give full satisfaction without excessive maintenance and attention. If it becomes evident during warranty period that device is not functioning properly or in accordance with specification requirements, or if in the opinion of the Contracting Officer, excessive maintenance and attention must be employed to keep device operational, device shall be removed and a new device meeting all requirements shall be installed as part of work until satisfactory operation of installation is obtained. Period of warranty shall start anew for such parts from date of completion of each new installation performed, in accordance with foregoing requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Where stainless steel is specified, it shall be corrosion resisting steel with brushed finish on exposed surfaces. Stainless steel shall have the grain of belting in the direction of the longest dimension and surfaces shall be smooth and without waves. During erection, all stainless steel surfaces shall be protected by suitable material.

B. Where cold rolled steel is specified, it shall be low carbon steel rolled to stretcher leveled standard flatness.

2.2 MANUFACTURED PRODUCTS

A. Materials, devices and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items. Items not meeting this requirement, but which otherwise meet technical specification, and the merits of which can be established through reliable test reports or physical examination of representative samples, will be considered.

B. When two or more units of same class of materials, devices, or equipment are required, these units shall be product of one manufacturer.

C. Manufacturers of equipment assemblies which include components made by others shall assume complete responsibility for the final assembled unit.
   1. All components of an assembled unit shall be product of same manufacturer.
   2. Parts which are alike shall be the product of a single manufacturer.
   3. Components shall be compatible with each other and with the total assembly for the intended service.
D. Welding at the project site shall be made by welders; and welding operators who have previously qualified by test as prescribed in American Welding Society Publication to perform the type of work required.

E. Motor nameplates shall state manufacturer's name, rated horsepower, speed, volts, amperes and other characteristics required by NEMA standards, and shall be securely attached to the item of equipment in a conspicuous location.

F. Where key operated switches and/or key operated cylinder locks are furnished in conjunction with any component of the material lift installation, four keys for each individual switch or lock shall be furnished. Each key shall be attached to a tag bearing a stamped or etched legend identifying its purpose. Tags shall be in accordance with “Property of U.S. Government” on reverse side of tag. Barrel keys not acceptable.

2.3 CAPACITY, SPEED, TRAVEL

A. The material lift shall have the capacity to lift the live load exclusive of the weight of entire car and plunger, all as specified in the following schedule:

<table>
<thead>
<tr>
<th>Material Lift Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall Platform Size</td>
</tr>
<tr>
<td>Rated Load - kg(pounds)</td>
</tr>
<tr>
<td>Rated Speed - m/s(fpm)</td>
</tr>
<tr>
<td>Total Travel - m/s(fpm)</td>
</tr>
<tr>
<td>Number of Stops</td>
</tr>
<tr>
<td>Number of Openings</td>
</tr>
<tr>
<td>Entrance Type &amp; Size</td>
</tr>
</tbody>
</table>

B. Actual material lift speed shall not vary more than 10 percent above nor more than 10 percent below specified speed.

2.4 POWER SUPPLY

A. For power supply in the machine room, see specification Division 16, ELECTRICAL and electrical drawings.

B. It shall be the electrical contractor's responsibility to supply the labor and materials for the installation of the following:
   1. A feeder from the power source indicated on the drawings to the hydraulic controller.
   2. Shunt trip circuit breaker for the controller located at the strike side of the machine room door. Shall be lockable in the “Off” position.
   3. Power wiring between the shunt trip and the controller.
4. Auxiliary circuits for hydraulic signal and control systems as indicated on the drawings, from the indicated source to the hydraulic controller. The hydraulic controller, motor and power and signal wiring from the controller to the machine shall be supplied and installed by the elevator contractor.

2.5 CONDUIT

A. Unless otherwise specified or approved, all electrical conductors, except traveling cable connections to the car, shall be installed in rigid zinc coated steel or aluminum conduit, electrical metallic tubing or metal wireways. Where permitted by NEC, 13mm (1/2 inch) trade size conduits and EMT may be used only for tap connections to interlocks, emergency exits and leveling units. All raceways completely embedded in concrete slabs, walls, or floor fill shall be rigid steel conduits. No rigid conduit or electrical metallic tubing shall be smaller than 13 mm(1/2 inch) electrical trade size. An auxiliary gutter may be used between controller, starter, and similar apparatus in the elevator machine room. Self supporting connections, where approved, shall be fully protected from abrasion, or other mechanical injury. Flexible metal conduit not less than 9.5mm (3/8 inch) electrical trade size may be used, not exceeding 457 mm (18 inches) in length, for short connections between risers and limit switches, interlocks, and for other applications permitted by the NEC. Flexible heavy duty service cord, type S.O., may be used between fixed car wiring and switches on car doors for safety edges and light ray devices.

B. Connect motors and other components subject to movement or vibration to the conduit or EMT systems with flexible conduit.

C. All conduit terminating in steel cabinets, junction boxes, wireways, switch boxes, outlet boxes and similar locations shall have approved insulation bushings. If the bushings are constructed completely of insulation material, a steel locknut shall be installed under the bushing. At ends of conduits not terminating in steel cabinets or boxes, the conductors shall be protected by terminal fittings having an insulated opening for the conductors.

D. Conduit and EMT fittings and connections using set screws or indentations as a means of attachment shall not be used.

E. Terminal boxes shall be provided for the conduit and wiring connections to the pump motor.

SEPC WRITER NOTE: Use Paragraph F for future floors only.

F. //Conduit, junction boxes, outlet boxes, etc., shall be sized for future travel requirements.//

2.6 CONDUCTORS
A. Unless otherwise specified, conductors, exclusive of traveling cables, shall be stranded or solid coated annealed copper in accordance with Fed. Spec. J C 30 for either Type RHW or THW. Where 16 and 18 AWG are permitted by NEC, either single conductor cable in accordance with Fed. Spec. J C 580 for Type TF, and or multi conductor cable, may be used provided the insulation of single conductor cable and outer jacket of multi conductor cable is flame retardant and moisture resistant. Multi conductor cable shall have color coding or other suitable identification for each conductor. Conductors for control boards shall be in accordance with NEC. No joints or splices shall be permitted in wiring except at outlets. Tap connectors may be used in wireways provided they meet all UL requirements.

B. All wiring must test free from short circuits or grounds. Insulation resistance between individual external conductors and between conductors and ground shall be not less than one megohm.

C. Where size of conductors is not given, capacity shall be such that maximum current shall not exceed limits prescribed by NEC.

D. Equipment grounding shall be provided. Ground conduits, supports, controller enclosures, motors, platform and car frames, and all other non-current conducting metal enclosures for electrical equipment in accordance with NEC. The ground wires shall be copper, green insulated and sized as required by NEC. Bond the grounding wires to all junction boxes, cabinets, and wire raceways.

E. Terminal connections for all conductors used for external wiring between various items of elevator equipment shall be solderless pressure wire connectors in accordance with Fed. Spec. W S 610. The Contractor may, at his option, make these terminal connections on No. 10 or smaller conductors with approved terminal eyelets set on the conductor with a special setting tool, or with an approved pressure type terminal block. Terminal blocks using pierce through serrated washers are not acceptable.

SPEC WRITER NOTE: If future travel is specified, include paragraph 2.6, F.

F. //Conductors shall be installed from junction box in hoistway to controller for future travel requirements.//

2.7 TRAVELING CABLES
A. All Conductors to the car shall consist of flexible traveling cables conforming with the requirements of NEC. Traveling cables shall run from the junction box on the car to a junction box in the hoistway or directly to machine room. Junction boxes in the hoistway and on car shall be equipped with terminal blocks. Terminal blocks having pressure wire connectors of the clasp type that meet UL 486 requirements for stranded wire may be used in lieu of terminal eyelet connections. Terminal blocks shall have permanent indelible identifying numbers for each connection. Cables shall be securely anchored to avoid strain on individual terminal connections. Flame and moisture resistant outer covering must remain intact between junction boxes. Abrupt bending, twisting and/or distortion of the cables shall not be permitted.

B. Provide 10 percent, but not less than 4 spare conductors in each traveling cable.

2.8 CONTROLLERS

A. All controllers required for the control, including dispatching, signals, and door operation of the system, shall be either the floor mounted freestanding type or wall mounted type with NEMA, Type 1, General Purpose Enclosures totally enclosed with hinged doors that lock, fastened rigidly to either the floor or the wall. Controller panels shall be moisture resistant, nonconductive, and non combustible material of adequate thickness to support components mounted thereon. All switches and relays shall be mounted on front of panel with all controller wiring, enclosed in approved flame retardant, nonconductive duct. Switches and relays may be opened by either restrained compression or leaf type contact springs in lieu of gravity. All similar switch and relay units on controller shall be of the same manufacturer. Connectors between front and rear shall be studs or through-bolt connections. Wiring connections for operation circuits and external control circuits shall be brought to terminal blocks on controller. Circuit connectors for external circuits shall be made with wire connectors or metal eyelets. Pressure type wire connectors shall be in accordance with Fed. Spec. W S 610. Contacts shall be of design and material to insure maximum conductivity, long life, and reliable operation without overheating or excessive wear. All relays and contractors shall be magnet operated. Resistance for solenoids, etc., shall be wire, wound on non combustible insulating material. Controller wiring shall be neatly arranged, readily accessible, easily traced and securely fastened in place. All spare conductors to controller shall be identified.

B. Identify each device and fuse (ampere rating) on panels by name, letter, or standard symbol, in an approved indelible and legible manner on device or panel. Coordinate identification markings with identical markings or wiring diagrams.

C. The elevator contractor shall provide solid state components and printed circuit boards to control the hydraulic machine and/or signal functions. Complete details of the components and printed circuit boards, together with a complete operational description, shall be submitted for approval prior to manufacturer. The following features shall be incorporated in the design:
1. The electrical connections between the printed circuit boards (modules) and the circuit connectors incorporated in the mounting racks shall be made through individual tabs which shall be an integral part of each module. The tabs shall be nickel-gold plated or other approved metal of equal electrical characteristics. Modules shall be notched so prevent insertion of the modules in the inverted position.

2. Light emitting diode (LEDs) may be used for visual monitoring of individual modules.

3. Components shall have interlocking circuits to assure failsafe operation and to prevent unwarranted elevator movement should any component fail to function properly.

4. Method of wire wrappings for point to point wire connections on the mounting racks shall be submitted for approval.

5. Modules shall be of the type that plug into pre-wired mounting racks. No field wiring or alteration shall be necessary in order to replace defective modules.

6. Any field wiring changes required during construction shall be made only to the mounting rack connection points and not to the individual module circuitry or components. If it becomes necessary to alter individual modules, they shall be returned to the factory where such design changes shall be made and module design records changed so that correct replacement units shall be available.

7. Module boards shall be fabricated from non-conductive, non-corrosive material and shall be of sufficient strength so as to support all components mounted thereon without warping. Mounting racks shall be spaced sufficiently apart to prevent accidental contact between individual modules.

8. All logic symbols and circuitry designations shall be in accordance with ASME Standards.

9. Solid state components shall be designed to operate at a maximum of 110 degrees F.

10. Wiring connections for operating circuits and for external control circuits shall be brought to terminal blocks mounted in an accessible location within the controller cabinet. Terminal blocks using pierce-through serrated washers shall not be acceptable.

SPEC WRITER NOTE: If future travel is planned, include the following paragraph.

11. //Controllers shall be provided with wiring and components for additional future travel of ___ floors and approximate ___ feet of travel.//

2.9 MICROPROCESSOR CONTROL SYSTEM

A. Provide solid state components and printed circuit boards to control hydraulically operated control valves to govern direction, acceleration, running, deceleration, leveling and stopping. Complete details of the components and printed circuit boards, together with a complete operational description, shall be submitted for approval.

B. Provide safety switch to cut off electric power to motor and valves, and stop material lift upon operation of any electrical safety device.
2.10 HYDRAULIC JACK UNIT

A. Cylinder and plunger shall be designed in accordance with ASME A17.1. It shall be of sufficient size to lift gross load the height specified, and shall be factory tested at a pressure equal to twice the calculated working pressure, for strength and to insure freedom from leakage. Bottom of cylinder head shall be dished concave to pressure and provided with safety bulkhead and top shall be provided with internal guide bearing and cylinder head. Cylinder head shall include a removable packing gland. Packing gland shall permit ready replacement of packing.

1. Provide a bleeder valve located below the cylinder flange on the jack unit to release air or other gases from the system.
2. Equip cylinder with drip ring below the packing gland to collect leakage of hydraulic fluid.
3. A double walled cylinder shall be used.
4. The jack unit mounting brackets shall be bolted to continuous footing channels that also support the rails and buffers.

B. A copper tubing scavenger line with a electrically operated pump and self cleaning strainers shall be installed between the piston drip ring and oil storage tank. Scavenger line, pump and strainer shall operate independently of hydraulic fluid pressure. Equip scavenger pump with a water float designed to prevent operation of the pump, should the pit flood. Design to be manually reset. Strap the pump and reservoir to the pit floor.

C. Plunger shall be heavy seamless steel tubing, turned smooth and true to within plus or minus .003 mm (0.015 inches) tolerance and no diameter change greater than .0007 mm (0.003 inches) per inch of length. Plunger surface shall be ground to a fine polish finish, 12 micro-inches or finer. Where plunger is multi-piece construction, machine turn the joints to assure perfectly matching surfaces. No tool marks shall be visible.

1. Secure plunger to underside of platform supporting beams with fastenings capable of supporting four times the weight of the plunger. The platen shall incorporate piston car vibration isolator as, hereinafter, specified.
2. Provide a stop ring electrically welded or screwed to the bottom of plunger to positively prevent plunger from leaving its cylinder. The plunger head shall be isolated from the platen to prevent corrosion and/or electrolysis.
3. Plunger shall be carefully protected and if gouged, nicked or scored, shall be replaced.

SPEC WRITER NOTE: If future travel is specified, include the following paragraph.

5. //For jack units that include future travel, locate the stop ring to permit only the actual travel and required runby//.

2.11 HYDRAULIC JACK UNIT CASING
A. The casing shall be iron or steel not less than .095 mm (0.375 inch) thick, at least 15.2 mm (six inches) larger in diameter than the cylinder. The casing shall be accurately set, positioned, and plumbed to accept jack unit. The bottom shall be closed with a minimum of 6 inches of concrete. Before setting, entire outside surface of casing shall be heavily double mopped with layers of hot asphalt, or an approved equal method of protection may be used. After setting, the top of the casing shall be sealed.

B. Provide PVC casing liner to fit inside steel casing or enclosed around jack unit. Fabricate from schedule 80 PVC pipe with watertight bottom and a top flange gasketed to seal to plunger flange and to form a complete, watertight, electrically non-conductive encasement of the under unit. Provide two one-inch diameter PVC filler elbows and caps at the top of the casing liner. Fill space between jack unit and casing liner with a petroleum based corrosive preventative.

C. Provide suitable well hole to accommodate casing. Coordinate the drilling of jack hole and setting cylinder with construction of concrete pit. Joint between the casing and the pit floor at bottom of pit shall be made watertight.

D. Bid shall be based on drilling hole in dirt, sand, rock, gravel, loam, boulders, hardpan, water, or other obstacles. The removal of all dirt and debris shall also be included.

2.12 PUMP UNIT ASSEMBLY

A. The pump unit for the control of the material lift shall be completely integrated, and self-contained in a unit fabricated of structural steel. The unit shall consist of a hydraulic fluid pump driven by an induction motor together with oil control valves, piping, etc. No hydraulic equipment shall be installed within the storage tank. Unit shall be completely enclosed on four open sides of the power unit frame with not less than 16-gauge steel removable panel sections. Panel sections shall be fully lined on the interior with one-inch rigid board, mineral glass fiber, or equivalent acoustical insulation.

B. Hydraulic system shall be designed so that working pressure shall not exceed 500 p.s.i. under any loading condition.

C. Pump shall be positive-displacement, rotary screw type, specially designed for hydraulic elevator service, having a steady discharge without pulsation to give smooth and quiet operation. Pump output shall be capable of lifting material lift car with rated capacity, with a speed variation of no more than ten percent between no load and full load in either direction. Pump shall operate under flooded suction in an accurately machined case with the clearance required to assure maximum efficiency. Provide self cleaning strainer in suction line to pump. Hydraulic fluid by-pass shall discharge directly into storage tank.

D. Motor shall be squirrel cage, drip proof, ball bearing, induction type, with a synchronous speed not in excess of 1800 R.P.M. Motor shall be designed specifically for material lift service, shall not exceed nameplate full load current by more than 10% and be continuously rated 120 starts per hour without exceeding a rise of 40 degrees C. Include electric soft starting.
E. Connect motor and pump with multiple V-belt. Belts and sheaves shall be sized for duty involved and designed to prevent any metallic contact between motor and pump shaft. Provide isolation units of rubber in shear to prevent transmission of pump and motor vibration to the building. Install expanded metal sheave guard that can be easily removed for servicing and inspection.

2.13 HYDRAULIC SYSTEM

A. The storage tank shall be sheet steel, of welded construction, and shall have a steel cover, suitable means for filling, a minimum one inch protected vent opening, an overflow connection, and a valved drain connection. Tank shall act as a storage tank only, and shall be of size to pass through machine room door as shown on drawings. Provide marked gauge to meter hydraulic fluid level. Tank shall be of capacity to hold volume of hydraulic fluid required to lift material lift to top terminal landing, plus a reserve of not less than ten gallons. Provide a baffle in the bottom of the tank to prevent entry of any sediment or foreign particles into hydraulic system. Baffle shall also minimize aeration of hydraulic fluid. Permissible minimum hydraulic fluid level shall be clearly indicated. Hydraulic fluid shall be of good grade to assure free flow when cool, and shall have minimum flash point of 204.4 degrees C (400 degrees F). Provide initial supply of hydraulic fluid for operation of material lift.

1. The viscosity of the hydraulic fluid shall be thermostatically controlled to maintain the fluid temperature in the reservoir, pump and valves at a constant operating viscosity.

2. Provide a data plate on the tank framing indicating the characteristics of the hydraulic fluid used.

B. Connections shall be furnished and installed between the storage tank, pump, muffler, operating valves, and cylinder complete with necessary valves, pipe supports, and fittings. All connections between the discharge side of the pump, check valve muffler, cylinder and lowering valves shall be of schedule 80 steel with screw, flanged, welded, or approved flexible or mechanical couplings. Size of pipe and couplings between cylinder and pumping unit shall be such that fluid pressure loss is limited to 4.5 kg (10 pounds).

C. Valves, piping, and fittings shall not be subjected to working pressure greater than those recommended by the manufacturer.

D. Support all horizontal piping. Place hangers or supports within 304 mm (12-inches) on each side of every change of direction of pipe line and space supports not over 3.0 meters (10 feet) apart. Secure vertical runs properly with iron clamps at sufficiently close intervals to carry weight of pipe and contents. Provide supports under pipe to floor.

1. Provide all Piping from remote machine room to hoistway, including necessary supports and/or hangers. If remote piping is underground or in damp, inaccessible areas, use galvanized pipe.
E. Install pipe sleeves where pipes pass through walls, floors, etc. Sleeves shall be set during construction. After installation of piping, the sleeves shall be equipped with snug fitting inner liner of either glass or mineral wood insulation.

F. Install blowout-proof, non-hammering, oil hydraulic muffler in the hydraulic fluid supply pressure line near power unit in machine room. Muffler shall be designed to reduce to a minimum any pulsation or noises that may be transmitted through the hydraulic fluid into the hoistway.

G. Control valves shall be solenoid operated and arranged so hydraulic fluid flow will be controlled in positive and gradual manner to insure smooth starting and stopping of material lift. Provide manually operated lowering valve which shall permit manual lowering of material lift in event of failure. The manual lowering valve shall be arranged to limit the maximum descending speed under manual operation to 25 F.P.M. Provide external tank shut off valve to isolate hydraulic fluid during maintenance operations. Provide all pump relief and other auxiliary valves to comply with the requirements of the Code and to insure smooth, safe, and satisfactory operation of material lift. Bypass and relief valve shall be furnished and adjusted in accordance with Rule 3.19.4.2 of the ASME A17.1. Check valve shall be installed to hold the material lift cab with rated load at any point when the pump stops. Provide gate valve at cylinder inlet capable of withstanding 150 percent pressure. Install a line strainer between oil hydraulic muffler and gate valve. The manual lowering valve shall be in a convenient location, easily accessible, and properly identified with a red arrow and not concealed within the storage tank. The operating handle shall be marked in red.

H. Provide a low oil control feature which shall shut off the motor and pump and return the material lift to the lowest landing. Upon reaching the lowest landing, doors will open automatically. Doors shall then close. All control buttons, except the door open button, shall be made ineffective.

I. Provide oil tight drip pan for assembled pumping unit, including storage tank. Pan shall be not less than 16 gauge sheet steel, with one inch sides.

J. The entire hydraulic system, including muffler, shall be tested to withstand a pressure equal to twice the calculated working pressure. Working pressure maximum shall be 500 psi. Submit certification that test has been performed.

K. The manual lowering valve shall be in a convenient location, easily accessible, and properly identified with a red arrow and not concealed within the storage tank. The operating handle shall be marked in red.

2.14 GUIDE RAILS

A. Guide rails shall be planed steel, standard T-Section, securely fastened to building structure with steel brackets by means of bolts and forged steel rail clips. Rails shall weigh not less than 8 pounds per foot. Rails shall conform in all respects with the Code, and shall be located so that the entire car assembly shall be in true balance with the guide rails.
B. Guide rails shall be supported by brackets at each floor. Where fastenings are over 4.3 meters (14 feet) apart, rails shall be reinforced with 229 mm (9 inch) channel backing, or approved equal, to secure the rigidity required for material lift capacity, platform size and method of loading.

C. Fishplate bolts, bracket bolts, and rail clip bolts shall be fitted with split lock washers and drawn up tight. All joints shall be located so as not to interfere with supporting clamps and brackets. Shims used to secure rail alignment shall be designed so that they remain in position, even through the fastening bolts may be loosened.

D. Guide rails shall extend from channels on pit floor to within 76 mm (three inches) of the underside of the concrete slab at the top of the hoistway with a maximum deviation of 3.2 mm (1/8 inch) from plumb in all directions. Provide a minimum of 19 mm (¾ inch) clearance between bottom of rails and top of channels.

E. Guide rail anchorages in pit shall be made in a manner that will not reduce the effectiveness of the pit waterproofing.

F. Guide rails shall be clean and free of any signs of rust or abrasion, and shall be filed to remove all rough edges prior to final inspection. All guide rail joints shall be filed to assure perfectly matching surfaces.

G. For attachment of guide rails in concrete or brick, where steel framing is not available, install approved inserts or bond blocks.

2.15 CAR GUIDE SHOES

A. Install on car frame four flexible sliding swivel guide shoes, each assembled on a substantial metal base, to permit individual self alignment to the guide rails.

B. Provide each shoe with renewable non-metallic gib of durable plastic material having low coefficient of friction and long wearing qualities, when operated on guide rails receiving infrequent, light applications of rail lubricant. Gibs containing graphite or other solid lubricants are not acceptable.

C. Flexible guide shoes of approved design, other than swivel type, may be used provided they are self-aligning on all three faces of the guide rails.

D. Provide spring take up in car guide shoes for side play between rails.

2.16 CROSSHEAD DATA PLATE

Permanently attach a non-corrosive metal data plate to car crosshead. Data plate shall bear information required by Rule 2.16.3 and 2.20.2.1 of ASME A17.1. Such information shall be etched or stamped on plate.

2.17 CAR BUFFERS:

A. Provide a minimum of two spring buffers for each car, in accordance with Rule 3.22 of ASME A17.1. Buffers and supports shall be securely fastened to the pit channels, and in the alignment with striker plates on car. Permanently fasten to each buffer a metal plate showing stroke and loading rating. Buffer anchorage shall not puncture pit waterproofing.
B. Buffers shall be designed and installed to provide minimum car runby required by Rule 3.22 of ASME A17.1.
C. Pipe stanchions and struts shall be furnished, as required, to properly support the buffer.

2.18 NORMAL AND FINAL TERMINAL STOPPING DEVICES
A. Mount normal terminal stopping switch on car or in hoistway to slow speed or car and bring it to an automatic stop level with the terminal landings.
B. Switch, when opened, shall permit operation of car in reverse direction.
C. No normal stopping device other than one mounted on car and activated by cams in hoistway, or mounted in hoistway and activated by cams on car, shall be permitted.

2.19 TOP OF CAR OPERATING DEVICE
A. The device shall conform to ASME A17.1 and the following:
   1. The device shall be activated by a switch mounted in the device. The switch shall have the "OFF" and "ON" positions permanently marked on the faceplate with 6.4 mm (1/4-inch) letters.
   2. Movement of the material lift shall be accomplished by the continuous pressure on a direction button and a safety button.
   3. Provide an emergency stop toggle type switch as per ASME A17.1.
   4. Provide permanent identifications for the operation of all components in the device.
   5. The device shall be permanently attached to the material lift crosshead, on the side of the material lift which is nearest to the hoistway doors.

2.20 WORKMAN’S LIGHTS AND OUTLETS
Provide duplex GFCI protected type receptacle and lamp, with wire guards on top of material lift car and beneath the platform. The receptacles shall be in accordance with Fed. Spec. W-C596 for Style D7, 2 pole, 3 wire grounded type rated for 15 amperes and 125 volts.

2.21 CORRIDOR POSITION INDICATOR
Provide LED position indicators directly over hoistway at Central Station landing. Indicator cover plates shall consist of faceplates of stainless steel, and inserted glass or plastic numerals. Numerals shall be not less than 19mm (3/4 inches) high or with engraved numerals on plastic strips installed behind plate glass or plastic cover plate. Cover plates shall be readily removable for re-lamping. Provide in back of each numeral an electric lamp located in light proof compartment to indicate position and direction of motion of car by illuminating proper numeral.

2.22 SIGNAL LANTERNS
Provide a lantern over each hoistway entrance or near each entrance, where directed, except at Central Station landing, a hall lantern fixture of stainless steel with glass or plastic lenses. Lens shall be illuminated from rear by a lamp of proper intensity, shielded to illuminate lens only. Lanterns shall be connected to signal in advance approach of non-personnel elevator at a landing. Each lantern shall contain a single stroke chime so connected that when a non-personnel material lift arrives at a landing, the chime shall sound momentarily.

2.23 HOISTWAY ENTRANCES

A. Each entrance shall be required size with door of the bi-parting, vertically-sliding type.

1. Frame shall be not less than No. 16 gauge, stainless steel assembled at corners and secured with smoothly dressed, welded joints. Sill shall be rigidly anchored and not less than No. 11 gauge stainless steel, and, shall be set true, straight and level with hoistway edges plumb over each other. Reinforce sill as indicated on the drawings. Sill shall be grouted full length after installation.

2. Door guides to provide door position on inside of hoistway shall be metal. Weight and method of fastening to frames and hoistway wall, above and below, shall conform to a standard practice of non-personnel elevator manufacturer. Provide gibs, struts from floor-to-floor, chains, and steel sheaves with sealed ball or roller bearings. Provide guides and stops for door travel.

3. Door panels shall be flush, hollow metal construction and bear a 1 ½ hour Underwriters' "B" label, one inch thick, of not less than No. 16 gauge stainless steel on both sides. Panels shall be reinforced. Interior of panels shall be filled with fireproof material. Upper door section shall be fitted with a safety non-crushing astragal and a glass vision panel of 6 mm (¼ inch) thick, wire glass not less than three (3) inches nor more than 102 mm (four (4) inches) in diameter.

4. Door operators shall be heavy duty, DC or AC power operators designed to automatically open vertical sliding, hoistway doors upon arrival of car at each landing. Door shall close automatically upon completion of loading and unloading cycles. Door "opening" and "closing" speed shall be approximately one foot per second. Inherent design, construction and installation of doors and power operator shall be such as to preclude possibility of doors opening until car makes stop at that landing.

5. Entrances shall be installed and shall be thoroughly protected by plastic or paper covering to prevent injury. Frames shall be furnished with wall anchors to assure additional rigidity.

2.24 ELECTRIC INTERLOCK

Hoistway doors shall be equipped with true electric interlocks of design that non-personnel elevator will be inoperative if any door is open; and, door cannot be opened except at landing at which car has stopped. Mechanism shall be so arranged that door is securely locked before electric contact is made. Mount retiring cam on car to operate locks. Interlock will not be accepted unless it has successfully met requirements of the Code.
2.25 CAR SLING
Construct car frames of structural shapes, ASTM A-36, rigidly bolted and welded together of adequate strength to support car with rated load and to conform to ASME A17.1.

2.26 CAR ENCLOSURES
A. Car shall have width and depth required for contract load and be constructed of minimum 14 gauge, stainless steel except car bottom shall be minimum 10 gauge, stainless steel.
Construction shall conform to ASME A17.1. Car bottom shall be arranged and reinforced to provide adequate support for loading and unloading unit and withstand impact of wheeled carts.
1. Provide car entrance with vertical sliding, bi-parting door constructed of sheet panels of stainless steel, guided and connected to each other by cables running over sheaves mounted at top of car. Car door shall be opened automatically and closed automatically by power operator. Provide safety contact, automatic reversing edge on underside of upper door section.
2. Provide a flush car light fixture in car ceiling. Light shall be connected to illuminate automatically when car arrives at landing and hoistway door is opened; and shall be automatically extinguished when hoistway door is closed.
3. Provide metal nameplate in car showing name of manufacturer and, as required by ASME A17.1, rated load in pounds in stamped, etched or raised letters and numerals.

2.27 CAR LEVELING DEVICE
Provide car leveling device for material lift which shall automatically bring car to within 6 mm (1/4 inch), plus or minus, of the floor landing at reduced speed. When the car is traveling in the up direction, the car shall level up to the floor; and when the car is traveling in the down direction, the car shall level down to the floor. The car shall not pass the floor and level back when stopping regardless of direction of travel or load in car. One way leveling augmented with an anti-creep device shall not be acceptable.

2.28 PIT STOP SWITCH
A. Provide an enclosed stop toggle switch in pit of material lift that is readily accessible from access door to pit. Toggle switch shall be manually opened and closed with red operating handle conspicuously and permanently marked “STOP", and “RUN". Switch shall be positively opened mechanically and opening shall not be solely dependent on springs.

2.29 OPERATING STATIONS AND CONTROL PANEL
A. Operating stations and control panels shall be stainless steel, flush mounted in or adjacent to hoistway.
1. All faceplates shall have all edges beveled at least 15 degrees.
2. Fasten all faceplates with non-corrosive, spanner head, white metal or bristol head, tamperproof screws.
3. Operating pushbuttons in faceplates shall be designed so that pressure on contact shall be independent of pressure on operating pushbutton. All pushbuttons shall be of the "non-sticking" type.

4. Each switch and operating device shall have indelible, 6 mm (¼ inch) high legends to indicate its identity and position.

B. Provide at each floor served by material lift, a complete set of operating pushbuttons with 13 mm (½ inch) numbers in the face of the button corresponding to the floors served. Pushbuttons shall not protrude beyond the faceplate when in normal position. Call register lights located within or behind the buttons, shall illuminate the floor numeral corresponding to the call registered. Also, provide an "In Use" light in this panel to show when material lift is in operation or the door is open.

C. Provide for material lift, a separate control panel at the makeup area and as shown on drawings, containing the following:
   1. Key operated "ON/OFF" service switch.
   2. Call and Send buttons to upper floors.
   3. Door "Open" and "Close" buttons for maintenance purposes and manual operation.
   4. A red-jewel, pilot light to indicate a malfunction in the system.

2.30 CALL AND SEND FLOOR DISPATCHING

A. Dispatch carts from make-up area level to designated Floor and return.
   1. Carts shall be manually placed on material lift platform. Destination button activation shall illuminate that button indicating call registration.

B. Thereafter, the following sequence of events shall take place:
   1. Hoistway and car doors shall automatically close.
   2. Material lift shall proceed to the destination.
   3. Car buzzer shall sound prior to the door's opening.
   4. Hoistway and car doors shall automatically open.
   5. Case cart is manually removed from lift.
   6. Hoistway and car doors shall be closed.
   7. Car shall be returned to the central station floor and answer the next call if one has been placed or remain at this level and park with its hoistway and car doors closed until another dispatch is made.
   8. // If a cart is not unloaded at the destination floor, an adjustable timer, set at 60 sec. will close the doors starting with a 5 second warning buzzer. The car will return to Central Station with cart. //

PART 3—EXECUTION

3.1 PREPARATION
A. Examine work of other trades on which the work of this Section depends. Report defects to Resident Engineer in writing, which may affect the work of this trade or equipment operation.
B. Ensure that shafts and openings for moving equipment are plumb, level and in line.
C. Before fabrication, take necessary job site measurements, and verify where work is governed by other trades. Check measurement of space for equipment, and means of access for installation and operation. Obtain dimensions from site for preparation of shop drawings.
D. Ensure the required preparatory work, provided under other Sections has been properly completed to receive the elevator work.
E. Supply in ample time for installation by other trades, inserts, anchors, bearing plates, brackets, supports and bracing including all setting templates and diagrams for placement.

3.2 INSTALLATION
A. Perform work with competent mechanics skilled in this work and under the direct control and supervision of the elevator manufacturer's experienced foreman.
B. Set hoistway entrances in alignment with car openings, and true with plumb sill lines.
C. Install machinery, guides, controls, car and all equipment and accessories in accordance with manufacturer's instructions, applicable codes, and standards, to provide a quiet, smooth operating installation, free from sideway, oscillation or vibration.
D. Grout sills and hoistway entrance frames.

3.3 CLEANING
Prior to final acceptance, remove protection from finished or ornamental surfaces, and clean and polish surfaces with due regard to type of material.

3.4 SPACE CONDITIONS
A. Attention is called to overhead clearance, pit clearances, overall space in machine room, and construction conditions at building site in connection with elevator work. Provide proper, satisfactory code legal installation of equipment as a whole, including all construction, accessories and devices in connection with elevator, mechanical and electrical work specified herein.
B. Any construction changes or relocation of equipment, conduit, wiring, etc., required to accomplish the specified material lift installation must be arranged for and obtained by the Contractor, subject to the approval of the Contracting officer. Cost of such changes shall be included in the base bid and shall form a part of the contract.

3.5 WORKMANSHIP AND PROTECTION
A. All installations shall be made in a first class, neat and skillful manner by mechanics experienced in the trade involved. All details of the installation shall be mechanically and electrically correct. All materials and equipment shall be new, and without imperfections.
B. No structural members shall be cut or altered. Work in place which is damaged or defaced shall be restored equal to original condition.
C. Finish work shall be straight, level and plumb, with true, sharp surfaces and lines. All machinery and equipment shall be protected against dirt, water or mechanical injury. At final completion, all work shall be thoroughly cleaned, and delivered in perfect unblemished condition.

3.6 PRE-TEST AND TEST

A. Pre-test as per specification, the material lifts and related equipment, in the presence of the Resident Engineer, for proper operation before requesting final inspection. Final inspection shall be conducted at other than normal working hours, if required by the Veterans Administrator's Resident Engineer. Material lifts shall be tested as specified in the presence of a qualified elevator inspector. Procedure outlined in the "American Society of Mechanical Engineers, Inspectors' Manual For Hydraulic Elevators, ASME A17.2.2" shall apply.

B. Upon completion of material lift installation, conduct operating and car balance test for approval of Contracting Officer. Furnish test instruments and materials, including standard 50-pound test weights, voltmeters, amp probe, sound level meter, centigrade thermometers, light meter, stop watch, MEGGER, pressure gauges, direct reading tachometer for making tests. Tests shall be conducted in the presence of, and witnessed by, the Veterans Resident Engineer.

C. Speed Load Runs: Speed test with no load, 50 percent load, and contract load shall be made in both directions, before the full load run test and after the full load test.

D. Full Load Run Test: The material lift shall be subjected to a test for a period of one hour continuous run, with specified full load in the car. During test run, the car shall be stopped at all floors in both directions of travel, for a standing period of not less than eight nor more than twelve seconds per floor. Material lift starting, stopping, acceleration and deceleration shall remain consistent during the test.

E. Temperature Rise Test: Motors shall be tested during Full Load Run Test to demonstrate that the temperature rise under operating conditions in the building will not exceed 40 degrees C, above ambient, when measured with a thermometer or other approved means. Full load run tests shall not be made until constant temperatures are reached on all such pieces of equipment. Other test conditions shall be as specified in the latest procedure of the Institute of Electrical and Electronic Engineers for heat runs on motors.

F. Car Leveling Test: Material lift car leveling device shall be tested for accuracy of leveling at all floors with no load, 50 percent load, and full load in car, in both directions of travel before and after temperature test. Accuracy of floor leveling, as specified, shall be within plus or minus 1/4-inch of level with any landing floor for which the stop has been initiated (with a definite range of distance in advance of the landing), regardless of load in car or direction of travel. The car leveling device shall automatically correct over travel as well as under travel, and shall maintain the car floor within plus or minus 1/4inch of level with the landing floor regardless of change in load.
G. Setting of the Car-Door Contacts: The position of the car door at which the car may be started shall be measured. The distance from full closure shall not exceed that required by the Code. This test shall be made with the hoistway doors closed, or the hoistway door contact inoperative.

H. Setting of Interlocks: The position of the hoistway door at which the car may be started shall be measured, and shall not exceed Code requirements.

I. Overload Devices: All overload current protection devices in the system shall be tested at final inspection.

J. Operating and Signal Systems: The car shall be operated by the operating devices provided. The operation, signals, and automatic floor leveling shall function in accordance with the requirements specified. Starting, stopping and leveling shall be smooth and comfortable, without bumps or jars.

K. Working Pressure: Working pressure of the hydraulic system shall be verified by pressure gauges placed in the system line. Maximum working pressure shall be 500 psi. Readings shall be taken in the machine room with no load, 50 percent load, and full load in car.

L. Insulation Resistance: Material lift's complete wiring system shall be free from short circuits and grounds; and the insulation resistance for the system shall be determined by use of MEGGER.

M. Evidence of malfunction in any tested system or parts of equipment or component part thereof that occurs during, or as a result of, the tests, shall be corrected, repaired, and/or replaced at no additional cost to the Government, and the test repeated.

N. If any equipment fails test requirements and a re-inspection is required, the Contractor shall be responsible for the cost of re-inspection including salaries, transportation expenses and other expenses incurred by the representatives of the Contracting Officer.

3.7 PAINTING AND FINISHING

A. Material lift pump unit, motors, power unit and the like shall be factory painted with manufacturer's standard finish and color.

1. Material lift pump unit, controllers, and crossheads of material lift shall be identified by 4-inch high numerals and letters located by code and as directed. Color of numbers shall contrast with color surfaces to which they are applied.

2. Surface (except contact surfaces of working parts) of material lift items, such as, controllers, car frame, underside of platforms, guide rails, rail brackets, all uncoated ferrous metal items and hydraulic piping shall be given an approved prime coat.

3. Upon completion of installation and prior to final inspection, all equipment shall be thoroughly cleaned of grease, oil, cement, plaster, and other debris. All equipment, except that otherwise specified as to architectural finish, shall then be given two coats of paint.

4. Paint floor designation numbers not less than four inches high, on hoistway doors, fascias and/or walls as required by Rule 211.4 of the Code. The color of the paint used shall contrast with the color of the surfaces to which it is applied.

B. Hoistway entrances of material lift:
1. Door panels shall be stainless steel with a brushed finish.
2. Fascia plates, toe guards, dust covers, hanger covers and other metal work, including built-in or hidden work and structural metal, (except stainless steel entrance frames and surfaces to receive baked enamel finish) shall be given an approved prime coat in the shop, and one field coat of paint of approved color.

3.8 INSTRUCTION OF EMPLOYEES

A. Provide competent instructors to train employees in the operation of equipment. Instruction on hydraulic elevator installation shall be given during regular working hours. Instruction shall commence upon completion of all work required and upon initial operation before final acceptance of work. Instructors shall be qualified representatives, possessing complete knowledge of equipment.

B. Instructors shall be available for one 8-hour working day, minimum, with instruction period directed by the Resident Engineer.

C. In addition to oral instruction, written instructions in triplicate relative to care, adjustment and operation of all parts of equipment shall be furnished and delivered to the Resident Engineer in independently bound folders. Video cassette recording will also be acceptable. Written instructions shall include complete, correct and legible wiring diagrams, nomenclature sheets of all electrical apparatus, including location of each device, complete and comprehensive sequence of operations, complete parts lists with descriptive literature and identification, diagrammatic cuts of equipment and parts, etc. Information shall also include electrical operating characteristics of all circuits, fields, relays, timers and electronic devices, as well as RPM values and related characteristics for all rotating equipment. Provide any supplementary instructions for adjustment and care of new equipment as may become necessary due to changes, modifications and/or replacement of equipment or its operation, under requirements of paragraph entitled, "Warranty of Construction".

3.9 INSPECTIONS AND MAINTENANCE

A. Furnish inspection and maintenance service on all material lift equipment for a period of (1) year after completion and final acceptance of work by Resident Engineer. This service shall consist of bi-weekly examination by skilled elevator personnel, cleaning, lubricating, adjusting, repairing and replacing of all parts including hydraulic fluid as necessary to keep the equipment in proper working order (except such parts which may be unsatisfactory because of improper use, accident or negligence not caused by the Contractor). Provide emergency callback service, should trouble develop at any time of day or night between regular examinations.

1. The elevator contractor shall maintain a log in an area designated by the Resident Engineer. The log shall list the date and time of weekly examinations and description of all trouble calls. Description of trouble calls shall include nature of trouble call, necessary corrections, and/or parts replacement.
END OF SECTION
PART 1 - GENERAL

1.1 WORK INCLUDED

A. Four traction elevators as follows:
   1. Two Geared Prisoner Elevators. Car Nos. 1 and 2
   2. Two Geared Service Elevators. Car Nos. 3 and 4

B. All engineering, equipment, labor, approvals and permits required to satisfactorily complete elevator installation required by Contract Documents.

C. Provide all required staging, hoisting, hoist/safety beams, and equipment necessary for the movement of equipment. Removal of hoist beams after elevator installation is complete if beams encroach on Code clearances.

D. Applicable conditions of General, Special, and Supplemental Conditions, and Division 1.

E. Preventive maintenance as described herein.

F. Additional equipment or finishes furnished under other sections, installed under this section:
   1. Closed-circuit cable television (CCTV) surveillance cameras for Elevator Nos. 1 – 5, related equipment and remote wiring. Mounting provisions, installation, and wiring for on-board cameras is by Elevator Contractor. Connect CCTV system to each on-board elevator camera at controller terminals in elevator machine room.
   2. Emergency intercommunication system for Elevator Nos. 1 – 5, including speakers, related equipment and remote wiring. On-board elevator speaker installed by Elevator Contractor. Connect emergency intercommunication system to each on-board elevator speaker at controller terminals in elevator machine room.
   3. Public address speakers, related equipment and remote wiring. On-board elevator speaker furnished and installed by Elevator Contractor. Connect public address system to each on-board elevator speaker at controller terminals in elevator machine room.

1.2 RELATED WORK PROVIDED UNDER OTHER SECTIONS

A. Refer to Drawing No. VT01.

1.3 DEFINITIONS

A. Terms used are defined in the latest edition of Safety Code, ASME A17.1.

B. Reference to a device or a part of the equipment applies to the number of devices or parts required to complete the installation.

C. Provisions of this specification are applicable to all elevators unless identified otherwise.
1.4 QUALITY ASSURANCE

A. Approved Providers: Alternate Providers must receive approval of Architect, Purchaser and/or Consultant at least 14 calendar days prior to bid date.

1. Geared Elevators: Fujitec, KONE, Mitsubishi, Otis, Schindler, ThyssenKrupp
2. Car Enclosure: Amlift, City Lift, Custom Cab Inc., Elevator Interiors and Design, Forms and Surfaces, Fujitec, Hauenstein & Burmeister, KONE, Mitsubishi, Otis, Schindler, Sterling, ThyssenKrupp, Tyler
3. Hoistway Entrance: Amlift, City Lift, Custom Cab Inc., Elevator Interiors and Design, Forms and Surfaces, Fujitec, Hauenstein & Burmeister, KONE, Mitsubishi, Otis, Schindler, Sterling, Swiss Dane, ThyssenKrupp, Tyler

B. Compliance with Regulatory Agencies: Comply with most stringent applicable provisions of following Codes, laws, and/or Authorities, including revisions and changes in effect;

1. Safety Code for Elevators and Escalators, ASME A17.1
3. Elevator and Escalator Electrical Equipment, ASME A17.5
4. National Electrical Code, NFPA 70
5. Americans with Disabilities Act (ADA)
6. Local fire authority
7. Requirements of Building Code and all other Codes, Ordinances and Laws within the governing jurisdiction
9. Uniform Federal Accessibility Standard (UFAS)

C. Warranty

1. Material and workmanship of installation shall comply in every respect with Contract Documents. Correct defective material or workmanship which develops within one year from date of final acceptance of work to satisfaction of Architect, Purchaser and Consultant at no additional cost, unless due to ordinary wear and tear, or improper use or care by Purchaser.
2. Defective is defined, but not to be limited to; operation or control system failures, car performance below required minimum, excessive wear, unusual deterioration or aging of materials or finishes, unsafe conditions, need for excessive maintenance, abnormal noise or vibration, and similar unsatisfactory conditions.
3. Make modifications, requirements, adjustments and improvements to meet performance requirements in Parts 2 and 3.

1.5 DOCUMENT VERIFICATION

In order to discover and resolve conflicts or lack of definition which might create problems, Provider must review Contract Documents for compatibility with its product prior to submittal of quotation. Purchaser will not pay for change to structural, mechanical, electrical, or other systems required to accommodate Provider's equipment.
1.6 SUBMITTALS

A. Within 60 calendar days after award of contract and before beginning equipment fabrication, submit shop drawings and required materials for review as outlined in Division I. Allow 30 calendar days for response to initial submittal.

1. Scaled and Fully Dimensioned Layout: Plan of pit, hoistway and machine room indicating equipment arrangement, elevation section of hoistway, details of car enclosures, hoistway entrances, and car/hall signal fixtures.

2. Design Information: Indicate equipment lists, reactions, and design information on layouts.


4. Fixtures: Cuts, samples, or shop drawings.

5. Finish Material: Submit 3” x 12” samples of actual finished material for Architect review of color, pattern, and texture. Compliance with other requirements is the exclusive responsibility of the Provider. Include, if requested, signal fixtures, lights, graphics, Braille plates, and detail of mounting provisions.

6. Signage: Drawings or Samples.

B. Senate Bill 1886 Submittals: Provide copies of all code authority/permit submittals to the Owner’s Representative.

C. Acknowledge and/or respond to review comments within 14 calendar days of return. Promptly incorporate required changes due to inaccurate data or incomplete definition so that delivery and installation schedules are not affected. Provider’s revision response time is not justification for equipment delivery or installation delay.

1.7 PERMIT, TEST AND INSPECTION

A. Obtain and pay for permit submittals, permit, license, company and mechanic certifications and inspection fee necessary to complete installation.

B. Perform test required by Governing Authority in accordance with procedure described in ASME A17.2. Guide for Inspection of Elevators, Escalators, and Moving Walks in the presence of Authorized Representative.

C. Supply personnel and equipment for test and final review by Consultant, as required in Part 3.

1.8 MAINTENANCE

A. Interim

1. When one or more elevators are near completion and ready for service, the General Contractor may accept elevators for interim use and place in service prior to substantial completion of project.

2. During this period General Contractor may pay a mutually agreed upon monthly amount per elevator for preventive maintenance. Indicate amount per unit per month with quotation.

3. Temporary acceptance form must be acceptable to General Contractor and signed prior to use.

4. General Contractor must provide or pay for temporary hoistway and car enclosures; protect installed equipment and finishes; and pay for all cleaning, repairs, and
replacement of materials necessary to restore elevator to “as-new” condition prior to final acceptance.

B. Warranty Maintenance

1. Provide preventive maintenance and 24-hour emergency callback service for one year commencing on date of final acceptance by Purchaser. Systematically examine, adjust, clean, and lubricate all equipment. Repair or replace defective parts using parts produced by the Provider of installed equipment. Maintain elevator machine room, hoistway, and pit in clean condition.
2. Use competent personnel, acceptable to the Purchaser, supervised and employed by Provider.
3. Warranty maintenance period specified in Item 1.08, B above shall be extended one month for each three month period in which equipment related failures average more than .25 per unit per month.
4. Purchaser retains the option to delete cost of warranty maintenance from new equipment contract and remit twelve (12) equal installments directly to Provider during period in which maintenance is being performed.

C. Preventive Maintenance

1. Quote monthly cost for five year Preventive Maintenance Agreement commencing upon completion of warranty maintenance. Submit quote based upon terms and conditions of the Preventive Maintenance Agreement, Section 14325. Base quotation on present labor and material cost. Price adjustment will be made at Agreement commencement date and thereafter as provided in Agreement.
2. Use competent personnel, acceptable to the Purchaser, employed and supervised by Provider.

PART 2 - PRODUCTS

2.1 SUMMARY

A. Prisoner Elevators

NUMBER: CAR NOS. 1 AND 2
CAPACITY: 4500 #
CLASS LOADING: PASSENGER CLASS A
SPEED: 200 F.P.M.
MACHINE: GEARED
MACHINE LOCATION: OVERHEAD
ROPING: 1:1
SUPERVISORY CONTROL: GROUP AUTOMATIC MICROPROCESSOR BASED SYSTEM
MOTOR CONTROL: AC VARIABLE VOLTAGE VARIABLE FREQUENCY MICROPROCESSOR BASED WITH DIGITAL CLOSED-LOOP FEEDBACK
POWER CHARACTERISTICS: 480 VOLTS, 3 PHASE, 60 HERTZ
STOPS: 4
OPENINGS: 4
FLOORS SERVED: 1, 2, 3, 3M
TRAVEL: 35'-6" ±
PLATFORM SIZE: 6'-0" WIDE X 9'-0" DEEP
MINIMUM CLEAR INSIDE CAR: 5'-8" WIDE X 8'-1" DEEP
ENTRANCE SIZE: 4'-0" WIDE X 8'-0" HIGH
ENTRANCE TYPE: TWO SPEED, SIDE OPENING. FRAMES AND DOORS AT ALL FLOORS SHALL HAVE SATIN, TEXTURED STAINLESS STEEL FINISH WITH DOOR VISION PANELS. PROVIDE BOLTED FRAMES
DOOR OPERATION: HIGH SPEED, HEAVY-DUTY, DOOR OPERATOR, MINIMUM OPENING SPEED 2-1/2 F.P.S.
DOOR PROTECTION: INFRARED, THREE DIMENSIONAL, FULL SCREEN DEVICE, WITH DIFFERENTIAL TIMING, NUDGING, AND INTERRUPTED BEAM TIME
SAFETY: FLEXIBLE GUIDE CLAMP-TYPE B, CAR
GUIDE RAILS: PLANED STEEL TEES
BUFFERS: SPRING
CAR ENCLOSURE: AS SPECIFIED
CLEAR HEIGHT UNDER CANOPY 10'-0"
BATTERY POWERED EMERGENCY CAR LIGHTING. PROVIDE SEPARATE CONSTANT PRESSURE TEST BUTTON IN CAR SERVICE COMPARTMENT. ILLUMINATE PORTION OF NORMAL CAR LIGHTING
SIGNAL FIXTURES: LED ILLUMINATION
HALL AND CAR PUSHBUTTON STATIONS: SINGLE HALL PUSHBUTTON RISER. INTERFACE WITH CCTV AND INTERCOM. SINGLE CAR OPERATING PANEL
VANDAL RESISTANT CAR AND HALL PUSHBUTTONS
CAR POSITION INDICATORS: SINGLE DIGITAL WITH CAR DIRECTION ARROWS, TRANSOM MOUNTED
SVGA AT CENTRAL CONTROL PANEL
HALL CAR POSITION INDICATOR: DIGITAL WITH CAR DIRECTION ARROWS AT ALL FLOORS, MOUNTED ABOVE EACH ENTRANCE.
COMMUNICATION SYSTEM: INTERCOM WITH DISTRESS SIGNAL – CAR AND ELEVATOR LOBBIES
FIXTURE SUBMITTAL:

SUBMIT BROCHURE DEPICTING PROVIDER’S PROPOSED DESIGNS WITH BID

ADDITIONAL FEATURES –

(CAR NOS. 1 AND 2):

CAR AND COUNTERWEIGHT ROLLER GUIDES
CAR TOP INSPECTION STATION
FIREFIGHTERS’ SERVICE, PHASE I AND II, INCLUDING ALTERNATE FLOOR RETURN
STANDBY POWER TRANSFER (AUTOMATIC TO MAIN FLOOR) WITH MANUAL OVERRIDE IN CENTRAL CONTROL PANEL
ACCESSIBILITY AND EMERGENCY MEDICAL SERVICES SIGNAGE, REAR MOUNTED FROM BACKSIDE OF JAMB
STATIONARY CAR RETURN PANEL ARRANGED FOR FLUSH CAR OPERATING PANEL WITH HAIRLINE JOINTS
HOISTWAY ACCESS SWITCHES AT TOP AND BOTTOM FLOORS
CAR AND HOISTWAY DOOR VISION PANELS
TEXTURED STAINLESS STEEL CAR DOOR FINISH
INDEPENDENT SERVICE FEATURE
PLATFORM ISOLATION
LOAD-WEIGHING DEVICE
ANTI-NUISANCE FEATURE
CENTRAL CONTROL PANEL AND REMOTE WIRING
COUNTER SUNK - TAMPER RESISTANT FASTENERS FOR ALL FASTENINGS EXPOSED TO THE PUBLIC
SILL SUPPORT ANGLES
ONE YEAR WARRANTY MAINTENANCE WITH 24-HOUR CALL-BACK SERVICE
MACHINE, POWER CONVERSION UNIT, AND CONTROLLER SOUND ISOLATION
SEISMIC DEVICES AND OPERATION
IN-CAR PRISONER RESTRAINTS
CCTV PROVISIONS – CAR AND ELEVATOR LOBBIES
SIGNAGE ENGRAVING FILLED WITH BLACK PAINT
NO VISIBLE COMPANY NAME OR LOGO
B. Service Elevators

NUMBER: CAR NOS. 3 AND 4
CAPACITY: 4500 #
CLASS LOADING: PASSENGER CLASS A
SPEED: 200 F.P.M.
MACHINE: GEARED
MACHINE LOCATION: OVERHEAD
ROPING: 1:1
SUPERVISORY CONTROL: GROUP AUTOMATIC MICROPROCESSOR BASED SYSTEM
MOTOR CONTROL: AC VARIABLE VOLTAGE VARIABLE FREQUENCY MICROPROCESSOR BASED WITH DIGITAL CLOSED-LOOP FEEDBACK
POWER CHARACTERISTICS: 480 VOLTS, 3 PHASE, 60 HERTZ
STOPS: 5
OPENINGS: 5
FLOORS SERVED: B, 1, 2, 3, 3M
TRAVEL: 50'-4" ±
PLATFORM SIZE: 6'-0" WIDE X 9'-0" DEEP
MINIMUM CLEAR INSIDE CAR: 5'-8" WIDE X 8'-1" DEEP
ENTRANCE SIZE: 4'-0" WIDE X 8'-0" HIGH
ENTRANCE TYPE: TWO SPEED, SIDE OPENING. FRAMES AND DOORS AT ALL FLOORS SHALL HAVE SATIN, TEXTURED STAINLESS STEEL FINISH WITH DOOR VISION PANELS. PROVIDE BOLTED FRAMES
DOOR OPERATION: HIGH SPEED, HEAVY-DUTY, DOOR OPERATOR, MINIMUM OPENING SPEED 2-1/2 F.P.S.
DOOR PROTECTION: INFRARED, THREE DIMENSIONAL, FULL SCREEN DEVICE, WITH DIFFERENTIAL TIMING, NUDGING, AND INTERRUPTED BEAM TIME
SAFETY: FLEXIBLE GUIDE CLAMP-TYPE B, CAR
GUIDE RAILS: PLANED STEEL TEES
<table>
<thead>
<tr>
<th><strong>BUFFERS:</strong></th>
<th>SPRING</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CAR ENCLOSURE:</strong></td>
<td>AS SPECIFIED</td>
</tr>
<tr>
<td></td>
<td>CLEAR HEIGHT UNDER CANOPY 10'-0&quot;</td>
</tr>
<tr>
<td></td>
<td>BATTERY POWERED EMERGENCY CAR LIGHTING. PROVIDE SEPARATE</td>
</tr>
<tr>
<td></td>
<td>CONSTANT PRESSURE TEST BUTTON IN CAR SERVICE COMPARTMENT.</td>
</tr>
<tr>
<td></td>
<td>ILLUMINATE PORTION OF NORMAL CAR LIGHTING</td>
</tr>
<tr>
<td><strong>SIGNAL FIXTURES:</strong></td>
<td>LED ILLUMINATION</td>
</tr>
<tr>
<td><strong>HALL AND CAR PUSHBUTTON STATIONS:</strong></td>
<td>SINGLE HALL PUSHBUTTON RISER. INTERFACE WITH CCTV AND INTERCOM. SINGLE CAR OPERATING PANEL</td>
</tr>
<tr>
<td></td>
<td>VANDAL RESISTANT CAR AND HALL PUSHBUTTONS</td>
</tr>
<tr>
<td><strong>CAR POSITION INDICATORS:</strong></td>
<td>SINGLE DIGITAL WITH CAR DIRECTION ARROWS, TRANSOM MOUNTED SVGA AT CENTRAL CONTROL PANEL</td>
</tr>
<tr>
<td><strong>HALL CAR POSITION INDICATOR:</strong></td>
<td>DIGITAL WITH CAR DIRECTION ARROWS AT ALL FLOORS, MOUNTED ABOVE EACH ENTRANCE.</td>
</tr>
<tr>
<td><strong>COMMUNICATION SYSTEM:</strong></td>
<td>INTERCOM WITH DISTRESS SIGNAL – CAR AND ELEVATOR LOBBIES</td>
</tr>
<tr>
<td><strong>FIXTURE SUBMITTAL:</strong></td>
<td>SUBMIT BROCHURE DEPICTING PROVIDER’S PROPOSED DESIGNS WITH BID</td>
</tr>
<tr>
<td><strong>ADDITIONAL FEATURES – (CAR NOS. 3 AND 4):</strong></td>
<td>CAR AND COUNTERWEIGHT ROLLER GUIDES</td>
</tr>
<tr>
<td></td>
<td>CAR TOP INSPECTION STATION</td>
</tr>
<tr>
<td></td>
<td>FIREFIGHTERS’ SERVICE, PHASE I AND II, INCLUDING ALTERNATE FLOOR RETURN</td>
</tr>
<tr>
<td></td>
<td>STANDBY POWER TRANSFER (AUTOMATIC TO MAIN FLOOR) WITH MANUAL OVERRIDE IN CENTRAL CONTROL PANEL</td>
</tr>
<tr>
<td></td>
<td>ACCESSIBILITY AND EMERGENCY MEDICAL SERVICES SIGNAGE, REAR MOUNTED FROM BACKSIDE OF JAMB</td>
</tr>
<tr>
<td></td>
<td>STATIONARY CAR RETURN PANEL ARRANGED FOR FLUSH CAR OPERATING PANEL</td>
</tr>
<tr>
<td></td>
<td>HOISTWAY ACCESS SWITCHES AT TOP AND BOTTOM FLOORS</td>
</tr>
<tr>
<td></td>
<td>CAR AND HOISTWAY DOOR VISION PANELS</td>
</tr>
<tr>
<td></td>
<td>TEXTURED STAINLESS STEEL CAR DOOR FINISH</td>
</tr>
</tbody>
</table>
INDEPENDENT SERVICE FEATURE
PLATFORM ISOLATION
LOAD-WEIGHING DEVICE
ANTI-NUISANCE FEATURE
CENTRAL CONTROL PANEL AND REMOTE WIRING
COUNTER SUNK - TAMPER RESISTANT FASTENERS FOR ALL FASTENINGS EXPOSED TO THE PUBLIC
SILL SUPPORT ANGLES
ONE YEAR WARRANTY MAINTENANCE WITH 24-HOUR CALL-BACK SERVICE
MACHINE, POWER CONVERSION UNIT, AND CONTROLLER SOUND ISOLATION
SEISMIC DEVICES AND OPERATION
CCTV PROVISIONS – CAR AND ELEVATOR LOBBIES
SIGNAGE ENGRAVING FILLED WITH BLACK PAINT
NO VISIBLE COMPANY NAME OR LOGO
WIRING DIAGRAMS, OPERATING INSTRUCTIONS, AND PARTS ORDERING INFORMATION
REMOTE MONITORING SYSTEM
NON-PROPRIETARY CONTROL SYSTEM AND DIAGNOSTICS PROVISIONS

2.2 MATERIALS

A. Steel

B. Stainless Steel: Type 304 or 316 complying with ASTM A167-88, with standard tempers and hardness required for fabrication, strength and durability. Apply mechanical finish on fabricated work in the locations shown or specified (Federal Standard and NAAMM nomenclature) with texture and reflectivity required to match Architect’s sample. Protect with adhesive-paper covering.
   1. No. 4: Directional polish (satin finish). Graining directions as shown or, if not shown, in longest dimension.
   2. No. 8: Reflective polish (mirror finish).
   3. Textured: 5WL as manufactured by Rigided Metals or Windsor pattern 5-SM as manufactured by Rimex Metals or approved equal with .050 inches mean pattern depth with bright directional polish (satin finish), unless otherwise noted.
C. Aluminum: Extrusions per ASTM B221; sheet and plate per ASTM B209.

D. Plastic Laminate: ASTM E84 Class A and NEMA LD3.1, Fire-Rated Grade (GP-50), Type 7, 0.050" ± .005" thick, color and texture as follows;
   1. Exposed Surfaces: Color and texture selected by Architect.
   2. Concealed Surfaces: Provider’s standard color and finish.

E. Fire-Retardant Treated Particle Board Panels: Minimum 3/4" thick backup for natural finished wood and plastic laminate veneered panels, edged and faced as shown, provided with suitable anti-warp backing; meet ASTM E84 Class "I" rating with a flame-spread rating of 25 or less, registered with Local Authorities for elevator finish materials.


G. Paint: Clean exposed metal parts and assemblies of oil, grease, scale, and other foreign matter and factory paint one shop coat of standard rust-resistant primer. After erection, provide one finish coat of industrial enamel paint. Galvanized metal need not be painted.

H. Prime Finish: Clean all metal surfaces receiving a baked enamel paint finish of oil, grease, and scale. Apply one coat of rust-resistant primer followed by a filler coat over uneven surfaces. Sand smooth and apply final coat of primer.

I. Baked Enamel Finish: Prime finish per Item I. above. Unless specified "prime finish" only, apply and bake three (3) additional coats of enamel in the selected solid color.

J. Glass: Laminated safety glass, minimum 9/16" thick, conforming to ANSI Z97.1 and CPSC 16 CFR Part 1201.

2.3 CAR PERFORMANCE

A. Car Speed: ± 3% of contract speed under any loading condition.

B. Car Capacity: Safely lower, stop and hold 125% of rated load.

C. Car Stopping Zone: ±1/4" under any loading condition.

D. Door Opening Time: 2.5 seconds from start of opening to fully open.

E. Door Closing Time: 5.4 seconds from start of closing to fully closed.

F. Car Floor-to-Floor Performance Time: 14.0 seconds from start of doors closing until doors are 3/4 open (1/2 open for side opening doors) and car stopped at next successive floor under any loading condition or travel direction (12'-6" typical floor height).

G. Car Ride Quality
   1. Horizontal acceleration within car during all riding and door operating conditions. Not more than 20 mg peak to peak in the 1 - 10 Hz range.
   2. Acceleration and Deceleration: Smooth constant and not more than 4 feet/second² with an initial ramp between 0.5 and 0.75 second.
   3. Sustained Jerk: Not more than 6 feet/second³.
H. Airborne Noise: Measured noise level of elevator equipment during operation shall not exceed 50 dBA in elevator lobbies and 60 dBA inside car under any condition including door operation and car ventilation exhaust blower on its highest speed.

2.4 OPERATION

A. Group Automatic (Car Nos. 1 & 2 and Nos. 3 & 4)

1. Approved systems to be furnished and installed by one of the approved Providers identified in Item 1.04, A. Approved microprocessor-based, group dispatch, car and motion control systems as follows including, as a minimum, the features described hereafter:

   a. Fujitec Millennium II
   b. KONE Resolve
   c. MCE IMC - AC
   d. Mitsubishi AI21
   e. Otis Elevonic
   f. Schindler Miconic TX R5
   g. ThyssenKrupp TAC 50

2. Operate cars as a group, capable of balancing service and providing continuity of group operation with one or more cars removed from the system.

3. Register service calls on cars from pushbuttons located at each floor and in each car. Slow down and automatically stop cars at landings corresponding to registered calls. Make stops at successive floors for each direction of travel irrespective of order in which calls are registered except when bypassing hall calls to balance and improve overall service; stop only one car in response to particular hall call. Assign hall calls to specific cars and continually review and modify these assignments to improve service. Simultaneous to initiation of slow down of a car for a hall call, cancel that call. Render hall pushbutton ineffective until car doors begin to close after passenger transfer. Cancel car calls in the same manner. Give priority to coincidental car and hall calls in car assignment.

4. Operate system to meet changing traffic conditions on a service demand basis. Include provisions for handling traffic which may be heavier in either direction, intermittent or very light. As traffic demands change, automatically and continually modify group and individual car assignment to provide the most-effective means to handle current traffic conditions. Provide means to sense long-wait hall calls and preferentially serve them. Accomplish car direction reversal without closing and reopening doors.

5. Use easily reprogrammable system software. Design basic algorithm to optimize service based on equalizing system response to registered hall calls and equalizing passenger trip time to shortest possible time.

6. Serve floors below main floor in a manner which logically minimizes delay in passing or stopping at main floor in both directions of travel. Provide manual means to force a stop at the main floor when passing to or from lower levels.

7. Required Features

   a. Dispatch Protection: Backup dispatching shall function in the same manner as the primary dispatching.
   b. Delayed Car Removal: Automatically remove delayed car from group operation.
   c. Position Sensing: Update car position when passing or stopping at each landing.
   d. Hall Pushbutton Failure: Multiple power sources and separate fusing for pushbutton risers.
e. Duplicate communication link for all group and individual car computers.

B. Security Operation:

1. Provide for complete control of Elevator Nos. 1 – 5 from the security control panel described in 2.12.
2. Provide capability to secure corridor call buttons, by floor, when on normal group operation.
3. Provide remote operation interface points as described in Section 17850.

C. Other Items

1. Load Weighing: Provide means for weighing car passenger load. Control system to provide dispatching at main floor in advance of normal intervals when car fills to capacity. Provide hall call by-pass when the car is filled to preset percentage of rated capacity and traveling in down direction. Adjustment range: 10% to 100%.
2. Anti-Nuisance Feature: If weight in car is not commensurate with number of registered car calls, cancel car calls. Systems employing either load weighing or door protective device for activation of this feature are acceptable.
3. Independent Service: Provide controls for operation of each car from its pushbuttons only. Close doors by constant pressure on desired destination floor button or door close button. Open doors automatically upon arrival at selected floor.
4. Car-to-Lobby Feature: Provide the means at central control station for automatic return to a designated secured floor. Return car nonstop after answering pre-registered car calls, and park with doors open for an adjustable time period of 60 - 90 seconds. Upon expiration of time period, car shall automatically revert to normal operation and close its doors until assigned as next car or until the car is placed on manual control via in-car attendant or out-of-service switch.

a. Upon selection of the “RECALL” position the elevators shall respond as follows:

1) If headed toward the designated level, bypass all intervening car or corridor calls and express nonstop to the designated level and park with its doors closed.
2) If standing at a floor, close its doors and express nonstop to the designated level and park with its doors closed.
3) If headed away from the designated level, stop at the next available floor and, without opening its doors, reverse and express nonstop to the designated level and park with its doors closed.

b. Upon selection of the “DOOR OPEN” position, the elevator doors shall open fully. Doors shall remain open until switch is returned to “OFF” position or the elevator is placed on the in-car Security Operation mode.

c. Upon selection of the “OFF” position, normal service shall be restored.

D. Firefighters’ Service: Provide equipment and operation in accordance with Code requirements.

E. Automatic Car Stopping Zone: Stop car within 1/4" above or below the landing sill. Maintain stopping zone regardless of load in car, direction of travel, distance between landings, hoist rope slippage or stretch.
F. Remote Monitoring and Diagnostics: Equip each controller and the group dispatch logic controller, with standard ports, interface boards, and drivers to accept maintenance, data logging, fault finding diagnostic, and monitoring computers, keyboards, modems, and programming tools. The system shall be capable of driving remote color CRT monitor(s) that continually scan and display the status of each car and call. Provide each group with a full, interactive elevator monitoring (EMS) system.

G. Motion Control: Microprocessor based AC, variable-voltage, variable frequency with digitally encoded closed-loop velocity feedback suitable for operation specified and capable of providing smooth, comfortable car acceleration, retardation, and dynamic braking. Limit the difference in car speed between full load and no load to not more than ±3% of the contract speed.

H. In-Car Security Operation (Prisoner Elevator Nos. 1 and 2): Provide a 2-position, key-operated switch labeled "SECURITY", surface-mounted adjacent to the car operating panel. When in the "ON" position, detention personnel shall have complete control of the elevator under independent service mode feature. Key shall be removable in the "OFF" position only.

I. Distress Signal (Elevator Nos. 1 – 5): Activation of the alarm button shall initiate continuous distress signal for each individual elevator. Provide illuminated jewels marked "ALARM" and a distinct audible signal in the Central Control panel for Public, Staff and Service elevators. Signals shall be cancelled from the Central Control Panel.

J. Attendant Operation Car Nos. 1 and 2: Include provision for attendant control of door closing, car direction, and calls answered. Locate attendant controls behind a locked panel immediately above the floor buttons.

K. Door Operation: Automatically open doors when car arrives at main floor. At expiration of normal dwell time, close doors. Reopen doors when car is designated for loading. Provide "heavy door/variable air pressure" feature for consistent specified door operation within appropriate speed and inertia limits.

L. Standby Lighting and Alarm: Car mounted battery unit with solid-state charger to operate alarm bell and car emergency lighting. Battery to be rechargeable with minimum 5-year life expectancy. Include required transformer. Provide constant pressure test button in service compartment of car operating panel. Provide lighting integral with portion of normal car lighting system.

M. Standby Power Operation: Upon loss of normal power, adequate standby power will be supplied via building electrical feeders to simultaneously start and run one car in each group and single cars at rated car speed and capacity.

1. Automatically return one car at a time, in each group and single car, nonstop to designated floor, open doors for approximately 3.0 seconds, close doors and park car. During return operation, car and hall call pushbuttons shall be rendered inoperative. As each car parks, system shall immediately select next car until all cars in a group have returned to the designated floor. If a car fails to start or return within 30 seconds, system shall automatically select next car in the group to automatically return.

2. When all cars in a group have returned to the designated floor, one car in each group shall be designated for automatic operation. When a service demand exists for 30 seconds and designated car fails to start, next available car in group shall be a selected for operation.
3. Provide separate group selection switch(es) in Central Control Panel.
   a. Switch labeled “STANDBY POWER OVERRIDE” with positions marked “AUTO” and appropriate car numbers. Key shall be removable in “AUTO” position only.
   b. Switch shall override automatic return and automatic selection functions, and cause the manually selected car to operate. Manual selection shall cause car to start and proceed to designated floor and open and close its doors before standby power is manually transferred to next selected car.
   c. Provide “STANDBY POWER” indicator lights (one per car) in central control panel. Indicator light illuminates when corresponding car is selected, automatically or manually, to operate on standby power.

4. Successive Starting: When normal power is restored or there has been a power interruption, individual cars in each bank shall restart at five second intervals.

2.5 MACHINE ROOM EQUIPMENT

A. Arrange equipment in spaces shown on drawings.

B. Geared Traction Hoist Machine
   1. Worm geared traction type with motor, brake, gear, drive shaft, deflector sheave, and gear case mounted in proper alignment on an isolated bedplate. Provide bedplate blocking to elevate deflector sheave above machine room floor.
   2. Provide hoist machine mounted direct drive, digital, closed-loop velocity encoder.
   3. Provide hoist machine drip pans to collect lubricant seepage.

C. Solid State Power Conversion and Regulation Unit
   1. Design unit to limit current, suppress noise, and prevent transient voltage feedback into building power supply. Conform to IEEE standards 446-1987 for line harmonics and switching noise.
   2. Isolate unit to minimize noise and vibration transmission. Provide isolation transformers, filter networks, and choke inductors.
   3. Suppress solid-state converter noises, radio frequency interference, and eliminate regenerative transients induced into the mainline feeders or the building standby power generator.
   4. Supplement direct-current power for the operation of hoist machine brake, door operator, dispatch processor, signal fixtures, etc., from separate static power supply.

D. Encoder: Direct drive, solid-state, digital type. Update car position at each floor and automatically restore after power loss.

E. Controller: UL/CSA labeled.
   1. Compartment: Securely mount all assemblies, power supplies, chassis switches, relays, etc., on a substantial, self-supporting steel frame. Completely enclose equipment with covers. Provide means to prevent overheating.
   2. Relay Design: Magnet operated with contacts of design and material to insure maximum conductivity, long life and reliable operation without overheating or excessive wear. Provide wiping action and means to prevent sticking due to fusion. Contacts carrying high inductive currents shall be provided with arc deflectors or suppressors.
3. Microprocessor-Related Hardware
   a. Provide built-in noise suppression devices which provide a high level of noise immunity on all solid-state hardware and devices.
   b. Provide power supplies with noise suppression devices.
   c. Isolate inputs from external devices (such as pushbuttons) with isolation modules.
   d. Design control circuits with one leg of power supply grounded.
   e. Safety circuits shall not be affected by accidental grounding of any part of the system.
   f. System shall automatically restart when power is restored.
   g. System memory shall be retained in the event of power failure or disturbance.
   h. Equipment shall be provided with Electro Magnetic Interference (EMI) shielding within FCC guidelines.

4. Wiring: CSA labeled copper for factory wiring. Neatly route all wiring interconnections and securely attach wiring connections to studs or terminals.

5. Permanently mark components (relays, fuses, PC boards, etc.) with symbols shown on wiring diagrams.

6. Provide controller or machine mounted auxiliary, lockable "open," disconnect if mainline disconnect is not in sight of controller and/or machine.

F. Sleeves and Guards: 2" steel angle guards around cable or duct slots through floor slabs or grating. Provide rope and smoke guards for sheaves, cables, and cable slots in machine room.

G. Machine and Equipment Support Beams
   1. Provide structural steel beams required for direct support of and attachment to building structure of hoist machine, deflector sheaves, overhead sheaves, governor, and rope dead-end hitch assemblies.
   2. Provide bearing plates, anchors, shelf angles, blocking, embedment, etc., for support and fastening of machine beams or equipment to the building structure.

H. Governor: Centrifugal-type, car driven machine room mounted. Provide required bracketing and supports for attachment to building structure.

I. Noise/Vibration Isolation: All elevator equipment including their supports and fastenings to building, shall be mechanically and electrically isolated from the building structure to minimize objectionable noise and vibration transmission to car, building structure, or adjacent occupied areas of building.

J. Sound Isolation
   1. Noise level relating to elevator equipment operation in machine room shall not exceed 80 dBA.
   2. All dBA readings shall be taken three (3) feet off the floor and three (3) feet from equipment.

K. Signage
   1. Provide engraved signage displaying the telephone number or numbers to call for emergency service. Provide a second identical sign for use by the building.
   2. Provide signage pertaining to strength of machine room floor per ASME A17.1, Rule 100.3c. Coordinate with structural engineer.
2.6 HOISTWAY EQUIPMENT

A. Guide Rails: Planed steel T-sections for car and counterweight of suitable size and weight for the application, including seismic reactions, including brackets for attachment to building structure. Provide rail backing and intermediate counterweight tie brackets to meet Code requirements. Provide bracketing, at top and bottom of floor beams. No additional structural points of rail attachment, other than those shown on the Contract Documents, will be provided.

B. Buffers, Car and Counterweight: Spring type with blocking and support channels. Provide switch on buffer to limit car speed if buffer is compressed.

C. Sheaves: Machined grooves and sealed bearings. Provide mounting means to machine beams, machine bedplate, car and counterweight structural members, or building structure.

D. Counterweight: Steel frame with metal filler weights.


F. Counterweight Guard: Metal guard in pit with guarded vision port.

G. Governor Rope and Encoder Tape Tensioning Sheaves: Mount sheaves on pit floor support frame or guide rail. Provide with guides or pivot point to enable free vertical movement and proper tension of rope and tape.

H. Hoist and Governor Ropes

1. Hoist Ropes: 8 x 19 or 8 x 25 Seale construction, traction steel type. Fasten with staggered length adjustable spring isolated shackles.

2. Governor rope to suit Provider’s specification.


J. Electrical Wiring and Wiring Connections

1. Conductors and Connections: Copper throughout with individual wires coded and connections on identified studs or terminal blocks. Use no splices or similar connections in wiring except at terminal blocks, control compartments, junction boxes, or condulets. Provide 10% spare conductors throughout. Run spare wires from car connection points to individual elevator controllers in the machine room. Provide six pairs of spare shielded communication wires in addition to those required to connect specified items. Tag spares in machine room. Provide Category 5 UTP wiring or equivalent provisions for future networking capabilities.

2. Conduit: Painted or galvanized steel conduit, EMT or duct. Conduit size, 1/2” minimum. Flexible heavy-duty service cord may be used between fixed car wiring and car door switches for door protective devices.

3. Traveling Cables: Flame and moisture-resistant outer cover. Prevent traveling cable from rubbing or chafing against hoistway or equipment within hoistway. Provide 2 RG6/U coaxial CCTV cables, Belden No. 9259, within traveling cable from car controller to car top, plus 3'-0” excess loop at both ends. Provide two pair 14 gauge wire for CCTV power. Terminate in properly identified car top and machine room junction boxes.

4. Auxiliary Wiring: Connect fire alarm initiating devices, emergency telephone system, paging speaker, CCTV, connection to building computer network, intercom, and
K. Entrance Equipment

1. Door Hangers: Two-point hanger roller with neoprene roller surface and suspension with eccentric upthrust roller adjustment.
2. Door Tracks: Bar or formed, cold-drawn removable steel tracks with smooth roller contact surface.
3. Door Interlocks: Operable without retiring cam. Paint interlock box flat black.
4. Door Closers: Spring, spirator or jamb/strut mounted counterweight type. Design and adjust to insure the smooth quiet mechanical close of doors.

L. Floor Numbers: Stencil paint 4" high floor designations in contrasting color on inside face of hoistway doors or hoistway fascia visible from within car.

2.7 HOISTWAY ENTRANCES

A. Complete entrances bearing fire labels from a nationally recognized testing laboratory approved by the authority having jurisdiction.

B. Frames: 14 gauge hollow metal at all floors. Bolted head to jamb assemblies at all floors. Provide with sound-deadening. Provide Arabic floor designation/Braille plates, centered at 60" above finished floor, on both side jambs of all entrances. Provide plates at main egress landing with “Star” designation. For designated emergency car, provide “Star of Life” designation plates at height of 78” – 84” above finished floor on both side jambs at all floors. Braille indications shall be below Arabic floor designation. Provide cast rear, flange mounted floor designation/Braille and “Star-of-Life” plates as manufactured by SCS, Vision Mark or Entrada.

C. Door Panels: 16 gauge steel, sandwich construction without binder angles. Provide sound deadening core. Provide a minimum of two gibs per panel, one at leading and one at trailing edge with gibs in the sill groove entire length of door travel. Construct door panels with interlocking, stiffening ribs. Architectural metal cladding shall wrap around leading and trailing edge of panel and return a minimum of 1/2" on rear side of leading edge of panel.

D. Sight Guards: 14 gauge, same material and finish as hoistway entrance door panels. Construct without sharp edges.

E. Sills: Extruded stainless steel. Extend sill full length of door travel.

F. Sill Supports: Structural or formed steel designed to support door sill based upon car loading classification. Mount to eliminate need for grout under the sill. Provide 5" x 5" x 1/2" cold-rolled structural steel angle, extending full width of hoistway. Fasten to building structure at maximum 18" O.C.

G. Fascia, Toe Guards and Hanger Covers: Car clear opening width 14 gauge furniture steel with flat black enamel finish.

H. Struts and Headers: Provide for vertical support of entrances and related material. Provide door open bumpers on entrances equipped with vertical struts.

I. Finish of Frames and Doors:
2.8 CAR EQUIPMENT

A. Frame: Bolted rolled or formed steel channel construction to meet load classification specified.

B. Safety Device: Type “B,” flexible guide clamp.

C. Platform: Isolated type, constructed of steel, or steel and wood which is fireproofed on underside. Design and construct to accommodate load classification requirements. Class “A” construction for passenger elevators.

D. Platform Apron: Minimum 14 gauge stainless steel, reinforced and braced to car platform front.

E. Guide Shoes: Roller type with three or more spring dampened, sound-deadening rollers per shoe.

F. Finish Floor Covering: Provided under other sections.

G. Sills: One piece stainless steel extrusion with extruded extension between car entrance columns to face of car front return. Extruded extension to match finish of sill.

H. Doors: Provide as specified for hoistway entrance doors.

I. Door Hangers: Two-point hanger roller with neoprene roller surface and suspension with eccentric upthrust roller adjustment.

J. Door Track: Bar or formed, cold-drawn removable steel track with smooth roller contact surface.

K. Door Header: Construct of minimum 12 gauge steel, shape to provide stiffening flanges.

L. Door Electrical Contact: Prohibit car operation unless car door is closed.

M. Door Clutch: Heavy-duty clutch, linkage arms, drive blocks and pickup rollers or cams to provide positive, smooth, quiet door operation. Design clutch so car doors can be closed, while hoistway doors remain open.

N. Restricted Opening Device: Restrict opening of car door(s) outside unlocking zone.

O. Door Operator: High-speed, heavy-duty door operator capable of opening doors at no less than 2-1/2 f.p.s. Accomplish reversal in no more than 2-1/2" of door movement. Provide solid-state door control with closed loop circuitry to constantly monitor and automatically adjust door operation based upon velocity, position, and motor current. Maintain consistent, smooth and quiet door operation at all floors, regardless of door weight or varying air pressure.
1. Acceptable closed-loop door operators
   a. G.A.L. MOVFR
   b. KONE AMD
   c. Mitsubishi LV4K
   d. Otis I Motion CL
   e. Schindler QKS
   f. ThyssenKrupp HD91

P. Door Control Device

1. Infrared Reopening Device: Black, fully enclosed device with three-dimensional infrared matrix or multiple beams extending vertically along edge of each leading door panel to minimum height of 7'-0" above finished floor. Device shall prevent doors from closing and reverse doors at normal opening speed if beams are obstructed while doors are closing, except during nudging operation. In event of device failure, provide for automatic shutdown of car at floor level with doors open.
   a. Acceptable Infrared 3D Reopening Device
      1) Lambda 3D by Otis
      2) Magic Edge by Tri-Tronics
      3) Microlite 3D by ThyssenKrupp
      4) Pana40 Plus 3D by Janus
      5) Mitsubishi 3D MBS

2. Nudging Operation: After beams of door control device are obstructed for a predetermined time interval (minimum 20.0 - 25.0 seconds), warning signal shall sound and doors shall attempt to close with a maximum of 2.5 foot pounds kinetic energy.

3. Interrupted Beam Time: When beams are interrupted during initial door opening, hold door open a minimum of 3.0 or 5.0 seconds. When beams are interrupted after the initial 3.0 or 5.0 second hold open time, reduce time doors remain open to an adjustable time of approximately 1.0 - 1.5 seconds after beams are reestablished.

4. Differential Door Time: Provide separately adjustable timers to vary time that doors remain open after stopping in response to calls.
   a. Car Call: Hold open time adjustable between 3.0 and 5.0 seconds.
   b. Hall Call: Hold open time adjustable between 5.0 and 8.0 seconds. Use hall call time when car responds to coincidental calls. When required, adjust to meet "notification time" requirements of CBC Title 24.

Q. Car Operating Panel

1. One car operating panel with faceplate, consisting of a metal box containing vandal resistant operating fixtures, mounted in the car stationary front return panel. Faceplate shall be hinged and constructed of 11 gauge, No. 4 stainless steel. Faceplate shall be finished with surrounding surfaces.

2. Suitably identify floor buttons, alarm button, door open button, and door close button with SCS, Visionmark or Entrada cast tactile symbols. Recessed flush rear mounted. Configure plates per local building code accessibility standards including Braille. Locate operating controls no higher than 48" above the car floor; no lower than 35" for alarm button, and intercom actuation button.

3. Provide minimum 3/4" diameter raised vandal resistant floor pushbuttons which illuminate to indicate call registration.
4. Provide vandal resistant alarm button at bottom of car operating panel to ring bell located on car, and sound distress signal at Central Control Panel. Illuminate button when actuated.

5. Provide stop switch with markings to show “run” and “stop.” Locate in locked car service compartment. Switch, when activated, shall sound Central Control Panel distress signal.

6. Provide “door open” button to stop and reopen doors or hold doors in open position.

7. Provide “door close” button to activate door close cycle. Cycle shall not begin until normal door dwell time for a car or hall call has expired, except firefighters’ operation.

8. Extended Door Hold Open Button: Provide button to extend normal door hold open period up to 90 seconds. Cancel extended time by registration of car call or actuation of door close button.

9. Provide firefighters’ Phase II key switch with engraved instructions. Include light jewel, buzzer, and call cancel button. Locate above car operating panel.

10. Provide lockable service compartment with recessed flush door. Door material and finish shall match car return panel or car operating panel faceplate. Inside surface of door shall contain an integral flush security window for displaying the elevator operating permit.

11. Include the following controls in lockable service cabinet with function and operating positions identified by engraved signage:
   a. Inspection switch.
   b. Light switch.
   c. Four position; off, low, medium, high, exhaust blower switch.
   d. Independent service switch.
   e. Constant pressure test button for battery pack emergency lighting.
   f. 120-volt, AC, GFCI protected electrical convenience outlet.
   g. Card reader override switch.
   h. Stop switch.
   i. Attendant operation switch – Cars 1 and 2.

12. Provide black paint filled, engraved signage on engraved stainless steel flange mounted plates as follows with approved size and font:
   a. Phase II firefighters’ operating instructions above main operating panel above corresponding keyswitch.
   b. Car number over main car operating panel.
   c. “No Smoking – LAMC No. 41.51 – Subject to Fine” over main car operating panel.
   d. Car capacity in pounds and persons on service compartment door.
   e. Failure signage on service cabinet door: “Should the car doors fail to open or the elevator become inoperative: Please do not become alarmed. Please use the button marked ‘Alarm’ or ‘Telephone’ to summon assistance. Remain in the car until assistance arrives and do not attempt to force doors or hatch open.
   f. 3/16” alarm and intercom button engraving.

R. Car Top Control Station: Mount to provide utilization while standing in an upright position.

S. Work Light and Duplex Plug Receptacle: GFCI protected outlet top and bottom of car. Include on/off switch and metal, grounded lamp guard. Provide additional GFCI protected outlet on car top for installation of car CCTV.
2.9 CAR ENCLOSURE

A. Car Enclosure Elevator Nos. 1 – 4: Provide complete as specified herein. Provide the following features:

1. Shell: Reinforced 14 gauge (1.9 mm) textured stainless steel formed panels as specified in Item 2.02. Panel width shall not exceed 15” (381 mm). Apply sound deadening mastic to exterior. Provide Elevator Nos. 1 and 2 with prisoner lock-up restraints bolted through cab walls. Provide with backing plates.

2. Canopy: Reinforced 12 gauge (2.66 mm) furniture steel formed panels with hinged lockable exit. Interior finish, white reflective baked enamel.

3. Front Return Panel: Reinforced 14 gauge (1.9 mm) textured stainless steel as specified in Item 2.02. Provide with cutouts for rear flange mounted engraved stainless steel signage. Provide cutouts for flush car stations.

4. Entrance Columns and Transom: Reinforced 14 gauge (1.9 mm), textured stainless steel. Include cutout in transom for car position/direction indicator.

5. Car Door Panels: Minimum reinforced 16 gauge (1.5 mm) textured stainless steel as specified in Item 2.02. Provide inner sound deadening core. Same construction as specified for hoistway door. Metal cladding shall wrap around leading edge of panel and return a minimum of 1” (12.7 mm) on rear side of leading edge of panels. Fasten with adhesive and unexposed mechanical fasteners.

6. Handrails/Guardrails: Two lines. Top handrail line minimum 1-½” (31.75 mm) diameter stainless steel tubular grab bar, Rimex “Rigitube”, or equal. Lower guardrail line 4” (101.6 mm) x ⅜” (9.53 mm) solid stainless steel flatstock bars mounted on both sides and rear of the car. Locate bottom guardrail line at 8” (203.2 mm) above car floor and handrail line at 32” (812.8 mm) above the car floor. Bolt rails through car walls from back and mount on 1-1/2” (38.1 mm) deep solid round stainless steel standoff spacers no more than 18” (457.2 mm) O.C. Provide backing plates. Return rail ends to car walls.

7. Ventilation: Three-speed Morrison AA exhaust blower mounted to car canopy on isolating rubber grommets. Provide with a security diffuser and grille. Exhaust blower shall meet requirements of Item 2.03, H.

8. Lighting: Fluorescent fixtures flush mounted in ceiling with protective security diffuser and steel guard over fixtures on car top.

2.10 HALL CONTROL STATIONS

A. Pushbuttons: Provide a single riser for each group with flush mounted faceplates. Include pushbuttons for each direction of travel which illuminate to indicate call registration. Include approved engraved message and pictorial representation prohibiting use of elevator during fire or other emergency situation as part of faceplate. Pushbutton design shall match car operating panel pushbuttons. Provide vandal resistant pushbutton and light assemblies.

2.11 SIGNALS

A. Car Position Indicator: Alpha-numeric digital indicator containing floor designations and direction arrows a minimum of 2” high to indicate floor served and direction of car travel. Locate fixture in car transom above car entrance. When a car leaves or passes a floor, illuminate indication representing position of car in hoistway. Illuminate proper direction arrow to indicate direction of travel.

B. Hall Position Indicator: Alpha-numeric digital indicator containing floor designations and direction arrows a minimum of 2⅛” high to indicate floor served and direction of car travel. Mount above entrance at all floors.

C. Faceplate Material and Finish: 11 gauge, No. 4 satin stainless steel, all fixtures.
D. Floor passing tone: Provide an audible tone of no less than 20 decibels and frequency of no higher than 1500 Hz, to sound as the car passes or stops at a floor served.

2.12 CENTRAL CONTROL AND DISPLAY PANEL

A. Central Control Panel: Provide interactive control and monitoring features/devices for Elevator Nos. 1 – 5 via SVGA touch screen monitor, keyboard and printer with separate panel including necessary status indicators and keyswitches. Locate as indicated on Drawings in the Central Control Room. Control panel touch screen shall be capable of overriding car and corridor stations. Separate panel shall consist of a flush mounted metal box with adequate ventilation to prevent overheating of components, and be fitted with a hinged No. 4 stainless steel faceplate which is clearly engraved with the elevator numbers, levels served, and device functions. Provide the following minimum features/devices for all elevators, except as indicated:

1. Car position and door position indicators and direction arrows on SVGA display for each elevator.
2. Manual selection to select “normal” or “security” operation.
3. Key-operated manual override switches for each standby/emergency power group.
4. Controls for “Individual Floor Lockout” individual hall station lockout, and “Lobby Parking” features. This may be accomplished via interactive display terminal, keyswitch, or toggle switch.
6. Warning indication or light and audible signal to indicate “Alarm Button” or “Stop Switch” activation. Provide means to disable stop switch audible signal.
7. Warning indication or light and audible signal to indicate an attempt to register unauthorized destinations and/or to force car doors open when car is moving or parked at a restricted landing.
8. Warning indication or light and audible signal to indicate an attempt to open emergency exit.
9. “Lamp Test” button to illuminate all lights and “Reset” button to cancel warning lights and signals.
10. Security recall switches.

Fixtures shall be located as directed by Architect. Where applicable, identify all indicators and manual switches with appropriate engraving. Provide wiring to control panel. Coordinate size and location with Building Console Supplier.

B. Machine Room Display Unit: Provide elevators with a PC Based machine room color SVGA display system. The CPU shall be equipped with Windows 2000 software and PC Anywhere software installed, networking provisions, and 56K modem. As a minimum, the SVGA shall display the following functions:

1. Car operating in normal/standby power.
2. Car position and direction of travel.
3. Car calls.
4. Hall calls.
5. Operating mode.
6. Door status.
7. Delayed car.
8. Load weigh and by-pass.
9. Car to lobby feature.
10. Car in/out of service.
11. Seismic operation.
12. Distress signal.

2.13 MONITORING SYSTEM

A. General: Provide an interactive system to monitor and manage the elevator equipment ("units"), hereinafter called "system". Data collection, data storage and real-time monitoring portion of the system shall be based on Microsoft Windows and be able to run on Windows 2000 Pro, XP Pro, or later operating systems. Provide the following features:

1. Network based, capable of interfacing with control systems via either serial data link or hardwired interface connections.
2. Operate on any TCP/IP based network system including but not limited to an Ethernet, Token Ring, Arc-Net, Lift-Net, etc.
3. Expansion capability to add unlimited number of monitoring terminals on the network.
4. Monitoring terminals shall operate “peer” to peer” or with a single client server. Failure of a single network device shall not affect the operation of the remainder of the system.
5. Complete backup of system data shall be accomplished at any single terminal/server location.
6. Display multiple banks, including multiple buildings, on a single monitoring terminal screen.

B. Monitoring Display: The system shall be capable of simultaneous monitoring of at least five hundred units on a single monitoring station utilizing a graphical representation of a plan view of the facility. Each elevator shown on the plan view, shall be individually displayed and shall be visible on the monitoring system display terminal without the need to scroll. Each individual unit, when operating “normally,” shall be displayed in green. In the event of a malfunction of any individual unit, the unit shall be displayed by a red blinking light on the monitoring system display. Units which are intentionally placed out of service shall be shown as yellow in the display mode. When malfunctioning units, or units intentionally placed out of service, are returned to normal operation the graphical representation for that unit(s) shall automatically return to green. The user shall have the ability to display additional information, such as the cause of fault/alarm, for all units by selecting the unit with a "mouse click" from the plan view of the facility. All monitored units shall be visible from any monitoring terminal on the network. Entry into the network shall be multi-level password protected.

C. System Capabilities:

1. The system shall be capable of real time display of all monitored status points on all monitored equipment. Fault and event notification screens and audible alarms shall be immediately displayed on selected monitoring stations. Different fault and event tables shall be defined on a per-bank basis. The system shall collect and store all status, fault and event information for later reporting and analysis. The system shall provide statistical analysis of hall call response times, traffic patterns, fault conditions, service logs and security usage in graphical and tabular format.
2. The system shall maintain a record of every status point change occurring on the monitored equipment, and provide the ability to replay these events in a simulation at a later time in real time, slow speed, single step, reverse or fast forward. This information shall be retained for a period of at least twenty-six weeks and a mechanism shall be provided whereby this information may be archived.
3. The system shall store traffic fault and statistical data for a period of at least three (3) years. The system shall log error type, car number, floor position and major system status points whenever a fault or logged event occurs.
4. The system shall provide interactive control of certain features provided in the elevator control system. These features may be revised as the requirements of the building change. Some of these interactive controls may include, but are not limited to, security floor lockouts, entering car and hall calls, Firefighters’ service, lobby recall, VIP service, Up/Down peak service, etc.

5. In the case of a power failure the system shall be capable of connecting to emergency power back-up unit. The loss of power shall not affect any stored data. The system shall have the capability to detect the loss (disconnect) of any individual unit from the monitoring system by periodically polling all units to ensure that normal communications between the unit(s) and the terminals/server are maintained.

6. The system will automatically re-boot the program and continue to operate after a power loss or other system malfunction.

D. Monitoring Equipment: The monitoring equipment shall have these minimum characteristics:

1. Monitoring Station Hardware: Provide one Monitoring Station.
   a. Central processing unit – IBM compatible microcomputer – desk top or mini-tower (multiple machine rooms or lobby displays)
   b. Type – Pentium or most current high-performance processor
   c. Speed – most current high-performance
   d. Internal hard drive – adequate storage for three years data for entire system
   e. Modem – most current high-performance
   f. Display monitor (19” – 20” LCD flat panel) – color, capable of simultaneous display of all monitored units
   g. Printer – current HP Color Desk Jet Series
   h. Keyboard – MS Windows compatible
   i. Mouse – MS Windows compatible
   j. Power requirements – 90 – 230 Volts AC 50 – 60Hz @ 8A

2. Monitoring Station Operating System Software
   a. MS Windows 2000 Pro, XP Pro, or later
   b. MS Windows 2000 Server, or later

E. Network requirements:

1. Maximum local network rated distance (2-20 gauge shielded TP): > 10 miles
2. Maximum number of nodes (combined PC, inputs/outputs): 500
3. Maximum I/O points per node (input or output): 2040
4. Access time to status bit change (typical 6-car bank): < 25ms
5. Must be capable of operating on RS485, RS422, Ethernet, Token Ring, Arc-net, Lift-Net, Fiber-Optic and mixed WAN TCPIP Networks

F. Monitoring Requirements: The system shall display and record the following information for each monitored unit. Serial data links may include many more points. Items listed below are minimum requirements.

1. Elevators:
   a. Group status:
      1) Group operational mode
      2) All units to be monitored on the same screen in a graphical format
      3) In/out of service
4) Standby power
5) Supervisory failure
6) Location and direction of hall calls

b. Individual car status – expandable menus:

1) Direction of travel
2) Independent service
3) Inspection service
4) Firefighters' service
5) Hospital Code Blue service
6) Position of elevator
7) Door status (open, opening, closing, closed)
8) Door dwell time
9) Load by-pass
10) Standby power
11) Power on/off
12) Door detector
13) Safety circuit
14) Door zone
15) Stop switch
16) Alarm button
17) Registered car Calls
18) Out of level
19) Machine room temperature exceeds 95 degrees
20) Stop Counter (Number of Starts)
21) Car speed
22) Door open times
23) Door close time
24) Start to stop motion time
25) Emergency 2-way communication device
26) Air conditioner/heater

c. Keyboard, Mouse and time clock control capabilities:

1) Floor lockouts (car or hall)
2) Lobby recall
3) VIP service
4) Firefighters’ service
5) Hospital Code Blue service
6) Up/Down Peak

d. Faults monitored with visual and audible alarm, triggered by combinations of any of the above status points:

1) Safety circuit
2) Alarm bell
3) Stop switch
4) Emergency 2-way communication device
5) Door reversal device
6) At least six (6) user selectable faults or events (i.e. water in pit, high machine room/cab temperature)

G. Reporting Requirements: System shall provide reports in color graphical format both on-screen and in printed form capability to conveniently switch from one report type to another and from one bank to another using minimal mouse clicks and key strokes. Reports shall
be displayed after minimal waiting time. Data for all reports shall be continuously recorded and stored. Reports shall be displayed by simply selecting a date and time range, bank of equipment and report type. Date and time range selections shall carry forward from one report selection to the next. Reporting functions shall be sub-divided into the following categories:

1. **Traffic Reports (elevators):**
   a. Number of hall calls per floor (hall call distribution on a per floor basis)
   b. Number of hall calls per hour (24 hour time-line)
   c. Hall call waiting times per floor (hall call waiting time distribution on a per floor basis)
   d. Hall call waiting times per hour (24 hour time-line)
   e. Distributed hall call response graph (24 hour time-line)
   f. Detailed hall call response graph (% calls / n seconds)
   g. Longest wait times including floor #, wait time, date, time and direction

2. **Fault Reports (elevators):**
   a. Ten most recent faults (most recent faults listed per bank)
   b. Fault log – displays the entire fault log for a given time period
   c. Faults per car (fault distribution on a per car basis)
   d. Faults per floor (fault distribution on a per floor basis)
   e. Faults per day/week/month (fault distribution on a per unit or group basis)

3. **Car Use Statistics (elevators):**
   a. Car use by hour (24 hour time-line of car calls, car starts, door cycles, delayed car, load by pass)
   b. Car use statistics (same as above, shown for an entire bank)

4. **Group Service Log (elevators):**
   a. Cars in service (24 hour time-line with text log of group availability of each car)
   b. Group functions (24 hour time-line with text log of actuation of group functions – Up peak, Down peak, Fire Svc, Em Pwr, etc.

**H. Interface to Third Party Building Management Systems:** The elevator monitoring system shall be capable of interfacing and exchanging data with a variety of third party building management systems such as Siemens, Landis & Staefa, Johnson Controls, SCADA, and others. Information shall be exchanged by Modbus protocol, open protocol or other suitable methods as required.

**I. Interactive Features:** The control system shall be capable where desired of operating interactive control features provided in the elevator control system. These features may be revised as the requirements of the building change. Some of these interactive controls may include but are not limited to: security floor lockouts, entering car and hall calls, Firefighters' return service, lobby recall, VIP service, UP/Down peak or hospital Code Blue service. Local codes may affect the availability or operation of these features.

1. **Security Access Features:** The monitoring system shall be capable of providing security enable/disable of all hall and car calls through on-screen menus at a minimum. The monitoring system shall also be capable of interfacing directly with card readers and security keypads in stand-alone mode, and indirectly through a serial interface with a third party security system. When in stand-alone mode, the monitoring system shall maintain a database of elevator users and security pass
codes. When on secure mode the use of each elevator will be recorded in a file together with the time, authorized pass code and destination for each call.

2. Elevator Control Features:
   a. Each elevator shall be capable of being controlled through the monitoring system. All control points shall be capable of seven-day twenty-four hour time clock automatic operation or manual operation from the mouse and keyboard. The control points shall include, but not be limited to, the following (where allowed by local codes)

   1) Lobby recall
   2) Car call security lockout
   3) Hall call security lockout
   4) Firefighters’ service
   5) Independent service
   6) VIP Service
   7) Hospital Code Blue service
   8) Standby power to selected car

3. Paging Feature: The monitoring system shall be capable of paging a service technician or other personnel based on pre-defined parameters of elevator faults or conditions. The paging system shall provide the ability to page multiple numbers determined by the type of event triggering the notification and shall be able to page different numbers based on preset times of day (i.e. different shifts). The system shall be capable of sending text messages to full text pagers in addition to supporting standard DTMF pagers.

4. Remote Access Feature: The monitoring system shall be capable of allowing approved individuals under multi-level password control, to access all system features via the local area network, internet, or via modem over the public telephone network to review the performance of the equipment or to evaluate a fault condition. The remote access feature shall be integrated into the monitoring system and shall not use third party “remote control” software products.

5. Data Transmission to Central Support Location: The system shall be capable where desired of transmitting fault, car usage and other data to a remote service desk or other office location for further processing, technician dispatch or other purposes. The data may be transmitted via the local area network, internet, or via modem over the public telephone network.

2.14 INTERCOM AND DISTRESS SIGNAL SYSTEM

A. General: Provide intercommunication system for Car Nos. 1 – 5. Include all back boxes, faceplates, and wiring between elevator hoistways and control panels.

   Include the following stations:

<table>
<thead>
<tr>
<th>Station Location</th>
<th>Type Station</th>
<th>Selection Buttons to Call</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elevator Machine Room</td>
<td>Master</td>
<td>Control Panels, Car Nos. 1 – 5</td>
</tr>
<tr>
<td>Lobby Control Panel</td>
<td>Master</td>
<td>Machine Rooms, Car Nos. 1 – 5</td>
</tr>
</tbody>
</table>
B. Basic Equipment

1. Amplifier providing static-free voice transmission with adequate volume and minimum distortion at all stations, with preamplifier capable of receiving voice and music inputs from building, and emergency building communication system.

2. Activation of emergency building communication system overrides all other conversations and permits one-way conversation to all master and remote stations in system.

3. Master Stations
   a. Speaker-microphone combination, hands free system for two-way communication.
   b. Selection buttons to enable communication with all master and remote stations. Maintain continual reception of hands-free reply from station when a selected button is depressed.
   c. Two-Position “Talk/Listen” Button: Press to talk; release to listen.
   d. Illuminate “in use” light when any station is being used.
   e. Reset button to make system available for use by any master station.
   f. Volume control knob of incoming volume.
   g. Button to establish communications with all stations.
   h. Distress light in lobby panel which illuminates when push-to-call button, or alarm button in car is actuated. Energize distress light and buzzer or chime until intercom selection button for that car has been depressed. Sound buzzer or chime in lobby panel simultaneously with a distress light illumination.

4. Remote Station
   a. Stations in cars and lobbies shall be activated by “push to talk,” two-way communication button. “Push to talk” button shall illuminate and flash when call is acknowledged. Button shall match floor pushbutton design. Provide uppercase “HELP”, “PUSH TO CALL”, “CALL ANSWERED WHEN FLASHING” engraved verbiage Sans Serif or simple Serif type adjacent to button. Provide “push to talk” button tactile symbol and Braille adjacent to button.
   b. Locate microphones and speakers, or transceiver/speaker combination in car front return. Locate lobby fixture as directed.
   c. Install remote speaker(s) provided under Item 1.01, E., 1, in car canopy, with shielded wiring to machine room junction box.

C. Station Housings

1. House master stations in a metal compartment with baked enamel finish. Attach to the group elevator supervisory control panel or wall mount.

2. Provide control center master intercoms with stainless steel faceplate and engraved operating instructions. Coordinate faceplate size and installation of units with building Console Supplier.
2.15 SEISMIC OPERATIONS AND EQUIPMENT

Provide design, components and operation per governing code. Provide dual counterweight derailment sensing wire(s) vertically each side of counterweight the entire height of travel. The counterweight frame shall be equipped with four derailment rings. A dual axis seismic switch shall be provided that will activate at no less than 0.15 times gravity in the vertical or horizontal directions. A minimum of one seismic switch shall be provided per single or group of elevators. Counterweight retainer plates must be bolted.

PART 3 - EXECUTION

3.1 SITE CONDITION INSPECTION

A. Prior to beginning installation of equipment, examine hoistway and machine room areas. Verify that no irregularities exist which affect execution of work specified.

B. Do not proceed with installation until work in place conforms to project requirements.

3.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver material in Provider’s original, unopened protective packaging.

B. Store material in original protective packaging. Prevent soiling, physical damage, or moisture damage.

C. Protect equipment and exposed finishes from damage and stains during transportation, erection, and construction.

3.3 INSTALLATION

A. Install all equipment in accordance with Provider’s instructions, referenced Codes, specification and approved submittal. A job site set of Division 14 specifications and Code Authority approved permit submittals.

B. Install machine room equipment with clearances in accordance with referenced Codes and specification.

C. Install all equipment so it may be easily removed for maintenance and repair.

D. Install all equipment for ease of maintenance.

E. Install all equipment to afford maximum accessibility, safety, and continuity of operation.

F. Remove oil, grease, scale, and other foreign matter from the following equipment and apply one coat of field-applied machinery enamel.

   1. All exposed equipment and metal work installed as part of this work which does not have architectural finish.


   3. Neatly touch up damaged factory-painted surfaces with original paint and color. Protect machine-finish surfaces against corrosion.
3.4 FIELD QUALITY CONTROL

A. Work at jobsite will be checked during course of installation. Full cooperation with reviewing personnel is mandatory. Accomplish corrective work required prior to performing further installation.

B. Have Code Authority acceptance inspection performed and complete corrective work.

3.5 ADJUSTMENTS

A. Install rails plumb and align vertically with tolerance of 1/16" in 100'-0". Secure joints without gaps and file any irregularities to a smooth surface.

B. Static balance car to equalize pressure of guide shoes on guide rails.

C. Lubricate all equipment in accordance with Provider’s instructions.

D. Adjust motors, power conversion unit, brake, controllers, leveling switches, limit switches, stopping switches, door operators, interlocks, and safety devices to achieve required performance levels.

3.6 CLEANUP

A. Keep work areas orderly and free from debris during progress of project. Remove packaging materials on a daily basis.

B. Remove all loose materials and filings resulting from work.

C. Clean and paint machine room equipment and floor.

D. Clean hoistways, car, car enclosure, entrances, operating and signal fixtures.

3.7 ACCEPTANCE REVIEW AND TESTS

A. Review procedure shall apply for individual elevators, portions of groups of elevators and completed groups of elevators accepted on an interim basis or elevators and groups of elevators completed, accepted, and placed into operation.

B. Provider shall perform review and evaluation of all aspects of its work prior to requesting Consultant's final review. Work shall be considered ready for Consultant's final contract compliance review when copies of Provider's test and review sheets are available for Consultant's review and all elements of work or a designated portion thereof are in place and a unit or group are deemed ready for service as intended.

C. Furnish labor, materials, and equipment necessary for Consultant’s review. Notify Consultant five (5) work days in advance when ready for final review of elevator unit or group.

D. Consultants written list of observed deficiencies of materials, equipment and operating systems will be submitted to Provider for corrective action. Consultant’s review shall include as a minimum:

1. Workmanship and equipment compliance with Contract Documents.
3. Performances of following are satisfactory:
   a. Starting, accelerating, running
   b. Decelerating, stopping accuracy
   c. Door operation and closing force
   d. Equipment noise levels
   e. Signal fixture utility
   f. Overall ride quality
   g. Performance of door control devices
   h. Operations of special security features and floor lock-off provisions.

4. Test Results
   a. In all test conditions, obtain specified car speed, performance times, stopping accuracy without re-leveling, and ride quality to satisfaction of Purchaser and Consultant. Tests shall be conducted under both no load and full load condition.
   b. Temperature rise in motor windings limited to 50° Celsius above ambient. A full-capacity, 1-hour running test, stopping at each floor for ten (10) seconds in up and down directions, may be required.

E. Performance Guarantee: Should Consultant’s review identify defects, poor workmanship, variance or noncompliance with requirements of specified Codes and/or ordinances, or variance or noncompliance with the requirements of Contract Documents, Provider shall complete corrective work in an expedient manner to satisfaction of Purchaser and Consultant at no cost;
   1. Replace equipment that does not meet Code or Contract Document requirements.
   2. Perform work and furnish labor, materials, and equipment necessary to meet specified operation and performance.

F. A follow-up final contract compliance review shall be performed by Consultant after notification by Provider that all deficiencies have been rectified. Provide Consultant with copies of the initial deficiency report marked to indicate items which Provider considers complete. If additional reviews are required due to Provider’s gross non-compliance with initial deficiency report, consultant shall bill Provider, and Provider acknowledges it will pay, for additional compliance reviews.

3.8 PURCHASER’S INFORMATION

A. Documents Required Prior to Final Payment
   1. Provide three sets of neatly bound written information necessary for proper maintenance and adjustment of equipment within 30 days following final acceptance of the project. Final retention will be withheld until data is received, accepted, and approved by Owner and reviewed by Design Consultant. Include the following as minimums:
      a. Straight line wiring diagram of “as installed” circuits, with index of location and function of components. Provide one reproducible master set. Mount one set wiring diagrams on panels, racked, or similarly protected, in machine room. Provide remaining set rolled and in a protective drawing tube. Maintain machine room set with addition of all subsequent field changes. These diagrams are Purchaser’s property.
      b. Lubricating instructions, including recommended grade of lubricants.
c. Parts catalogs for all replaceable parts including ordering forms and instructions.
d. Four sets of neatly tagged keys for all switches and control features properly tagged and marked.
e. Neatly bound instructions explaining all operating features including all apparatus in the car and lobby control panels.
f. Neatly bound maintenance and adjustment instructions explaining areas to be addressed, methods and procedures to be used, and specified tolerances to be maintained for all equipment.
g. Diagnostic test device complete with access codes, adjusters manuals and set-up manuals for adjustment, diagnosis and troubleshooting of elevator system and performance of routine safety tests.


3. Acceptance of such records by Owner/Consultant shall not be a waiver of any Provider deviation from Contract Documents or shop drawings or in any way relieve Provider from his responsibility to perform work in accordance with Contract Documents.

3.9 INSTRUCTION TO PURCHASER'S PERSONNEL

A. Training during Final Adjustments:

1. The City may assign a maximum of two (2) City elevator mechanics to observe during the final adjustment of one of each type of elevator. Elevator Contractor's adjusters shall explain the procedures for adjusting the elevator and answer all questions.

B. Formal Training:

1. Provide formal training, consisting of minimum of three (3) days, eight (8) hours each day, in the adjustment, troubleshooting and repair of the complete elevator control and drive system. Class duration and content shall be similar to that received by the Elevator Contractor's/Equipment Manufacturer's adjusters and service personnel.
2. Class size shall be limited to ten (10) City elevator mechanics.
3. Instructor shall be a trained instructor possessing complete knowledge of the elevator system.
4. Training shall be provided within six months after acceptance of the elevators.
5. Training shall be during normal business hours at a local site agreeable to both parties.
6. Approximately one half the time shall be classroom instruction and the remainder shall be "hands on" at the job site.
7. Training manuals shall be provided to each student covering all aspects of the equipment.
8. The City may video tape or audio tape the classroom sessions. Tapes shall be used for City training purposes only.

C. Training During the Warranty Period:

1. Elevator Contractor's adjusters and service personnel, while troubleshooting, adjusting, or repairing during the warranty period, shall provide training and answer questions regarding the procedures used.
3.10 OWNER'S INFORMATION, MATERIALS, AND TOOLS

General: Within sixty (60) days following initial acceptance of the elevator installation, provide written information and diagnostic tools necessary for proper maintenance and adjustment of the equipment, as follows:

A. Provide two (2) copies and one (1) mylar reproducible of all wiring diagrams, including straight-line wiring diagrams of all "as built and installed" elevator electrical circuits with index of location and function of all components. Provide logic diagram for all microprocessors. NOTE: Leave one (1) complete set of corrected installation diagrams and wiring dope sheets on the job for each unit.

B. Provide two (2) copies of all "final" construction and installation drawings.

C. Provide three (3) neatly bound and indexed sets of the following:
   1. Sequence of operation and/or floor charts of the motion control and supervisory control panels, and related operating equipment, including individual and group microprocessors.
   2. Operating instructions and complete, detailed adjustment and application data and instructions for all equipment components including controller, microprocessor, selectors, motors, drives, valves, switches, etc.
   3. Lubricating instructions, including recommended grade of lubricants.
   4. Parts catalogs for all replaceable parts, including ordering forms and instruction. If a given component is made up of smaller parts, the smaller parts shall also be clearly identified by number.
   5. Provide a summary of contract data for each type of equipment furnished, including quantity and part number.
   6. Supplemental data required or requested by The City to facilitate equipment maintenance and adjustment.

D. Provide all special tools, including top-level solid-state diagnostic equipment, which the Manufacturer and Installer supplies to his adjusters and service personnel for proper maintenance and adjustment of all equipment. Special tools shall become the property of The City. NOTE: If solid-state microprocessor or group supervisory diagnostic equipment and/or tools are not available for sale, Elevator Contractor shall quote The City on lease or rental of this equipment, including acceptable terms. Quote as a separate item.

E. The following supplemental information will be required by The City for this project.
   1. Step-by-step adjusting procedures, as used by elevator Manufacturer's/Installer's field adjustor, for each type of equipment used in this specific installation. This shall include, but not be limited to the following:
      a. Selectors / encoders.
      b. Brakes: Shoe clearance core clearance, brake switch, and all other adjustments necessary to give a satisfactory functioning brake.
      c. Controllers: Relay air gaps, current operated relays, timed circuits, set-reset relays, and all other necessary adjustments and settings.
      d. Electronic devices and circuits.
      e. Dispatching controller: Timed circuits, etc.
      f. Computer type dispatcher: Data and procedure to change settings.
      g. Overload relays: Current settings upon tripping, testing and maintenance procedures.
      h. Acceleration and deceleration patterns, including time and slow-down settings.


k. Hoistway switches and cams.

l. Terminal landing slow down device.

m. Leveling and re-leveling units in hoistway.

n. Load compensation: Load weighing device settings and load compensation adjustments.

o. Safeties: Clearance to rails and pull out in pounds for the releasing carrier. Setting of safety operated switch.

p. Door protective devices: Focusing, testing, maintenance, and adjusting procedures.

q. Roller guides: Spring tension and stop settings.

r. Motors: Air gap, compounding, neutral setting and all other necessary adjustments.

s. Door operator and doors: Door operator control switches, door operator control potentiometers or resistances, door motor, door checks, door closers, door and gate locks, clutches/bayonets, door unlocking cams, encoders, and door restrictors.

t. Communications, annunciating, and security systems.

2. List of necessary tools, instruments, and other equipment used in the adjusting procedure, including method for incorporating them in procedures.

3. Final adjusting data for each elevator, including, but not limited to, settings for the following:

a. Load compensation sensing device in voltage or current for empty fully loaded car.

b. Selectors/encoders.

c. Brakes: Shoe running clearance and brake coil current.

d. Hatch switches and devices.

e. Door operator control switch settings.

f. Safety device: Full-load, full-speed, test data.

g. Full-load starting and running current.

h. Current settings or current operated relays.

i. Motor field resistance settings.

j. Timers: Time delay settings, including method and equipment needed to program microprocessor.

k. Electronic power supply voltages necessary for correct functioning of equipment and from where measured.

F. Maintenance Materials:

1. Expendable parts: The Elevator Contractor shall provide one or more secure metal cabinets in each machine room containing expendable parts normally required for maintenance and repairs during the warranty period. Locate cabinets in machine rooms as directed by The City. Parts cabinets and all parts contained therein shall become property of The City and shall not be removed at the expiration of the warranty period. As a minimum, provide the following items:

a. One set of renewal contacts and operating coil for each type of motor starter and main contactor installed.

b. Two resistors and two capacitors of each size and value installed.

c. One complete set of SCR's, Triacs, power transistors and/or similar devices for each type of power convertor/drive unit installed.

d. Two control relays of each type and voltage installed.
e. One complete key-operated switch, including individually keyed lock cylinder (for each function) of each type installed.
f. Twenty-four lamps of each type and voltage installed.
g. One car and hall button (for each function), with identical graphics, of each type installed.
h. Ten fuses of each type and size installed.
i. One control circuit board of each type and part number installed.
j. One set of door operator belts/chains of each type installed.
k. Two complete sets of hoistway door interlock contacts for each type installed.
l. Two sheaves for each type of car and hoistway door hanger assembly installed.
m. One set of pump unit drive belts for each type installed.
n. One set of packing for each size jack assembly installed.
o. Any other parts required for prompt replacement.

2. Replacement Parts: The Elevator Contractor shall maintain the following parts in a warehouse within 50 miles of the Project premises:

   a. One door operator motor of each type installed.
   b. Transformers and choke coils of each type installed.
   c. One set of hoist motor and sheave bearings.
   d. Parts for door protective devices of the type installed.
   e. Such other parts as are necessary to ensure prompt replacement in the event of an individual elevator shutdown or group system failure.

G. Maintenance Tools and Software Manuals: Provide all special tools, including top-level, solid-state diagnostic tools and software documentation which the equipment Manufacturer and/or Installer supplies to his adjusters and service personnel, necessary for the proper troubleshooting, maintenance and adjustment of the entire system.

   1. Diagnostic tools may be hand-held or built into controller system and shall be of the type not requiring periodic recharging or reprogramming, nor be of the automatic destruct type. Passwords to access top-level diagnostics and adjusting features shall be provided.
   2. Tools and supporting software may be programmed so as to operate only with this Projects identification serial numbers.
   3. Special tools shall become the property of The City. NOTE: If individual microprocessor or group supervisory diagnostic equipment and/or tools are not available for sale, Elevator Contractor shall quote The City on lease of this equipment. Terms of lease must be acceptable to The City. Quote as a separate item.

3.11 WARRANTY INSPECTION AND RETEST

   A. At least thirty (30) days prior to warranty expiration, Elevator Contractor shall schedule final inspection and retest with City representatives. Final inspection and retest shall include close examination of all equipment by The City and Equipment Manufacturer's necessary to perform all tests required by The City's representative.

   B. Replace, repair, or adjust any equipment found defective and covered by warranty prior to expiration of warranty period.

   C. Warranty period shall not expire until retest is complete, corrective measures are complete, specified instructions and training are complete, and all required submittals are received and approved by The City.
END OF SECTION
PART 1 - GENERAL

1.1 WORK INCLUDED

A. One In-ground Hydraulic Elevator as follows:
   1. One Passenger Elevator. Car No. 5

B. All engineering, equipment, labor and permits required to satisfactorily complete elevator installation as required by contract documents.

C. Provide all required staging, hoisting, hoist/safety beams, and equipment necessary for the movement of equipment. Removal of hoist beams after elevator installation is complete if beams encroach on Code clearances.

D. Applicable conditions of General, Special, and Supplemental Conditions, and Division 1.

E. Preventive maintenance as described herein.

F. Equipment furnished by others, installed under this section

   1. Provide per Section 14210, 1.01, F, 1 – 3.
   2. Security access system for Elevator No. 5, including card readers, digital key pads, related equipment and remote wiring (if provided as part of overall building security system). Mounting and interface provisions, installation and wiring for on-board devices is by Elevator Contractor. Connect access system to each elevator card reader at controller interface terminals in elevator machine room.

1.2 RELATED WORK SPECIFIED ELSEWHERE

A. Refer to Drawing No. VT01

1.3 DEFINITIONS

A. Terms used are defined in the latest edition of the Safety Code for Elevators and Escalators, ASME A17.1.

B. Reference to a device or a part of the equipment applies to the number of devices or parts required to complete the installation.

1.4 QUALITY ASSURANCE

A. Qualified Providers: Amtech, Fujitec, KONE, Mitsubishi, Otis, Schindler, ThyssenKrupp. Alternate Providers must receive approval of the Architect, Purchaser and/or Consultant at least ten days prior to bid date.

B. Approved


C. Compliance with Regulatory Agency: Comply with most stringent applicable provisions of following Code and/or Authority, including revisions and changes in effect on date of this specification;

1. Safety Code for Elevators and Escalators ASME A17.1
2. Guide for Inspection of Elevators, Escalators, and Moving Walks, ASME A17.2
3. Elevator and Escalator Electrical Equipment, ASME A17.5
4. National Electrical Code, NFPA 70
5. Americans with Disabilities Act (ADA)
6. Local fire jurisdiction
7. Requirements of UBC and all other Codes, Ordinances and Laws applicable within the governing jurisdiction
8. Life Safety Code, NFPA 101, and CCR Title 19
9. Uniform Federal Accessibility Standard (UFAS)
10. California Code of Regulations Title 8 and California Building Code Title 24

D. Warranty

1. Material and workmanship of the installation shall comply in every respect with contract documents. Correct defective material or workmanship which develops within one year from date of final acceptance of work to the satisfaction of the Architect, Purchaser and Consultant at no additional cost, unless due to ordinary wear and tear, or improper use or care by Purchaser. Perform maintenance in accordance with terms and conditions indicated in attached Preventive Maintenance Contract.

2. Defective is defined to include, but not limited to; operation or control system failures, performance below required minimum, excessive wear, unusual deterioration or aging of materials or finishes, unsafe conditions, the need for excessive maintenance, abnormal noise or vibration, and similar unsatisfactory conditions.

3. Make modifications, adjustments and improvements to meet performance requirements in Parts 2 and 3.

1.5 DOCUMENT VERIFICATION

In order to discover and resolve conflicts or lack of definition which might create problems, Provider must review contract documents for compatibility with its product prior to bidding. Review structural, architectural, electrical and mechanical documents, and elevator specification. Attach specific, written exception and/or clarification with quotation. Compliance with all provisions of contract documents is assumed and required in the absence of written exception. Purchaser will not pay for change to structural, mechanical, electrical, or other systems required to accommodate Provider’s equipment if not identified before contract award.
1.6 SUBMITTALS

A. Within 60 days after award of contract and before beginning equipment fabrication, submit shop drawings and required material for review as outlined in Division I. Allow 30 days for response to initial submittal.

1. Scaled or Fully Dimensioned Layout: Plan of pit, hoistway and machine room indicating equipment arrangement, elevation section of hoistway, details of car enclosures, hoistway entrances, and car/hall signal fixtures.
2. Design Information: Indicate equipment lists, reactions, and design information on layouts.
4. Fixtures: Cuts, samples, or shop drawings.
5. Finish Material: Submit 3” x 12” samples of actual finished material for review of color, pattern, and texture by Architect. Compliance with other requirements is the exclusive responsibility of the Provider. Include, if requested, signal fixtures, lights, graphics, Braille plates, and mounting provisions.

B. Senate Bill 1886 Submittals: Provide copies of all code authority/permit submittals to the Owner’s Representative.

C. Acknowledge and/or respond to drawing comments within 14 days of return; promptly incorporate required changes due to inaccurate data or incomplete definition so that delivery and installation schedules are not affected. Revision response time is not justification for equipment delivery or installation delay.

1.7 PERMIT, TEST AND INSPECTION

A. Obtain and pay for permit, license, and inspection fee necessary to complete the installation.

B. Perform test required by Governing Authority in accordance with procedure described in ASME A17.2 Inspectors’ Manual for Elevators and Escalators in the presence of Authorized Representative.

C. Supply personnel and equipment for test and final review required by Consultant, as indicated in Part 3.

1.8 MAINTENANCE

A. Interim

1. When one or more elevators are near completion and ready for service, the Purchaser may accept elevators for interim use and place in service before entire installation of all elevators has been completed and accepted.
2. During this period, Purchaser may pay a mutually agreed upon amount per elevator for preventive maintenance. Indicate amount per unit per month with bid.
3. Temporary acceptance form must be acceptable to Purchaser and signed prior to use.
4. User must provide or pay for temporary hoistway and car enclosures; protect installed equipment and finishes; and pay for all cleaning, repairs, and replacement of materials necessary to restore elevator to “as new” condition prior to final acceptance by Purchaser.
B. Warranty Maintenance

1. Provide preventive maintenance and 24-hour emergency callback service for one year commencing on date of final acceptance by Purchaser. Systematically examine, adjust, clean, and lubricate all equipment. Repair or replace defective parts using parts produced by the manufacturer of installed equipment. Maintain elevator machine room, hoistway, and pit in clean condition.

2. Use competent personnel, acceptable to the Purchaser, supervised and employed by the Provider.

3. The warranty maintenance period specified in Item 1. above shall be extended one month for each three-month period in which equipment-related failures average more than .25 per unit per month.

4. Purchaser retains the option to delete cost of warranty maintenance from new equipment contract and remit twelve equal installments directly to Provider during period in which work is being accomplished.

C. Contract Preventive Maintenance: Quote monthly cost for five year Preventive Maintenance Agreement commencing on completion of the one year period in Item 1.08, B. above. Submit quote based upon terms and conditions of the Preventive Maintenance Agreement furnished with this specification. Base quotation on present labor and material cost. Price adjustment will be made at contract commencement date and thereafter as provided in contract.

PART 2 - PRODUCTS

2.1 SUMMARY

A. Passenger Elevator

NUMBER: CAR NO. 5
CAPACITY: 3500 #, CLASS A LOADING
SPEED: 125 F.P.M.
OPERATIONAL CONTROL: SELECTIVE COLLECTIVE, MICROPROCESSOR BASED SYSTEM NON-PROPRIETARY
MOTOR CONTROL: SINGLE SPEED AC WITH SCR SOFT START WITH CLOSED TRANSITION
POWER CHARACTERISTICS: 480 VOLTS, 3 PHASE, 60 HERTZ
STOPS: 3
OPENINGS: 3
FLOORS SERVED: B, 1, 2
TRAVEL: 27'-4"±
PLATFORM SIZE: 7'-0" WIDE X 6'-2" DEEP
MINIMUM CLEAR INSIDE CAR: 6'-8" WIDE X 5'-5" DEEP
ENTRANCE SIZE: 3'-6" WIDE X 7'-0" HIGH
ENTRANCE TYPE: SINGLE SPEED, CENTER OPENING
DOOR OPERATION: HIGH SPEED, HEAVY-DUTY, MASTER
DOOR OPERATOR, MINIMUM OPENING
SPEED 2-1/2 F.P.S.

DOOR PROTECTION: INFRARED, THREE DIMENSIONAL,
FULL SCREEN DEVICE, WITH
DIFFERENTIAL TIMING, NUDGING AND
INTERRUPTED BEAM TIME

MACHINE: HYDRAULIC PUMP

HYDRAULIC TYPE: DIRECT PLUNGER

MACHINE ROOM: ADJACENT AT BOTTOM LANDING

GUIDE RAILS: PLANED STEEL TEES

BUFFERS: SPRING

CAR ENCLOSURE: AS SPECIFIED AND AS DETAILED ON
ARCHITECTURAL DRAWINGS

CAR CANOPY HEIGHT 8'-0"

SIGNALS: VANDAL RESISTANT

REGISTRATION LIGHTS: SINGLE HALL PUSHBUTTON RISER
SINGLE CAR OPERATING PANEL
VANDAL-RESISTANT CAR AND HALL
PUSHBUTTONS

LED FIXTURE ILLUMINATION

POSITION INDICATOR: CAR DIGITAL WITH DIRECTION
ARROWS, TRANSOM MOUNTED
SECURITY CONTROL PANEL,
INCLUDING PC, CRT (TOUCH SCREEN),
AND KEYBOARD

HALL LANTERNs: AT ALL FLOORS WITH VOLUME
ADJUSTABLE ELECTRONIC CHIME OR
TONE. SOUND TWICE FOR DOWN
DIRECTION, VANDAL RESISTANT

COMMUNICATION SYSTEM: INTERCOM WITH DISTRESS SIGNAL –
CAR AND ELEVATOR LOBBY

FIXTURE SUBMITTAL: SUBMIT BROCHURE DEPICTING
MANUFACTURER'S PROPOSED
DESIGNS WITH BID

ADDITIONAL FEATURES –
(CAR NO. 5):

CAR ROLLER GUIDES
CAR TOP INSPECTION STATION
STANDBY POWER TRANSFER
(AUTOMATIC TO MAIN FLOOR) WITH
MANUAL OVERRIDE IN FIREFIGHTERS
CONTROL PANEL
ADA AND EMERGENCY MEDICAL SERVICES ACCESS AND SIGNAGE, REAR MOUNTED FROM BACKSIDE OF JAMB

STATIONARY CAR RETURN PANEL ARRANGED FOR FLUSH CAR OPERATING PANEL WITH HAIRLINE JOINTS

HOISTWAY ACCESS SWITCHES AT TOP AND BOTTOM FLOORS

INDEPENDENT SERVICE FEATURE

PLATFORM ISOLATION, JACK TO PLATEN CONNECTION(S)

CENTRAL CONTROL PANEL AND REMOTE WIRING WITH REMOTE CALL AND SEND CAPABILITY

TAMPER RESISTANT FASTENERS FOR SIGNAL FIXTURE FACEPLATES

SILL SUPPORT ANGLES

ONE YEAR WARRANTY MAINTENANCE WITH 24 HOUR CALLBACK SERVICE

HYDRAULIC PUMP UNIT AND CONTROLLER SOUND ISOLATION

JACK HOLE, OUTER CASING AND WATERTIGHT PVC SLEEVE

WATERTIGHT PVC SLEEVE FOR UNDERGROUND PIPING

SEISMIC SAFETY VALVE

SEISMIC DEVICES

PAD BUTTONS AND VINYL COVERED PADS

CARD READER PROVISIONS

CCTV PROVISIONS – CAR AND ELEVATOR LOBBY

BATTERY PACK EMERGENCY CAR LIGHTING. PROVIDE SEPARATE CONSTANT PRESSURE TEST BUTTON IN CAR SERVICE COMPARTMENT ILLUMINATE PORTION OF NORMAL CAR LIGHTING

SIGNAGE ENGRAVING FILLED WITH BLACK PAINT

NO VISIBLE COMPANY NAME OR LOGO
2.2 MATERIALS

A. Steel


B. Stainless Steel: Type 304 or 316 complying with ASTM A167, with standard tempers and hardness required for fabrication, strength and durability. Apply mechanical finish on fabricated work in the locations shown or specified (Federal Standard and NAAMM nomenclature) with texture and reflectivity required to match Architect’s sample. Protect with adhesive-paper covering.

1. No. 4: Bright directional polish (satin finish). Graining directions as shown or, if not shown, in longest dimension.
2. No. 8: Reflective polish (mirror finish).
3. Textured: 5WL as manufactured by Rigidized Metals or Windsor pattern 5-SM as manufactured by Rimex Metals or approved equal with .050 inches mean pattern depth with bright directional polish (sat in finish).

C. Aluminum: Extrusions per ASTM B221; sheet and plate per ASTM B209.

D. Plastic Laminate: ASTM E84 Class A and NEMA LD3.1, Fire Rated Grade (GP 50), Type 7, 0.050” ± .005” thick, color and texture as follows;

1. Exposed Surfaces: Color and texture selected by Architect.
2. Concealed Surfaces: Manufacturer’s standard color and finish.

E. Fire Retardant Treated Particle Board Panels: Minimum 3/4” thick backup for natural finished wood and plastic laminate veneered panels, edged and faced as shown, provided with suitable anti warp backing; meet ASTM E84 Class “I” rating with a flame spread rating of 25 or less, registered with Local Authorities for elevator finish materials.

F. Natural Finish Wood Veneer: Standard thickness, 1/40” thoroughly dried conforming to ASME/HPMA HP 1983, Premium Grade. Place veneer, tapeless spliced with grain running in direction shown, belt and polish sanded, book matched. Species and finish designated and approved by Architect.

G. Paint: Clean exposed metal parts and assemblies of oil, grease, scale, and other foreign matter and factory paint one shop coat of rust resistant primer. After erection, provide one finish coat of industrial enamel paint. Galvanized metal need not be painted.
H. Prime Finish: Clean all metal surfaces receiving a baked enamel paint finish of oil, grease, and scale. Apply one coat of rust resistant primer followed by a filler coat over uneven surfaces. Sand smooth and apply final coat of primer.

I. Baked Enamel Finish: Prime finish per Item I. above. Unless specified "prime finish" only, apply and bake three (3) additional coats of enamel in the selected solid color.

2.3 CAR PERFORMANCE

A. Car Speed: ± 10% of contract speed under any loading condition.

B. Car Capacity: Safely lower, stop and hold up to 125% of rated load.

C. Car Stopping Zone: ± 3/8" under any loading condition.

D. Door Opening Time: 1.6 seconds from start of opening to fully open.

E. Door Closing Time: 2.4 seconds from start of closing to fully closed.

F. Car Floor to Floor Performance Time: 13.25 seconds from start of doors closing until doors are 3/4 open (1/2 open for side opening doors) and car in stopping zone at next successive floor under any loading condition or travel direction (12'-6" typical floor height).

G. Pressure: Fluid system components shall be designed and factory tested for 500 p.s.i. maximum operating pressure shall be 400 p.s.i.

H. Noise and Vibration Control

1. Airborne Noise: Measured noise level of elevator equipment and its operation shall not exceed 50 dBA in elevator lobbies and 60 dBA inside car under any condition including door operation and car ventilation exhaust blower on its highest speed.

2. Vibration Control: All elevator equipment provided under this contract, including power unit, controller, oil supply lines and their support shall be mechanically isolated from the building structure and electrically isolated from the building power supply and to each other to minimize the possibility of objectionable noise and vibrations being transmitted to occupied areas of the building.

3. Limit noise level in the machine room relating to elevator equipment and its operation to no more than 80 dBA.

4. All dBA readings to be taken three (3) feet off the floor and three (3) feet from the equipment using the "A" weighted scale.

2.4 OPERATION

A. Selective Collective Microprocessor Based (Car No. 5): Operate car without attendant from pushbuttons in car and located at each floor. When car is available, automatically start car and dispatch it to floor corresponding to registered car or hall call. Once car starts, respond to registered calls in direction of travel in order floors are reached.

Do not reverse car direction until all car calls have been answered or until all hall calls ahead of car and corresponding to direction of car travel have been answered.

Slow car and stop automatically at floors corresponding to registered calls, in the order in which they are approached in either direction of travel. As slowdown is initiated for a hall call, automatically cancel hall call. Cancel car calls in same manner. Hold car at arrival floor an adjustable time interval to allow passenger transfer.
Answer calls corresponding to travel direction of car unless call in the opposite direction is highest or lowest call registered.

Illuminate appropriate pushbutton to indicate call registration. Extinguish light when call is answered.

B. Security Operation: Provide per 14210, 2.04, B, 1, 2, 3.

C. Other Items

1. Low Oil Control: In the event oil level is insufficient for travel to the top floor, provide controls to return elevator to the main level and park until oil is added.
2. Independent Service: Provide controls for operation of each car from its pushbuttons only. Close doors by constant pressure on desired destination floor button or door close button. Open doors automatically upon arrival at selected floor.

D. Firefighters’ Service: Provide equipment and operation in accordance with Code requirements.

E. Automatic Stopping Zone: Stop car within 3/8" above or below the landing sill. Avoid overtravel/undertravel, and maintain stopping accuracy regardless of load in car, direction of travel, or distance between landings.

F. Remote Monitoring and Diagnostics: Equip each controller and the group dispatch logic controller, with standard ports, interface boards, and drivers to accept maintenance, data logging, fault finding diagnostic, and monitoring computers, keyboards, modems, and programming tools. The system shall be capable of driving remote color CRT monitor(s) that continually scan and display the status of each car and call. Provide each group with a full, interactive elevator monitoring (EMS) system.

G. Motion Control: AC type with unit valve suitable for operation specified and capable of providing smooth comfortable acceleration and deceleration. Limit the difference in speed between full load and no load to not more than ±10% of the contract speed in either direction of travel.


I. Door Operation: Automatically open door when car arrives at main floor whether car call has been registered or not. Provide “heavy door/variable air pressure” feature for operation of doors within appropriate inertia limits.

J. Standby Lighting and Alarm: Car mounted, battery unit with solid state charger to operate alarm bell and car emergency light fixture. Battery to be rechargeable with minimum 5-year life expectancy. Provide constant pressure test button in service compartment of car operating panel. Provide lighting integral with portion of normal car lighting system. Include required transformer.

K. Standby Power Transfer: Upon loss of normal power, adequate standby power will be supplied via the normal electrical feeders to start and run elevator at rated speed and load.

1. Provide "STANDBY POWER" indicator light in firefighters’ control panel. Indicator light illuminates only when car is selected to operate on standby power.
L. Card/Proximity Reader Security System: Provide provisions inside Car No. 5 for reader unit. Unit furnished by Security Subcontractor. Mount reader unit as directed by Architect and cross connect from car pushbuttons to control module in machine room via five pair of shielded wires and two RG6 type coaxial cables. Reader control module and mounting provided by Security Subcontractor.

2.5 MACHINE ROOM EQUIPMENT

A. Arrange equipment in spaces shown on drawings.

B. Pump Unit: Assembled unit consisting of positive displacement pump, induction motor, master-type control valves combining safety features, holding, direction, bypass, stopping, manual lowering functions, shut off valve, oil reservoir with protected vent opening, oil level gauge, outlet strainer, drip pan, muffler, all mounted on isolating pads. Provide oil cooling unit and oil temperature thermostat to maintain oil at operating temperature. Enclose entire unit with removable sheet steel panels lined with sound-absorbing material. Provide closed transition SCR soft start. Design unit for 120 upstarts/hour.

C. Encoder: Direct drive, solid state, optical, digital type. Update car position at each floor and automatically restore after power loss.

D. Controller: UL/CSA labeled.

1. Compartment: Securely mount all assemblies, power supplies, chassis switches, relays, etc., on a substantial, self supporting steel frame. Completely enclose equipment with covers. Provide means to prevent overheating.

2. Relay Design: Magnet operated with contacts of design and material to insure maximum conductivity, long life and reliable operation without overheating or excessive wear. Provide wiping action and means to prevent sticking due to fusion. Contacts carrying high inductive currents shall be provided with arc deflectors or suppressors.

3. Microprocessor Related Hardware

a. Provide built in noise suppression devices which provide a high level of noise immunity on all solid state hardware and devices.

b. Provide power supplies with noise suppression devices.

c. Isolate inputs from external devices (such as pushbuttons) with opto isolation modules.

d. Design control circuits so that one side of power supply is grounded.

e. Safety circuits shall not be affected by accidental grounding of any part of the system.

f. System shall automatically restart when power is restored.

g. System memory shall be retained in the event of power failure or disturbance.

h. Equipment shall operate properly with a 500 KHZ to 1300 MHZ radio frequency signal, transmitted at a power level of not less than 100 watts Effective Radiated Power (ERP) at a distance of three (3) feet.

i. Equipment shall be provided with Electro Magnetic Interference (EMI) shielding within FCC guidelines.

4. Wiring: CSA labeled copper for factory wiring. Neatly route all wiring interconnections and securely attach wiring connections to studs or terminals.

5. Provide controller or machine mounted auxiliary, lockable “off” disconnect if mainline disconnect not in sight of controller and pump unit.

6. Permanently mark components (relays, fuses, PC board, etc.) with symbols shown on wiring diagrams.

7. Provide reduced voltage motor starting circuits with solid-state motor starter.
E. Muffler: Provide in discharge oil line near pump unit. Design shall dampen and absorb pulsation and noise in the flow of hydraulic fluid.

F. Piping and Oil: Provide piping, connections and oil for the system. Buried piping shall be secondarily contained with watertight Schedule 40 PVC sleeves between elevator machine room and pit. A minimum of two sound isolation couplings shall be provided between the pump unit and oil line and the oil line and jack unit. Provide isolated pipe stands or hangers as required.

2.6 HOISTWAY EQUIPMENT

A. Guide Rails: Planed steel T sections of suitable size and weight for the application, structural support spacing, car weight, and seismic reactions, with brackets for attachment to building structure. Provide car rail backing to meet Code requirements. Provide double bracketing, i.e., top and bottom of floor beam, if required. Size rails to span supports indicated.

B. Buffers: Spring type with blocking and supports.

C. Hydraulic Jack Assembly

1. Cylinder(s): Seamless steel pipe. Design head to receive unit-type packing and provide means to collect oil at cylinder head and return automatically to oil reservoir. Provide cylinder protection. Provide cylinder stabilizer bracketing as required.

2. Plunger(s): Polished seamless steel tubing or pipe. If plunger length exceeds 24', provide two or more sections not exceeding 16' in length, or coordinate installation of longer unit at the jobsite. Join section by internal threaded couplings. Multiple section jack units shall be factory polished while assembled and marked for proper future reassembly. Isolate plunger from car frame(s).

D. Jack Support and Fluid Shut-Off Valve: Provide steel pit channels to support jack assembly and transmit loads to building structure. Provide intermediate stabilizers as required. Provide manual on/off valve in oil line adjacent to pump unit and jack unit in pit.

E. Well Hole Casing: Well hole is to be provided by Elevator Contractor. No additional compensation will be allowed for unforeseen conditions of any kind or spoil removal.

Install steel outer casing minimum 18" diameter. Install watertight PVC casing over jack assembly for cylinder protection prior to insertion into the outer casing. Extend PVC sleeve through pit floor slab to underside of jack support beams and seal with non-permeable membrane. Provide vision ports/evacuation tubes.

F. Seismic Safety Valve: Provide a pressure sensitive, mechanically-actuated seismic safety valve, conforming to ASME A17.1, Rule 2410.6. Connect valve directly to jack assembly inlet.

G. Normal Terminal Stopping Devices: Per Code.

H. Electrical Wiring and Wiring Connections

1. Conductors and Connections: Copper throughout with individual wires coded and connections on identified studs or terminal blocks. Use no splices or similar connections in wiring except at terminal blocks, control compartments, junction boxes. Provide 10% spare conductors throughout. Run spare wires from car connection points to individual elevator controllers in the machine room. Provide six
pairs of spare shielded communication wires in addition to those required to connect specified items. Tag spares in machine room.

2. Conduit: Painted or galvanized steel conduit and duct. Flexible conduit not to exceed 36" in length. Flexible heavy duty service cord may be used between fixed car wiring and car door switches for door protective devices.

3. Traveling Cables: Type ET flame and moisture resistant outer cover. Prevent traveling cable from rubbing or chafing against hoistway or equipment within hoistway. Provide 2 RG6 coaxial CCTV cables within traveling cable from car controller to car top. Terminate in properly identified car top and machine room junction boxes.

4. Auxiliary Wiring: Connect smoke sensors, emergency telephone system, paging speaker, CCTV, card reader, intercom, and announcement and/or background music in car controller in machine room. Provide conduit and wiring between controller and machine room boxes.

I. Entrance Equipment

1. Door Hangers: Two-point hanger roller with neoprene roller surface and suspension with eccentric upthrust roller adjustment.

2. Door Tracks: Bar or formed, cold drawn removable steel tracks with smooth roller contact surface.

3. Door Interlocks: Operable without retiring cam. Paint interlocks flat black.

4. Door Closers: Spring, spirator or jamb/strut mounted counterweight type. Design and adjust to insure the smooth quiet mechanical close of doors.

J. Floor Numbers: Stencil paint 4" high floor designations in contrasting color on inside face of hoistway doors at each landing and adjacent to the leading edge of the door.

2.7 HOISTWAY ENTRANCES

A. Complete entrances bearing UL fire labels.

B. Frames: Hollow metal, bolted flush head to jamb connection assembly fabricated from not less than 14 gauge material. Provide with sound deadening. Permanently attach cast rear flange mounted Arabic floor designation plates, centerline at 60" above finished floor, on both side jambs. Provide main egress landing plates with “Star” designation. For designated emergency car, provide cast rear flange mounted “Star of Life” designation plate at height of 78" - 84" above finished floor on both side jambs.

C. Door Panels: 16 gauge steel, sandwich construction without binder angles. Provide sound deadening core. Provide leading edges of center opening doors with rubber astragals. Provide a minimum of two gibs per panel, one at leading and one at trailing edge with gibs in the sill groove their entire length of travel. Architectural metal cladding shall wrap around leading edge of panel and return a minimum of 1" on rear side of panel.

D. Sight Guards: 14 gauge, same material and finish as hoistway entrance door panels. Construct without sharp edges.

E. Sills: Extruded aluminum. Extend sill full length of door travel.

F. Sill Support Angles: Structural or formed steel designed to support door sill, based upon car loading classification. Mount to eliminate need for grout under the sill.

G. Fascia, Toe Guards and Hanger Covers: 14 gauge furniture steel with flat black enamel finish.
H. Struts and Headers: Provide for vertical support of entrances and related material. Provide door open bumpers on entrances equipped with vertical struts.

I. Finish of Frames and Doors:

<table>
<thead>
<tr>
<th>CAR NO</th>
<th>FLOOR</th>
<th>FRAMES</th>
<th>DOOR PANELS</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>ALL</td>
<td>TEXTURED SATIN</td>
<td>TEXTURED SATIN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>STAINLESS STEEL</td>
<td>STAINLESS STEEL</td>
</tr>
</tbody>
</table>

2.8 CAR EQUIPMENT

A. Frame: Welded or bolted, rolled or formed steel channel construction to accommodate load classification requirements.

B. Platform: Isolated type, constructed of steel, or steel and wood which is fireproofed on the underside. Design and construct to accommodate load classification requirements. Minimum class “A” construction for all passenger elevators.

C. Platform Apron: Minimum 14 gauge stainless steel, reinforced and braced to car platform front.

D. Guide Shoes: Roller type with three or more spring dampened, sound-deadening rollers per shoe.

E. Finish Floor Covering: By others.

F. Sills: Extruded aluminum with extruded extension between car entrance columns to face of car front return. Extruded extension to match finish of sill.

G. Toe Guard: Minimum 14 gauge steel, reinforced and braced to car platform, with flat black finish.

H. Doors: Provide as specified for hoistway entrance doors.

I. Door Hangers: Two-point hanger roller with neoprene roller surface and suspension with eccentric upthrust roller adjustment.

J. Door Track: Bar or formed, cold-drawn removable steel track with smooth roller contact surface.

K. Door Header: Construct of minimum 12 gauge steel, shape to provide stiffening flanges.

L. Door Electrical Contact: Prohibit car operation unless car door is closed within tolerance allowed by Code.

M. Door Clutch: Heavy duty clutch, linkage arms, drive blocks and pickup rollers or cams to provide positive, smooth, quiet door operation. Design clutch so car doors can be closed, while hoistway doors remain open.

N. Restricted Opening Device: Restrict opening of car doors outside the unlocking zone.
O. Door Operator: High speed, heavy duty, master door operator capable of opening doors at no less than 2-1/2 f.p.s. Accomplish reversal in no more than 2-1/2" of door movement. Open doors automatically when car arrives at a floor.

1. Acceptable closed-loop door operators
   a. G.A.L. MOVFR
   b. KONE AMD
   c. Mitsubishi LV4K
   d. Otis I Motion CL
   e. Schindler QKS
   f. ThyssenKrupp HD91

P. Door Control Device

1. Infrared Reopening Device: Black, fully enclosed device. Three dimensional full screen infrared matrix or multiple beams extending vertically along edge of each leading door panel to minimum height of 7'-0" above finished floor. Device shall prevent doors from closing and reverse doors at normal opening speed if beams are obstructed while doors are closing, except during nudging operation. If device fails, provide for automatic shutdown of car at floor level with doors open.

   a. Acceptable Infrared 3D Reopening Device
      1) Lambda 3D by Otis
      2) Magic Edge by Tri-Tronics
      3) Microlite 3D by ThyssenKrupp
      4) Pana40 Plus 3D by Janus
      5) Mitsubishi 3D MBS

2. Nudging Operation: After beams of door control device are obstructed for a predetermined time interval (minimum 20.0 - 25.0 seconds), warning signal shall sound and doors shall attempt to close with a maximum of 2.5 foot pounds kinetic energy. Activation of the door open button shall override the nudging operation and reopen the doors.

3. Interrupted Beam Time: When beams are interrupted during initial door opening, hold door open a minimum of 3.0 seconds. When beams are interrupted after the initial 3.0 second hold open time, reduce time doors remain open to an adjustable time of approximately 1.0 - 1.5 seconds after beams are reestablished.

4. Differential Door Time: Provide separately adjustable timers to vary time that doors remain open after stopping in response to calls.

   a. Car Call: Hold open time adjustable between 3.0 and 5.0 seconds.
   b. Hall Call: Hold open time adjustable between 5.0 and 8.0 seconds. Use hall call time when car responds to coincidental calls.

Q. Car Operating Panel

1. One car operating panel with faceplate, consisting of a metal box containing the operating vandal resistant fixtures, mounted behind the car enclosure stationary front return panel. Faceplate shall be hinged and constructed of 11 gauge, No. 4 stainless steel.
2. Suitably identify vandal resistant assemblies including floor buttons, alarm button, door open button, and door close button with SCS, Visionmark or Entrada cast tactile symbols recessed flush rear mounted. Provide plates per California CBC, Title 24 accessibility standards including Braille. Locate operating controls no higher than 48" above the car floor; no lower than 35" for alarm button and intercom actuation button.

3. Provide minimum 3/4" diameter raised 1/8" with square shoulder floor pushbuttons which illuminate to indicate call registration.

4. Provide alarm button at bottom of car operating panel to ring bell located on car, and sound distress signal at control panel. Illuminate button when actuated.

5. Provide keyed stop switch with markings to show “run” and “stop.” Locate in locked car service compartment.

6. Provide “door open” button to stop and reopen closing doors or hold doors in open position. Button operable only while car is stopped at a floor regardless of special operational features, except firefighters’ service.

7. Provide “door close” button to activate door close cycle. Cycle shall not begin until normal door dwell time for a car call has expired, except firefighters’ service.

8. Provide firefighters' Phase II key switch with engraved instructions per Code requirements. Include light jewel, buzzer, and call cancel button.

9. Provide lockable service compartment with recessed flush door. Door material and finish to match car return panel or car operating panel faceplate. Door to contain an integral flush security window for displaying the elevator operating certificate. Inside surface of door shall accommodate mounting provisions for certificate.

10. Include the following controls with function and operating positions identified by engraved signage painted black:
   a. Inspection switch.
   b. Light switch.
   c. Four position; off, low, medium, high, exhaust blower switch.
   d. Independent service switch.
   e. Constant pressure test button for battery pack emergency lighting.
   f. 120-volt, AC, GFCI protected electrical convenience outlet.
   g. Card reader override switch.
   h. Stop switch.

11. Provide black paint filled, engraved signage with size and style approved by Architect as follows:
   a. Phase II firefighters' operating instructions on main operating panel above corresponding keyswitch.
   b. Car number over main car operating panel.
   c. “NO SMOKING” LAMC No. 41.51 “SUBJECT TO FINE” over main car operating panel.
   d. Car capacity in pounds and persons on service compartment door.
   e. Failure signage in 1/8" high letters on service cabinet door: “Should the elevator doors fail to open or the elevator become inoperative: Please do not become alarmed. Please use the button marked “ALARM” to summon assistance, or telephone. Remain in the car until assistance arrives and do not attempt to force doors or hatch open.”
   f. 3/16" alarm and intercom button engraving.

R. Car Top Control Station: Per Code. Mount to provide utilization while standing in an upright position.

S. Work Light and Duplex Plug Receptacle: GFCI protected outlet top and bottom of car. Include on/off switch and grounded metal lamp guard.
2.9 CAR ENCLOSURE

A. Passenger Elevator: Provide complete car enclosure as specified herein and detailed on architectural drawings. Provide the following features.

1. Shell: Reinforced 14 gauge furniture steel with baked enamel interior finish as selected. Apply sound deadening mastic to exterior.
2. Canopy: Reinforced 12 gauge furniture steel with lockable, hinged emergency exit. Interior finish white reflective baked enamel.
3. Front Return Panels: Reinforced 14 gauge No. 4 stainless steel with cutouts for car operating panel and other equipment.
4. Entrance Columns: Reinforced 14 gauge No. 4 stainless steel.
5. Transom: Reinforced 14 gauge No. 4 stainless steel full width of enclosure with cutout for car position indicator.
6. Car Door Panels: Minimum reinforced 16 gauge No. 4 stainless steel. Same construction as hoistway door panels. Architectural metal cladding to wrap around leading edge of panel and return a minimum of 1” on rear side of panel.
8. Interior Wall Finish: Provide removable stand-off wall panels, faced and edged, with textured stainless steel. Color and pattern as selected.
11. Lighting: Provide fluorescent fixtures with wiring and hookup. Coordinate with emergency lighting requirements. Provide emergency lighting integral with portion of normal car lighting system. Include required transformer. Provide temporary lighting as required.
12. Suspended Ceiling: Three section, translucent plastic panels mounted in an extruded aluminum angle and T-frame.
14. Pads and Buttons: Three-piece removable pads. Two pads covering side walls and adjacent front returns and one covering rear wall. Provide cutouts to access main car operating panel.

2.10 HALL CONTROL STATIONS

A. Pushbuttons: Provide a single riser with flush-mounted faceplates. Include pushbuttons for each direction of travel which illuminate to indicate call registration. Include approved engraved message and pictorial representation prohibiting use of elevator during fire or other emergency situation as part of faceplate. Pushbutton design shall match car operating panel pushbuttons. Provide vandal resistant pushbutton and light assemblies.

B. Hoistway Access Switches: Mount in entrance frame side jamb at top and bottom floor. Provide fixture with faceplate.

C. Faceplate Material and Finish

1. Hall Pushbutton Station: 11 gauge No. 4 stainless steel
2. Hoistway Access Switch: 11 gauge No. 4 stainless steel
2.11 SIGNALS

A. Hall Lantern: Provide at each entrance to indicate travel direction of arriving car. Illuminate up or down lights and sound tone twice for down direction travel prior to car arrival at floor. Sound level to be adjustable from 20 - 80 dBA measured at 5'-0" in front of hall pushbutton and 3'-0" off floor. Illuminate light until the car doors start to close. Provide advanced hall lantern notification to comply with ADA hall call notification time. Minimum 2-1/2" in the smallest dimension, arrow lenses with faceplates. Provide vandal resistant lantern and light assemblies consisting of series of lines for maximum visibility.

B. Car Position Indicator: Alpha-numeric digital indicator type containing floor designations and direction arrows a minimum of 2" high to indicate floor served and direction of car travel. Locate fixture in transom above car entrance. When a car leaves or passes a floor, illuminate indication representing position of car in hoistway. Illuminate proper direction arrow to indicate direction of travel.

C. Faceplate Material and Finish
   1. Hall Lantern: No. 4 stainless steel.
   2. Car Position Indicator: No. 4 stainless steel

D. Floor passing tone: Provide an audible tone of no less than 20 decibels and frequency of no higher than 1500 Hz, to sound as the car passes or stops at a floor served.

2.12 CENTRAL CONTROL AND DISPLAY PANEL

Per Specification Section 14210.

2.13 REMOTE MONITORING SYSTEM

Per Specification Section 14210.

2.14 INTERCOM AND DISTRESS SIGNAL SYSTEM

Per Specification Section 14210.

2.15 SEISMIC OPERATIONS AND EQUIPMENT

Provide design, components, and operation per CCR Title 8 and ASME A17.1, Part XXIV.

PART 3 - EXECUTION

3.1 SITE CONDITION INSPECTION

A. Prior to beginning installation of equipment, examine hoistway and machine room areas. Verify that no irregularities exist which affect execution of work specified.

B. Do not proceed with installation until work in place conforms to project requirements.

3.2 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver material in manufacturer's original, unopened protective packaging.

B. Store material in original protective packaging. Prevent soiling, physical damage, or moisture damage.
C. Protect equipment and exposed finishes from damage and stains during transportation, erection, and construction.

3.3 INSTALLATION

A. Install all equipment in accordance with manufacturer's instructions, referenced Codes, specification and approved submittal.

B. Install machine room equipment with clearances in accordance with referenced Codes and specification.

C. Install all equipment so it may be easily removed for maintenance and repair.

D. Install all equipment for ease of maintenance.

E. Install all equipment to afford maximum accessibility, safety, and continuity of operation.

F. Remove oil, grease, scale, and other foreign matter from the following equipment and apply one coat of field applied machinery enamel.
   1. All exposed equipment and metal work installed as part of this work which does not have architectural finish.
   3. Neatly touch up damaged factory painted surfaces with original paint and color.
      Protect machine finish surfaces against corrosion.

3.4 FIELD QUALITY CONTROL

A. Work at jobsite will be checked during course of installation. Full cooperation with reviewing personnel is mandatory. Accomplish corrective work required prior to performing further installation.

B. Have Code Authority acceptance inspection performed and complete corrective work.

3.5 ADJUSTMENTS

A. Install rails plumb and align vertically with tolerance of 1/16" in 100'-0". Secure joints without gaps and file any irregularities to a smooth surface.

B. Static balance car to equalize pressure of guide shoes on guide rails.

C. Lubricate all equipment in accordance with manufacturer's instructions.

D. Adjust motors, valves, controllers, leveling switches, limit switches, stopping switches, door operators, interlocks, and safety devices to achieve required performance levels.

3.6 CLEANUP

A. Keep work areas orderly and free from debris during progress of project. Remove packaging materials on a daily basis.

B. Remove all loose materials and filings resulting from work.

C. Clean machine room equipment and floor. Paint floor.
D. Clean hoistways, car, car enclosure, entrances, operating and signal fixtures.

3.7 ACCEPTANCE INSPECTION AND TESTS

A. General: Furnish labor, materials, and equipment necessary for tests. Notify Consultant five (5) days in advance when ready for final review of unit or group. Final acceptance of installation will be made only after all field quality control reviews have been completed, identified deficiencies have been corrected, all Purchaser's information and certificates have been received, and the following items have been completed to satisfaction of Purchaser and Consultant.

1. Workmanship and equipment comply with specification.
2. Contract speed, capacity, floor to floor, and door performance comply with specification.
3. Performance of following are satisfactory:
   a. Starting, accelerating, running
   b. Decelerating, stopping accuracy
   c. Door operation and closing force
   d. Equipment noise levels
   e. Signal fixture utility
   f. Overall ride quality
   g. Performance of door control devices
   h. Operations of special security operation and floor lock-off provisions.

4. Test Results
   a. In all test conditions, obtain specified speed, performance times, stopping accuracy without re-leveling, and ride quality to satisfaction of the Purchaser and Consultant.

   1) Temperature rise in motor windings limited to 50° Celsius above ambient. A full-capacity, 1-hour running test, stopping at each floor for ten (10) seconds in up and down directions, may be required.

B. Performance Guarantee: Should tests reveal defects, poor workmanship, variance or noncompliance with requirements of specified Codes and/or ordinances, or variance or noncompliance with the requirements of specification, complete corrective work to satisfaction of Purchaser and Consultant at no cost;

1. Replace equipment that does not meet Code or specification requirements.
2. Perform work and furnish labor, materials, and equipment necessary to meet specified operation and performance.
3. Perform and assume cost for retesting required by Governing Code Authority, Purchaser and Consultant to verify specified operation and/or performance.

C. Field Review Scheduling: Schedule progress and final equipment reviews with Consultant. Reply promptly, in writing, to corrective work indicated on Consultant's progress and/or final review reports, indicating status, schedule for completion, and questions. Consultant anticipates scheduled appointments will be met. Contract amount will be reduced to reimburse Consultant at normal billing rates for appointments not kept, or for additional follow up reviews required due to gross non compliance with previous review requirements.

3.8 PURCHASER'S INFORMATION

Provide per Specification Section 14210.
3.9  INSTRUCTION TO PURCHASER’S PERSONNEL

Provide per Specification Section 14210.

3.10  OWNER’S INFORMATION, MATERIALS, AND TOOLS

Provide per Specification Section 14210.

3.11  WARRANTY INSPECTION AND RETEST

Provide per Specification Section 14210.

END OF SECTION
SECTION 14325
VERTICAL TRANSPORTATION MAINTENANCE

1.1 DUTIES OF CONTRACTOR

A. Contractor’s Services: Contractor shall provide work and materials, collectively “Services,” at time or times further specified and described in other provisions of this Agreement. “Services” shall include, all labor, transportation, supplies, materials, parts, tools, scaffolding, machinery, hoists, employee safety equipment, equipment, lubricants, supervision, applicable taxes, and all other work and materials expressly required under this Agreement or reasonably inferred whether or not expressly stated herein. Services shall be performed as follows;

1. Diligently and in a first class, complete and workmanlike manner, free of defect or deficiency, and in conformance with all applicable original manufacturer’s specifications.

2. In conformance with Purchaser’s rules, regulations and requirements for work at the Property, as modified and supplemented during term of this Agreement.

3. In such manner as to minimize any annoyance, interference, or disruption to occupants of Property and their invitees.

4. In conformance with all other provisions of this Agreement.

5. In conformance with all legal and code requirements.

6. By qualified, careful and efficient employees in conformity with best industry practices and to Purchaser’s satisfaction.

7. Facilitate proactive preventive maintenance, maximize equipment life and maximize beneficial usage of the vertical transportation equipment covered by this Agreement. Contractor expressly acknowledges that Purchaser is relying on Contractor’s professional expertise in performance of Services to achieve desired results.

B. Materials Included in Services: Services shall include all materials. The term “materials” shall include all tangible property, whether designated as materials, goods, parts or otherwise. All such materials shall be as follows;

1. New, as specified herein.

2. Good quality and suitable for their intended uses. Utilize original equipment manufacturers’ materials, goods or parts, for all renewal, replacement, repair, and lubrication procedures.

3. Proration of equipment shall not be allowed.

4. No consideration shall be given in regard to obsolescence of systems, materials or parts.

C. Material Delivery: All materials shall be delivered F.O.B. to the Property. Whenever materials are specified as “or equal” under this Agreement, substitutions must have the written approval of Purchaser. All specified materials shall be delivered to the Purchaser in their original unbroken packages, wrappings or containers. Title to all materials delivered to and stored at the Property which are intended to become part of the completed Services shall pass to Purchaser upon installation.

D. Scheduling, Inspection, Clean-Up and Acceptance: Contractor shall coordinate with, and follow the directives of Purchaser with respect to scheduling Services and any deliveries hereunder. Contractor shall comply with Purchaser’s requirements for clean-up using containers supplied by Contractor. Contractor shall repair any damage to the Property and adjacent areas caused by Services. Payment for Services shall not be deemed acceptance
of defective, deficient or non-conforming Services. Purchaser shall have full access to inspect Services at all times.

E. Protection of Persons and Property: Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with Services and shall comply with all applicable safety laws, good industry standards, take all reasonable precautions for safety of Purchaser, Purchaser’s Property, Purchaser’s tenants, Purchaser’s employees, Contractor’s employees, and other persons on or about Property.

1.2 EXTENT OF THE SERVICES

A. Contractor shall be responsible for execution of Services included in this Agreement as follows:

1. Proactive Preventive Maintenance: Contractor agrees to regularly and systematically examine, clean, lubricate, adjust, and as conditions warrant, repair or replace all vertical transportation equipment included under this Agreement. Contractor shall maintain elevator machine rooms, hoistways, pits, car tops and equipment in or on these areas in a consistently clean condition.

B. In performing Services, Contractor agrees to provide parts obtained from or recommended by Manufacturer(s) of equipment for replacement or repair. Equivalent parts may be used if approved by Purchaser in writing. Parts requiring repair shall be rebuilt to “like new” condition.

C. Check and adjust the group dispatching system at interval required to ensure all circuits and time settings are consistently and properly adjusted to minimize system response time of registered car and hall calls.

D. If, as a result of examination or testing of the equipment, corrective action is found to be required, Contractor shall proceed immediately to make repairs, replacements, and adjustments. If Contractor believes such work is not Contractor’s responsibility, a written report signed by Contractor shall be delivered to Purchaser for further action with exception of a safety or potential safety situation, in which case, Contractor shall immediately correct the problem.

E. Contractor shall lubricate equipment at intervals recommended by equipment Manufacturer, or as dictated by use of equipment. All lubricants shall be suitable for purpose intended and shall meet or exceed minimum requirements specified by Manufacturer of equipment to which the lubricant is applied. Lubricants, cleaning fluids and all combustible liquids shall be stored in a metal cabinet in machine room and shall be disposed of in accordance with OSHA and EPA guidelines. Post MSDS data sheets as required. A metal can and lid shall be provided in each machine room for temporary storage of oily rags.

F. No parts or equipment required by Services may be removed from the Property without written approval of Purchaser. This does not include renewal parts stocked on the job by Contractor, which shall remain Contractor’s sole property until installed on the equipment.

G. Contractor shall paint equipment at intervals frequently enough to maintain a professional appearance, prevent rusting, and preserve the equipment. Floors in machine rooms, machinery spaces, and pits shall be painted “deck gray.” All paint shall be suitable for the purpose intended and shall be high quality. Notify and schedule all painting procedures with Purchaser.

H. Contractor shall repair damage to car and hoistway door(s) finish when caused by improper adjustment or maintenance of associated equipment.

I. Contractor shall provide metal spare parts cabinets of suitable size for storage of spare parts and wiring diagrams in each machine room. No open storage of parts or other items shall be permitted. Stock parts cabinets with adequate renewal parts per Section 14210.
J. As-built/as-modified wiring diagrams shall be kept neatly folded and stored, except where mounted on boards, and shall be copied and replaced by the Contractor as their condition warrants.

K. Contractor shall not be required to install new attachments, or perform newly mandated tests recommended or directed by inspecting entities; insurance companies; and federal, state, or municipal governmental authorities subsequent to the date of this Agreement unless compensated for such tests or attachments.

L. Services shall not include:
   1. Repairs or replacements required due to negligence, accident or misuse of the equipment by anyone other than the Contractor, their employees, subcontractors, servants or agents, or other causes beyond the Contractor’s control except ordinary wear.
   2. Repair or replacement of Property items, such as hoistway or machine room walls, floors, car interior finishes, car finish floor material, hoistway entrance frames, car and hoistway door panels, car and hoistway door sills, signal fixture faceplates, and fire alarm initiating devices.
   3. Mainline and auxiliary disconnect switches, fuses and feeders to elevator/escalator control panels in machine rooms.
   4. Lamps for normal car and machine room illumination.
   5. Audio and visual devices not provided by Contractor.
   6. Underground hydraulic piping and cylinders.

1.3 CONTRACTOR’S EMPLOYEES

A. Employees: Contractor shall have in its employ at all times a sufficient number of capable employees to properly, adequately, safely, and promptly provide all Services. All matters pertaining to employment, supervision, compensation, promotion and discharge of Contractor’s employees are the responsibility of the Contractor, which is in all respects the employer of such employees. This Agreement is not one of agency, partnership, master-servant, or joint employer, but one with Contractor engaged in the business of providing Services hereunder as an independent contractor. All employment related claims involving Contractor’s employees are Contractor’s sole responsibility and Purchaser shall have no liability with respect thereto.

B. Supervision: Contractor shall be responsible for the supervision and execution of Services by its employees. A minimum annual inspection of site conditions shall be conducted by a designated supervisor of Contractor to ensure that all Services hereunder are properly performed. Contractor shall inform Purchaser of name of such supervisor responsible for Services and supervisor shall have the authority to act as Contractor’s agent. Supervisor shall notify Purchaser of site inspection and provide Purchaser with written confirmation of findings. Contractor shall have sole responsibility for means, methods, techniques, procedures, safety precautions or employment practices in connection with Contractor’s performance of Services.

C. Personnel Issues: Contractor agrees each of its employees will be properly qualified and will use reasonable care in the performance of Services. If Purchaser, in Purchaser’s sole opinion, determines, for any reason, that the qualifications, actions or conduct of any particular Contractor employee has violated this Agreement by performing unsatisfactory Services, interfering with operation of Property, bothering or annoying any occupants, other contractors or subcontractors then at Property, or that such actions or conduct is otherwise detrimental to Purchaser, then upon Purchaser’s written notice, Contractor shall immediately provide qualified replacement. Contractor employees shall report to designated property personnel upon arrival and departure from property in the performance of services.
D. Subcontractors and Suppliers: Unless first approved in writing by Purchaser, Contractor shall have no authority to engage any subcontractors or other parties to perform Services. Neither Purchaser’s approval nor designation of any subcontractors or suppliers nor failure of performance thereof by such parties, shall relieve, release or affect in any manner any of Contractor’s duties, liabilities or obligations hereunder, and Contractor shall at all times be and remain fully liable hereunder.

1.4 INDEMNIFICATION

A. To the extent permitted by law, Contractor shall indemnify, and hold harmless Indemnified Parties from and against any and all claims, demands, losses, damages, injuries, liabilities, expenses, penalties, judgments, liens, encumbrances, orders and awards, whether foreseen or unforeseen, direct or indirect, special or consequential, all of which are collectively referred to as “claims,” however caused, which directly or indirectly relate to or result wholly or in part from, or are alleged to relate or result wholly or in part from:

1. Services performed or required to be performed by Contractor.
2. Any violation of this Agreement by Contractor.
3. Any action or omission of Contractor outside the scope of this Agreement.

B. Such indemnity shall include reasonable attorneys’ fees, experts’ fees, court costs, and other related expenses arising out of any matter covered by foregoing indemnity, except to extent of claims excluded under Item 1.04, C. Contractor shall initially defend claims hereunder on behalf of Indemnified Parties through counsel approved in writing by Purchaser (not unreasonably withheld), until such time as such counsel determines that exclusion in Item 1.04, C. may apply, or such counsel otherwise has a conflict of interest, or Purchaser or Purchaser’s insurer reasonably determines that such counsel’s performance is unsatisfactory. Contractor’s counsel shall then withdraw its representation of Indemnified Parties and transfer all relevant files and documents to a counsel designated, in writing, by Purchaser or other Indemnified Party. Purchaser or other Indemnified Party shall assume responsibility at that time for its defense and payment of its attorney’s fees and costs are subject to reimbursement of such reasonable attorney’s fees and costs by Contractor unless Item 1.04, C. applies.

C. Such indemnity shall not apply to the extent of claims caused by the negligence or willful misconduct of the party, parties, seeking to be indemnified, whether determined by a court of competent jurisdiction with all appeals expired or exhausted, or pursuant to a written settlement and release agreement reasonably approved in writing by Contractor and Purchaser, and by their respective insurers, if applicable. For purposes of this clause “negligence” by an Indemnified Party shall not include its passive failure to supervise Contractor.

D. Notwithstanding foregoing Items 1.04, A., B. and C., such indemnity shall be limited, with respect to claims for indirect damages only, to the amount of $100,000 per occurrence, plus reasonable attorneys’ fees and other defense costs.

E. The term “Indemnified Parties” herein shall mean Owner, Purchaser and their respective subsidiaries, beneficiaries, parents, shareholders, affiliates, directors, officers, partners, agents, servants and employees of all of the foregoing and anyone else acting for or on their behalf.

F. Contractor’s obligations under Item 1.04 shall survive expiration or earlier cancellation of this Agreement for one year.

1.5 INSURANCE

Prior to commencing work, Contractor shall secure insurance, at their sole cost, and submit certificate of confirmation naming indemnified parties as additional insured. In the event Property
is owned by a joint venture or other multi-party entity, all joint venture partners or parties with an equity interest in the ownership shall be named as additional insureds. Contractor’s insurance shall be primary to any applicable loss. With Purchaser’s approval, an Owners & Contractors Protective Liability (OCPL) Policy may be substituted for commercial general liability coverage. Following are minimum insurance coverage requirements:

<table>
<thead>
<tr>
<th>TYPE OF INSURANCE COVERAGE</th>
<th>AMOUNT</th>
</tr>
</thead>
<tbody>
<tr>
<td>WORKERS’ COMPENSATION AND OCCUPATIONAL DISEASE</td>
<td>STATUTORY LIMITS</td>
</tr>
<tr>
<td>EMPLOYER’S LIABILITY (INCLUDING OCCUPATIONAL DISEASE COVERAGE)</td>
<td>$2,000,000</td>
</tr>
<tr>
<td>COMMERCIAL GENERAL LIABILITY, INCLUDING OPERATIONS, CONTRACTUAL, AND COMPLETED OPERATIONS COVERAGE, OCCURRENCE BASIS</td>
<td>$5,000,000 COMBINED SINGLE LIMIT FOR BODILY INJURY AND PROPERTY DAMAGE</td>
</tr>
<tr>
<td>COMMERCIAL AUTOMOBILE LIABILITY COVERING OWNED, NON-OWNED AND HIRED VEHICLES USED IN THE PERFORMANCE OF THE SERVICES</td>
<td>$2,000,000 COMBINED SINGLE LIMIT FOR BODILY INJURY AND PROPERTY DAMAGE</td>
</tr>
</tbody>
</table>

Commercial General and Automobile Liability: Contractor shall maintain a policy of property damage and public liability insurance, including automobile coverage which shall protect the Purchaser against any liability imposed by law for damages, for injury to property or for bodily injuries, including death, suffered or claimed to have been suffered by reason of any direct or indirect negligent act or omission of any employee, servant or agent of the Contractor.

Before commencing work, Contractor shall furnish Purchaser with certificate of all said policies, including an endorsement which states that such insurance will not be cancelled or materially changed unless Purchaser is given 30 days notice, in writing, of the intention of said insurer to cancel or change any such policy.

Nothing in this Agreement shall be construed to mean that Contractor assumes any liability on account of accidents to persons, or property, except those directly, or indirectly, due to negligent acts or omissions of Contractor, its employees, subcontractors, servants or agents. Contractor shall not be held responsible or liable for any loss or damage due to any cause beyond its control, including, but not limited to, acts of government, strikes, lockouts, fire, explosion, theft, floods, riot, civil commotion, war, malicious mischief or act of God. Dates for performance or completion of any ongoing maintenance or corrective action required shall be extended by such length of time as may be reasonably necessary to compensate for unavoidable delay.
1.6 AGREEMENT TERM AND CANCELLATION

This Agreement shall be in force until expiration of Warranty Maintenance period.

A. If Contractor violates any provision or fails to properly provide Services required by this Agreement, Purchaser shall advise Contractor of deficiencies and shall allow Contractor a reasonable period, 30 days unless otherwise agreed, to correct deficiencies at Contractor’s expense, to Purchaser’s sole satisfaction. If Contractor fails to correct deficiencies in allotted time, Purchaser shall have right to cancel Agreement upon 30 days written notice to Contractor, or subsequent to original notice to correct deficiencies, Purchaser, after an additional 10 days written notice to Contractor, may perform or cause to be performed all or any part of Services and Contractor agrees that it will reimburse Purchaser for any expense incurred therefore. Purchaser, at their election, shall deduct amount from any sum owing Contractor. The waiver by Purchaser of a breach of any provision of this Agreement by Contractor shall not be construed as a waiver of any subsequent breach by Contractor.

B. If, Property is sold or a change of management occurs, this Agreement shall remain in force until expiration or cancelled by Contractor, Owner, or Management Company upon 30 days written notice to other party.

C. If Agreement is cancelled, Contractor agrees to take action reasonably necessary to cause an orderly cessation and transition of Services to Purchaser or another Contractor designated by Purchaser without detriment to rights of Purchaser or to continued operation of Property including, but not limited to, refraining from any interference or disruption with tenants or other contractors. Without limiting generality of foregoing, Contractor shall immediately deliver to Purchaser all reports, records, wiring diagrams, portable electronic diagnostic tools, access codes, and other materials and documentation related to and required to facilitate Services required by this Agreement. Purchaser shall withhold final payments due Contractor until receipt of required information and tools. Subsequently, all payments due Contractor shall be prorated on a per diem basis, and no further compensation shall be due to Contractor.

1.7 ADDITIONAL WORK

A. If work is required, outside scope of Services, hourly rates below apply. If additional overtime work is required, within the scope of Services, Purchaser will pay only difference between straight time and overtime labor at hourly rates indicated below. If overtime work is required outside scope of Services, straight time rate plus applicable overtime premium will be basis for hourly charges. Contractor may adjust overtime rates in accordance with Item 1.06, A., labor portion only.

<table>
<thead>
<tr>
<th>BILLING RATES</th>
<th>MECHANIC</th>
<th>HELPER</th>
<th>CREW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straight Time</td>
<td>$________</td>
<td>$________</td>
<td>$________</td>
</tr>
<tr>
<td>Overtime Premium (1.5 Time)</td>
<td>$________</td>
<td>$________</td>
<td>$________</td>
</tr>
<tr>
<td>Overtime Premium (1.7 Time)</td>
<td>$________</td>
<td>$________</td>
<td>$________</td>
</tr>
<tr>
<td>Overtime Premium (Double Time)</td>
<td>$________</td>
<td>$________</td>
<td>$________</td>
</tr>
</tbody>
</table>
1.8 HOURS AND MANNER OF WORK

A. Services, except as otherwise noted under this Agreement, including unlimited emergency callback service, shall be performed during regular hours of regular working days of the Elevator Trade. Provide a minimum of 6 man hours per week of preventive maintenance irrespective of testing, call backs and repair hours. Provide overtime callback service at no additional cost.

B. Response time for callback service:
   1. During regular working hours, Contractor shall arrive at Property within 30 minutes from time of notification.
   2. After hours, Contractor shall respond to callback service within 60 minutes from the time of notification.

C. Removal of elevators from beneficial usage to facilitate Services by Contractor shall be coordinated with and approved by the Purchaser. Purchaser agrees to permit Contractor to remove elevators from service for a reasonable time to perform Services of this Agreement.

1.9 PURCHASER’S RIGHT TO INSPECT SERVICES

A. Purchaser reserves the right to make, or cause to be made, such inspections and tests whenever necessary to ascertain that Services are being fulfilled. Deficiencies noted shall be submitted, in writing, to the Contractor. Contractor shall promptly correct deficiencies at its expense.

B. A qualified Elevator Consultant acceptable to both parties may be retained by Purchaser to perform review of Services and mediate disputes.

1.10 CONTRACTOR TO COMPLY WITH LAWS

A. In the performance of Services, Contractor agrees it will abide by all existing laws, codes, rules and regulations set forth by appropriate authorities having jurisdiction in location where Services are performed.

B. Contractor shall perform ASME A17.1 equipment tests including, but not limited to, annual no load, slow speed test of car safeties, governors and buffers; monthly Firefighters’ service operational tests; annual pressure relief tests on hydraulic elevators; annual standby power operation test(s) on elevators, battery pack car emergency lighting, and 5-year, full load, full speed, test of car and counterweight safeties, governors and buffers, etc. Written reports of all tests shall be submitted to the Purchaser. Provide Purchaser with five (5) day prior notification of tests so that a Representative of the Purchaser may witness all tests. In the event of differing testing requirements between these requirements and local codes or ordinances, the more stringent requirement shall prevail. All annual tests shall be performed during the 11th month of Warranty Maintenance.

C. Contractor shall affix metal tags to the tested devices clearly indicating the type of test, date of test, Contractor performing test, and applicable code rule.

D. Contractor shall affix and maintain Car/State number designation on all elevator equipment in the machine room and pit including hoist machine, pump unit, controller, car crosshead, electrical disconnect, buffer, etc.
1.11 PERFORMANCE REQUIREMENTS

A. Contractor agrees to maintain minimum performance requirements of designated elevators:

<table>
<thead>
<tr>
<th>ELEVATOR</th>
<th>FLOOR TO FLOOR TIME (SECONDS)</th>
<th>DOOR OPEN TIME (SECONDS)</th>
<th>DOOR CLOSE TIME (SECONDS)</th>
<th>STOPPING ACCURACY (INCH)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. 1 – 4</td>
<td>14.00</td>
<td>2.5</td>
<td>5.4</td>
<td>±1/4 &quot;</td>
</tr>
<tr>
<td>No. 5</td>
<td>13.25</td>
<td>1.6</td>
<td>2.4</td>
<td>±1/4 &quot;</td>
</tr>
</tbody>
</table>

1. Floor to floor time is measured from start of door(s) close until elevator is stopped at next typical successive floor, in either direction of travel, and door(s) is 3/4 open. Typical floor height 12'-6".
2. Door open time is measured from start of door(s) open until door(s) is fully open.
3. Door close time is measured from start of door(s) close until door(s) is fully closed.
4. Door closing force shall be no more than 30 lbf. Door closing force is measured with door(s) at rest and between 1/3 and 2/3 closed.
5. Car stopping accuracy shall be measured under all load conditions.
6. Rated car speed, regardless of load, shall not vary more than ± 3% on traction elevators and 10% on hydraulic elevators.

B. Car Ride Quality – Traction Elevators

1. Horizontal acceleration within cars during all riding and door operating conditions shall not exceed 20 mg peak to peak in the 1 - 10 range. Measurement criteria ISO804.
2. Acceleration and deceleration shall be constant and not exceed 3 feet/second\(^2\) with an initial ramp between 0.5 and 0.75 seconds.
3. Sustained jerk shall not exceed 6 feet/second\(^3\).

C. Measured noise levels in a moving car outside the leveling zone shall not exceed 55 dBA under any condition including car ventilation blower or fan on highest speed. Measured noise levels in car within the leveling zone or when car is stopped shall not exceed 60 dBA. There shall be no discernible sound in the elevator car from hoist machine, ropes, sheaves, pump unit, SCR units, platforms, car enclosure walls, or car guides unless it is mutually determined by Contractor and Purchaser that such sounds are attributable to the design of the equipment (provided such design exception shall not apply to the extent that Contractor has provided design or redesign Services under this Agreement or related Agreement).

D. Maintain alignment of car guide rails to a tolerance of 1/16" in 100’ in any direction.

E. While maintaining performance requirements, Contractor shall maintain a comfortable elevator ride with smooth acceleration, retardation and accurate stop. Door operation shall be quiet and smooth with positive checking.

F. Performance requirements indicated are minimum standard, and are not the sole criteria for judging the Contractor’s performance.

1.12 SPECIAL CONDITIONS
A. Contractor shall conspicuously post Preventative Maintenance Schedule and work log in each machine room. Alternatively, collect maintenance and testing logs electronically within elevator computer control system. Data shall be accessible by Purchaser via copy or printout at all times. Log or electronic printout shall include all entries for routine preventive maintenance, repairs, tests, callbacks and Supervisor’s surveys. Entries shall include date work is completed, Mechanic’s or Supervisor’s name, brief description of work completed, including elevator number and number of elevators serviced, and the approximate time required for work excluding travel time to and from property. Purchaser shall be allowed to inspect and copy log or electronic printout and maintenance schedule at any time.

B. Contractor shall maintain Purchaser’s complete set of straight line wiring diagrams in good condition. Drawings shall be consistently modified with “as built” conditions with any changes or modifications to circuits resulting from control modifications, parts replacement or equipment upgrades made by Contractor during Agreement term. Purchaser shall be allowed to reproduce these “as built” drawings and retain sole possession of these drawings in event Agreement is cancelled. If Agreement is cancelled, Purchaser will withhold final payment until an as built/as modified set of wiring diagrams is provided by Contractor.

C. At least quarterly, or more often if requested, Contractor shall provide and review with the Purchaser a summary of all callbacks. The intent of this review is to minimize callbacks by developing consistent communication between the Contractor and Purchaser relative to callback trends, equipment downtime and their causes.

D. City inspection fees in regard to operation of equipment covered by this Agreement, shall be paid by the Purchaser. Fees for reinspection due to failure to eliminate deficiencies covered by Services shall be paid by Contractor.

E. Purchaser may provide Contractor with information to enable Contractor to render Services hereunder, or Contractor may learn information about Property or develop such information from Purchaser. Contractor agrees:

1. To treat, and to obligate Contractor’s employees, subcontractors and suppliers to treat as confidential all such information whether or not identified by Purchaser as confidential.

2. Not to disclose any such information or make available any reports, recommendations and/or conclusions which Contractor may make on behalf of Purchaser to any person, firm or corporation or use the same in any manner, whatsoever, without first obtaining Purchaser’s written approval, except to the extent necessary in connection with performing Services or when required by law.

3. Contractor shall not, in the course of performance of this Agreement, or thereafter, use or permit the use of Purchaser’s name or the name of any affiliate of Purchaser, or the name, address or any picture or likeness of or reference to the Property in any advertising, promotional or other materials prepared by or on behalf of Contractor without the prior written approval of Purchaser.

1.13 PURCHASER’S RESPONSIBILITIES

A. Provide clear, safe and convenient access to Property and elevator equipment rooms.

B. Maintain equipment room lighting, car lighting, telephone lines to controller terminal(s), equipment room electrical switch gear and electrical feeders to elevator controllers.

C. Maintain equipment room heating and air conditioning systems.

D. Maintain fire alarm initiating devices in elevator lobbies, machine rooms, hoistways, etc.

E. Prevent storage of Property equipment or supplies in elevator equipment rooms and obstruction of equipment room access corridors and doors.

F. Maintain standby power generator systems and related switch gear and feeders.
G. Maintain equipment rooms, hoistways, and pits in a code compliant and dry condition.

H. Coordinate with Contractor in regard to Purchaser required equipment retrofits such as elevator security systems, new car interior finishes, car interior TV systems, etc.

I. During Property construction and/or retrofit, make provisions to limit infiltration of dust and debris into elevator equipment and equipment spaces. Routinely clean walls and floors of hoistways and equipment spaces.

1.14 PREVIOUS REPRESENTATIONS

All previous communications or agreements, written or verbal, are hereby abrogated and this writing constitutes the whole Agreement between the parties hereto.

1.15 EXTENT OF LAW

This Agreement shall be interpreted in accordance with the laws of the State of California.

1.16 TIME

Time shall be of the essence in the performance of the terms of this Agreement.

END OF SECTION
SECTION 14560
GRAVITY CHUTES
(TRASH)

SPEC WRITER NOTE: Use this spec section with caution. Edit spec to conform to latest publications before issuing on a specific project.

SPEC WRITER NOTES: Delete between // _____ // if not applicable to project. Also delete any other item or paragraph not applicable in the section and renumber the paragraphs.

PART 1 - GENERAL
1.1 DESCRIPTION
This section specifies gravity trash chutes complete and ready for operation.

1.2 RELATED WORK
A. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL)
B. Section 15900, CONTROLS AND INSTRUMENTATION
C. Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL)

1.3 SUBMITTALS
A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
B. Complete layout drawings of system, including detail drawings of stations.
C. Shop Drawings of Fabricated Equipment and Manufacturer's Literature and Data:
   Submit as one package:
   1. Gravity Chute
   2. Gravity Chute Loading Stations
   3. Automatic Fire Dampers

1.4 QUALITY ASSURANCE
A. Criteria:
   1. Manufacturer regularly and presently manufacturers the item submitted as one of their principal products.
   2. There is a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within 8 hours of receipt of notification that service is requested.
   3. Installer, or supplier of a service, has technical qualifications, experience, and trained personnel and facilities to perform the specified work.
   4. Manufacturer's system has been in satisfactory operation on one installation similar to this system for at least one year.
B. Product Criteria:
   1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units are products of one manufacturer.
   2. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
      a. All components of an assembled unit need not be products of the same manufacturer, but component parts which are alike are the products of a single manufacturer.
      b. Components are compatible with each other and with the total assembly for the intended service.
   3. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark securely affixed in a conspicuous place on equipment or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

C. Transport trash in plastic bags.

D. Space Conditions: Contractor shall pay special attention to existing structure provided in prior phases of construction.

E. Employee Instructions: Provide a qualified representative possessing complete knowledge of system and equipment to train employees in operation and maintenance of system. Training period shall be as follows:
   1. Four hours instructing maintenance personnel on the operation and maintenance of system.
   2. In addition to verbal instruction, furnish written instructions in triplicate relative to care, adjustment, and operating of all parts of equipment in independently bound folders. Written instructions shall include complete, correct, and legible wiring diagrams, complete and comprehensive sequence of operations, complete parts lists with descriptive literature and identifications, diagrammatic cuts of equipment and parts.

1.5 MAINTENANCE SERVICE
   Furnish inspection and maintenance service on all equipment for a period of 1 year after notification by Department of Veterans Affairs that system is to be put into daily operation. This service shall consist of examination by competent and qualified mechanics; cleaning, oiling, greasing, adjustments and replacement of any parts required to place equipment in proper working order, (except parts made necessary by improper use, accident or negligence). Maintenance to be preformed monthly.

1.6 WARRANTY
   A. All labor and materials furnished in connection with the Gravity chutes shall be subject to terms of "Warranty of Construction" articles of the General Conditions. Upon receipt of notice from the Government of any failure of any portion of materials or workmanship furnished, the failure shall be corrected at no additional cost to the government.
B. No device will be accepted that will not give perfect satisfaction without excessive maintenance and attention. If it becomes evident during the warranty period that the equipment is not functioning properly, or in accordance with specification requirements, or, if in the opinion of the Contracting Officer excessive maintenance and attention must be employed to keep equipment operating, remove equipment and install a new device meeting all requirements as part of the work until satisfactory operation on installation is obtained. Period of warranty shall start a new from date of completion of new installation performed in accordance with foregoing requirements.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.

B. Federal Specifications (Fed Spec.):

QQ-S-571E .................................. Solder, Electronic
WW-T-799F .................................. Tube, Copper, Seamless, Water (For Use with Solder-Flared or Compression-Type Fittings)

C. National Fire Protection Association (NFPA):

80-92 ................................. Fire Doors and Fire Windows
82-90 ................................. Incinerators, Waste and Linen Handling Systems and Equipment
90A-89 ................................. Installation of Air-Conditioning and Ventilating Systems

D. American Society for Testing and Materials (ASTM):

A176-92 ................................. Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
A463-88 ................................. Steel Sheet, Cold-Rolled, Aluminum-Coated, Type 1 and Type 2
A526/A526M-90 ......................... Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip process, Commercial Quality

E. Underwriter's Laboratories (UL):

555-90 ................................. Safety Fire Dampers

PART 2 - PRODUCTS

2.1 GRAVITY CHUTE

A. Risers:

//1. Six hundred millimeters (24 inch) diameter tubes, constructed of 14 gauge galvanized steel conforming to ASTM A526. //

//2. Six hundred millimeters (24 inch) diameter tubes, constructed of (16 gauge) aluminized steel conforming to ASTM A463. //

3. Chute parts extending above-roof shall conform to ASTM A176, Type 430 stainless steel.

4. Provide slip type expansion joints in chute risers between floors, upper section telescoping into section below.
5. Support chutes by frames and fasteners at each floor to prevent sound transmission to the floor slab as recommended by manufacturer. Weld and dress smooth connection joints between vertical shafts and horizontal intakes with no projections that may catch or tear waste.

6. Provide factory applied sound insulation with sprayed on sound deadening material.

7. Gravity chute shall meet the NFPA 82 requirements.

B. Provide Chute Fire Dampers as indicated on drawings.

1. The base of the gravity chute shall terminate with sliding gate type fire dampers that carry the UL (1-1/2 hour 250 degrees F) "B" label, covering size, design and construction of gate, frame and closing mechanism. Dampers shall conform to UL 555.

2. Provide Chute Fire Dampers with an electric interlocking mechanism so that no intake doors can be opened in the risers when the chute fire damper has been activated.

C. Provide Gravity Chute disinfecting and sanitizing device as indicated on drawings.

1. Equip chute at top with copper flushing rings containing 1.5 mm (1/16 inch) diameter spray holes, 65 mm (2 1/2 inches) on centers with extra holes which shall completely drain ring when water is shut off. In lieu of flushing rings, chute may be equipped with spray heads designed to flush inside of chute.

2. Contractor shall provide all necessary fittings to water supply piping to connect the disinfecting and sanitizing device to the plumbing system.

3. Equip bottom of chute with hinged access for cleaning and water removal.

2.2 GRAVITY CHUTE LOADING STATIONS

A. Fabricate loading station of 16 gauge stainless steel. Station shall consist of the intake door mounted in a single face plate. The intake door shall have pivot type hinges, and be located as indicated on drawings.

B. Intake doors shall carry the UL (1-1/2 hour 250 degrees F) "B" label, covering size, design and construction of the door, frame, latching, and closing mechanism. Fabricate door of stainless steel and provide self-closing and self-latching devices. Door size shall be a minimum of 15-inch wide by 18-inch high, side hinged with cylinder lock. Install door frame flush with finished wall.

1. Provide cylinder locks, keyed the same for all dispatch stations. Furnish 15 keys for each chute. Stamp the letters "TRASH CHUTE KEY" on each key tag to identify location of use.

2. Provide a 15-inch by 15-inch access panel with an UL (1-1/2 hour 250 degree F) "B" label, covering size, design and construction of the door, frame latching and closing mechanism. Locate where indicated on drawings.

C. Provide intake doors, shroud door(s) and connector door, with electric interlocking mechanism to permit only one door in a riser to be opened at a time.

1. Each intake door shall have an indicator showing when the door is locked.

2. The shroud shall be no less than 45° angle, but shall be 60° when possible.
D. Clearly letter on the intake door in letters approximately one-inch high, the word "TRASH". Raise or incise letters in door face in permanent manner. Raised lettering shall be metal or plastic with metal attachment.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Gravity Chute Loading Stations:
   1. Set station flush with adjacent surface.
   2. Attach face plate to supports with stainless steel screws.

B. Sound Dampening: Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).

C. Hangers:
   1. Conveyance lines and air intake and exhaust ducts: When proper hanger spacing does not correspond with joist or rib spacing, structural steel channels may be attached to joists or ribs and tubing suspended there from.
   2. Vertical Runs: Support at each floor line and at the roof line.

D. Automatic Fire Dampers: Shall conform to NFPA 82.

E. Protection: Protect all finish parts of equipment, such as shafts and bearing where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Cover and protect equipment against dirt, water, and chemical or mechanical injury. Clean exposed materials and equipment at completion of all work.

3.2 TESTS:

A. Demonstrate entire system will operate as specified. Test all lines in sequence by the passage of five test runs of material from each station. Demonstrate operation of station controls by a minimum of five test runs when dispatch buttons are operated simultaneously at two or more separate stations.

B. Resident Engineer shall witness the pre-test and final inspection.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

This section specifies gravity linen chutes complete and ready for operation.

1.2 RELATED WORK

A. Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL)
B. Section 15900, CONTROLS AND INSTRUMENTATION
C. Section 16050, BASIC METHODS AND REQUIREMENTS (ELECTRICAL)

1.3 SUBMITTALS

A. Submit in accordance with Section 01340, SAMPLES AND SHOP DRAWINGS.
B. Complete layout drawings of system, including detail drawings of stations.
C. Shop Drawings of Fabricated Equipment and Manufacturer's Literature and Data:
   Submit as one package:
   1. Gravity Chute
   2. Gravity Chute Loading Stations
   3. Automatic Fire Dampers

1.4 QUALITY ASSURANCE

A. Criteria:
   1. Manufacturer regularly and presently manufactures the item submitted as one of their principal products.
   2. There is a permanent service organization maintained or trained by the manufacturer which will render satisfactory service to this installation within 8 hours of receipt of notification that service is requested.
   3. Installer, or supplier of a service, has technical qualifications, experience, and trained personnel and facilities to perform the specified work.
   4. Manufacturer's system has been in satisfactory operation on one installation similar to this system for at least one year.

B. Product Criteria:
   1. Multiple Units: When two or more units of the same type or class of materials or equipment are required, these units are products of one manufacturer.
   2. Assembled Units: Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.
      a. All components of an assembled unit need not be products of the same manufacturer, but component parts which are alike are the products of a single manufacturer.
      b. Components are compatible with each other and with the total assembly for the intended service.
3. Nameplates: Nameplate bearing manufacturer's name or identifiable trademark securely affixed in a conspicuous place on equipment or name or trademark cast integrally with equipment, stamped, or otherwise permanently marked on each item of equipment.

C. Soil linen shall be transported in laundry bags.

D. Space Conditions: Contractor shall pay special attention to existing structure provided in prior phases of construction.

E. Employee Instructions: Provide a qualified representative possessing complete knowledge of system and equipment to train employees in operation and maintenance of system. Training period shall be as follows:
   1. Four hours instructing maintenance personnel on the operation and maintenance of system.
   2. In addition to verbal instruction, furnish written instructions in triplicate relative to care, adjustment, and operating of all parts of equipment in independently bound folders. Written instructions shall include complete, correct, and legible wiring diagrams, complete and comprehensive sequence of operations, complete parts lists with descriptive literature and identifications, diagrammatic cuts of equipment and parts.

1.5 MAINTENANCE SERVICE

Furnish inspection and maintenance service on all equipment for a period of 1 year after notification by Department of Veterans Affairs that system is to be put into daily operation. This service shall consist of examination by competent and qualified mechanics; cleaning, oiling, greasing, adjustments and replacement of any parts required to place equipment in proper working order, (except parts made necessary by improper use, accident or negligence). Maintenance to be performed bi-monthly.

1.6 WARRANTY

A. All labor and materials furnished in connection with the Gravity chutes shall be subject to terms of "Warranty of Construction" articles of the General Conditions. Upon receipt of notice from the Government of any failure of any portion of materials or workmanship furnished, the failure shall be corrected at no additional cost to the government.

B. No device will be accepted that will not give perfect satisfaction without excessive maintenance and attention. If it becomes evident during the warranty period that the equipment is not functioning properly, or in accordance with specification requirements, or, if in the opinion of the Contracting Officer excessive maintenance and attention must be employed to keep equipment operating, remove equipment and install a new device meeting all requirements as part of the work until satisfactory operation on installation is obtained. Period of Warranty shall start a new from date of completion of new installation performed in accordance with foregoing requirements.

1.7 APPLICABLE PUBLICATIONS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
B. Federal Specifications (Fed Spec.):
   - QQ-S-571E ................................Solder, Electronic
   - WW-T-799F................................Tube, Copper, Seamless, Water (For Use with Solder Flared or Compression-Type Fittings)

C. National Fire Protection Association (NFPA):
   - 80-92 ..........................................Fire Doors and Fire Windows
   - 82-90 ..........................................Incinerators, Waste and Linen Handling Systems and Equipment
   - 90A-89 .............................................Installation of Air-Conditioning and Ventilating Systems

D. American Society for Testing and Materials (ASTM):
   - A176-92......................................Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
   - A463-88......................................Steel Sheet, Cold-Rolled, Aluminum-Coated, Type 1 and Type 2
   - A526/A526M-90 ...........................Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process, Commercial Quality

E. Underwriter's Laboratories (UL):
   - 555-90 .............................................Safety Fire Dampers

PART 2 - PRODUCTS

2.1 GRAVITY CHUTE

A. Risers:
   1. Twenty-four inch diameter tubes, constructed of 14 gauge galvanized steel conforming to ASTM A526.
   2. Twenty-four inch diameter tubes, constructed of 16 gauge aluminized steel conforming to ASTM A463.

3. Chute parts extending above-roof shall conform to ASTM A176, Type 430 stainless steel.

4. Provide slip type expansion joints in chute risers between floors, upper section telescoping into section below.

5. Support chutes by frames and fasteners at each floor to prevent sound transmission to the floor slab as recommended by manufacturer. Weld and dress smooth connection joints between vertical shafts and horizontal intakes with no projections that may catch or tear waste.

6. Provide factory applied sound insulation with sprayed on sound deadening material.

7. Gravity chute shall meet the NFPA 82 requirements.

B. Support:

Provide at base of chute a single 45 degree radius sweep section reinforced at bottom by steel impact having full bottom bearing. Support bottom of chute with two inch diameter chromium plated standard steel or stainless steel adjustable pedestal, with flange for bolting to floor. Brace top of pedestal to wall as shown.
C. Provide Chute Fire Dampers as indicated on drawings.
   1. The base of the gravity chute shall terminate with sliding gate type fire dampers that carry the UL (1-1/2 hour 250 degrees F) "B" label, covering size, design and construction of gate, frame and closing mechanism. Dampers shall conform to UL 555.
   2. Provide Chute Fire Dampers with an electric interlocking mechanism so that no intake doors can be opened in the risers when the chute fire damper has been activated.

D. Provide Gravity Chute disinfecting and sanitizing device as indicated on drawings.
   1. Equip chute at top with copper flushing rings containing 1/16-inch diameter spray holes, 2 1/2-inches on centers with extra holes which shall completely drain ring when water is shut off. In lieu of flushing rings, chute may be equipped with spray heads designed to flush inside of chute.
   2. Contractor shall provide all necessary fittings to water supply piping to connect the disinfecting and sanitizing device to the plumbing system.
   3. Equip bottom of chute with hinged access for cleaning and water removal.

2.2 GRAVITY CHUTE LOADING STATIONS

A. Fabricate loading station of 16 gauge stainless steel. Station shall consist of the intake door mounted in a single face plate. The intake door shall have pivot type hinges, and be located as indicated on drawings.

B. Intake doors shall carry the UL (1-1/2 hour 250 degrees F) "B" label, covering size, design and construction of the door, frame, latching, and closing mechanism. Fabricate door of stainless steel and provide self-closing and self-latching devices. Door size shall be a minimum of 21-inch wide by 21-inch high, side hinged with cylinder lock. Install door frame flush with finished wall.
   1. Provide cylinder locks, keyed the same for all dispatch stations. Furnish 15 keys for each chute. Stamp the letters "LINER CHUTE KEY" on each key tag to identify location of use.
   2. Provide a 15-inch by 15-inch access panel with an UL (1-1/2 hour 250 degree F) "B" label, covering size, design and construction of the door, frame latching and closing mechanism. Locate where indicated on drawings.

C. Provide intake doors, and connector door, with electric interlocking mechanism to permit only one door in a riser to be opened at a time.
   1. Each intake door shall have an indicator showing when the door is locked.
   2. Discharge Doors: 24 inches wide by 30 inches high, top hinged with hold open device and fusible link. Fusible link to be in compliance with applicable codes.

D. Clearly letter on the intake door in letters approximately one-inch high, the word "LINEN". Raise or incise letters in door face in permanent manner. Raised lettering shall be metal or plastic with metal attachment.

2.3 LAUNDRY BAGS

Cotton dacron with sufficient strength to withstand impact at discharge hopper without bursting.
PART 3 - EXECUTION

3.1 INSTALLATION

A. Gravity Chute Loading Stations:
   1. Set station flush with adjacent surface.
   2. Attach face plate to supports with stainless steel screws.

B. Sound Dampening: Section 15050, BASIC METHODS AND REQUIREMENTS (MECHANICAL).

C. Hangers:
   1. Conveyance lines and air intake and exhaust ducts: When proper hanger spacing does not correspond with joist or rib spacing, structural steel channels may be attached to joists or ribs and tubing suspended therefrom.
   2. Vertical Runs: Support at each floor line and at the roof line.

D. Automatic Fire Dampers: Shall conform to NFPA 82.

E. Protection: Protect all finish parts of equipment, such as shafts and bearing where accessible, from rust prior to operation by means of protective grease coating and wrapping. Close pipe openings with caps or plugs during installation. Cover and protect equipment against dirt, water, and chemical or mechanical injury. Clean exposed materials and equipment at completion of all work.

3.2 TESTS:

A. Demonstrate entire system will operate as specified. Test all lines in sequence by the passage of five test runs of material from each station. Demonstrate operation of station controls by a minimum of five test runs when dispatch buttons are operated simultaneously at two or more separate stations.

B. Resident Engineer shall witness the pre-test and final inspection.

END OF SECTION
SECTION 15010
BASIC MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Basic Mechanical Requirements specifically applicable to Division 15 Sections, in addition to Division 1 - General Requirements.

1.2 DESCRIPTION

A. Furnish all materials and perform all labor required to execute the work as indicated on the project contract documents and specifications and as required to complete the work of Division 15 sections, except as otherwise herein specifically excluded.

1.3 WORK INCLUDED

A. The scope of work for Divisions 15 shall include everything necessary and incidental to completing the Heating, Ventilating, and Air Conditioning (HVAC), and Plumbing work indicated on the Project Contract Documents, including but not limited to the following:

1. The installation of roof mounted, Packaged Gas Heat / Electric Cool Air Conditioning Units complete with factory furnished field installed equipment roof curbs.

2. The installation of all required air filters for all HVAC systems included in the scope of this Project.

3. The installation of roof mounted, in-line, ceiling, and utility set Exhaust Fans for general or special system exhaust requirements.

4. The installation of HVAC system Ceiling Diffusers and Ceiling Registers including volume dampers and mounting frames to match the ceiling types on the Project.

5. The installation of all supply, return, exhaust and fresh air ductwork for the entire Project including manual volume dampers, fire dampers, combination fire / smoke dampers, duct hangers and supports, seismic restraints, sleeves, inserts and anchors, and all other required appurtenances for all new HVAC systems installed under the scope of work for this Division.

6. The installation of all duct lining, duct and pipe insulation including all rigid inserts, weather covers and water sealing.

7. The installation of condensate drain piping as detailed herein including valves, fittings, and piping specialties.

8. The preparation and submission of complete Shop Drawings for all equipment and materials installed under the scope of work for all disciplines specified under Division 15.

9. The installation of all Equipment Identification as specified herein.

10. The complete Air Test and Balancing for all HVAC systems installed in the scope of the Project by an Independent Test and Balance Contractor.
11. The complete air pressure and soap testing of all natural gas piping installed in the scope of this project.

12. The preparation and submission of complete Written Operating and Maintenance Instructions for all equipment and accessories installed in the scope of this Project for each discipline under Division 15.

13. The preparation and submission of complete Record Drawings for all work installed under Division 15.

14. The preparation and submission of One (1) Year Written Guarantee in a form as stipulated in Division 1 – General Requirements.

15. The Scope of Work for Division 15 shall be coordinated with the scope of work with all other Divisions included in the Project Contract Documents and Specifications.

16. All existing conditions and dimensions shall be verified in the field prior to the fabrication and installation of any new work for Division 15.

1.4 WORK SPECIFIED ELSEWHERE

A. Concrete, Architectural Sheet Metal, Doors and Exterior Wall Louvers, Painting and Patching, Sawcut and Coring, and Electrical.

1.5 SITE INSPECTION

A. The Contractor shall visit the project site prior to submitting a bid and thoroughly familiarize himself with the existing conditions that impact the new work. By the act of submitting a bid, the successful contractor accepts all existing conditions under which he will be required to perform the scope of work indicated on the Contract Documents and specifications of Division 15.

B. No change order allowance will be made due to the bidding Contractor failing to comply with Paragraph “A” above.

1.6 ORDINANCES, REGULATIONS AND CODES

A. References to Technical Societies, Trade Organizations, Governmental Agencies is made in Division 15 in accordance with the following abbreviations:

AFI - Air Filter Institute
AMCA - Air Moving & Conditioning Association
ARI - Air Conditioning & Refrigeration Institute
ASHRAE - American Society of Heating, Refrigerating and Air Conditioning Engineers
ASME - American Society of Mechanical Engineers
ASTM - American Society of Testing Materials
AWSC - American Welding Society Code
ANSI - American National Standards Institute B31.1, “Code for Pressure Piping”
CBC - California Building Code, latest approval edition
CCR - California Code of Regulations, latest approval edition
CEC - California Electrical Code, latest approval edition
CFC - California Fire Codes, latest approval edition
CMC - California Mechanical Code, latest approval edition
CPC - California Plumbing Code, latest approval edition
DSA - Division of the State Architect
B. Requirements of Regulatory Agencies: Materials and installation shall comply with applicable local, state, and national codes and ordinances. Rulings and interpretations of the enforcing agencies shall be considered as part of the local codes. No change orders shall be permitted for furnishing items required by the local codes but not specified or shown on the drawings.

C. Codes and Standards:

1. UBC, California Amendments and Los Angeles Amendments (California Building Code - Part 2, Title 24, CCR).
2. UMC, California Amendments and Los Angeles Amendments (California Mechanical Code - Part 4, Title 24 CCR).
3. UPC, California Amendments and Los Angeles Amendments (California Plumbing Code - Part 5, Title 24 CCR).

D. Nothing in these drawings and specifications is to be construed to permit work in violation thereof. Ordinances, regulations and codes are to be construed as minimum requirements.

E. The responsibility of the Mechanical Engineer shall be to provide Construction Observation to determine the Contractor’s performance relative to the obligations of the Contract Documents and specifications for Division 15. The responsibility of the Mechanical Engineer does not include determining the adequacy of the Contractor’s safety measures in, on, or near the Project Construction Site. The installing contractor assumes full and total responsibility for all safety measures required for the project construction for the duration of the project.

F. Ventilating, refrigeration and electrical equipment and appliances are required to be approved by the Underwriters’ Laboratories, Inc., or other nationally recognized testing agency and installed per the testing agency’s specifications.

1.7 PERMITS, FEES AND INSPECTIONS

A. Obtain and pay for all necessary permits, fees, assessments, complimentary drawings, required by any legally constituted public authorities having jurisdiction.

1.8 DRAWINGS AND SPECIFICATIONS
A. The Mechanical Engineer’s decision will be final on interpretation of the Drawings and Specifications.

B. The Drawings and Specifications are complimentary. Any work called for on the Drawings and not mentioned in the Specifications, or vice versa, shall be performed as though fully set forth in both.

C. Where codes, standards, drawings or specifications are in conflict, the most stringent requirement shall prevail.

D. Alternate support or seismic restraint details shall have prior approval in writing by the Mechanical Engineer. The Contractor shall be responsible for obtaining all agency approvals without any additional cost or time compensation to the Contract and without any time penalty on the work schedule.

1.9 SUBMITTALS

A. Within thirty (30) days after the award of Contract and prior to executing any fabrication or installation, the Contractor shall prepare and submit to the Mechanical Engineer for review and approval, complete Division 15 Shop Drawings and Submittals for the Project. This shall include HVAC and Plumbing disciplines under the scope of Division 15.

B. All submittals shall be bound in a neat ring type binder form and shall contain a complete list, in index form for all equipment and materials proposed for use on the Project. All submittals shall be complete as one package and submitted at one time. Partial or incomplete submittals will not be reviewed and will be returned to the Contractor rejected for re-submittal.

C. All information contained in the Submittals and Shop Drawings shall be properly identified by reference number to the item number of paragraphs in the Contract Specifications and Drawing Equipment Schedules. Any deviation or substitution shall be clearly identified on the submittal page and noted as such.

D. All Equipment or materials fabricated or installed prior to obtaining the Mechanical Engineers Shop Drawing and Submittal review and approval are at the Contractors own risk. The Contractor, at his own expense, shall be responsible for correcting and/or removing all work installed or fabricated prior to obtaining Shop Drawing and Submittal approvals.

E. The Contract Documents and Specifications specify and detail equipment and materials deemed the most suitable for the service anticipated. This is not to preclude other products are equally as good and efficient. The Contractor shall prepare the Project Division Bid on the basis of the equipment and materials specified for the purpose of determining the Project Division low Bid. The awarding of the Contract shall constitute a contractual obligation to furnish the specified basis of design equipment and materials or listed equals.

F. After the execution of the Contract, should the Contractor desire to substitute equipment other than that specified in the Contract, such a substitution shall be considered for one reason only – the equipment proposed for substitution is superior in construction and efficiency to that specified herein.

G. In the event the Contractor obtains the Mechanical Engineer’s approval for equipment other than that described herein, the Contractor shall, at his own expense, make all required changes in the supporting structures, buildings, related trade costs, and piping necessary to accommodate the substituted equipment. Complete Record Drawings shall be furnished to the Mechanical Engineer indicated all details of the installation.
H. The following list is the minimum Shop Drawing and Submittal package that the Contractor shall prepare and submit to the Mechanical Engineer for review and approval. The Project Shop Drawings and Submittals shall be complete in every aspect as described in the paragraphs above. Partial or incomplete submittals will not be reviewed and will be returned to the Contractor rejected for re-submittal.

1. The installing Contractor shall prepare and submit for approval the following Shop Drawing and Submittal package as part of the Scope of Work for Division 15, HVAC, Plumbing, and Fire Protection:
   
a. Prepare prior to fabrication and installation, complete field coordinated installation Shop Drawings for each discipline included in Division 15 Scope of Work in this Project.
   
b. All Shop Drawings shall be prepared using the manual drafting method or using AutoCAD Release 14. Contractor submitted hand sketches are not acceptable and will be returned to the installing Contractor rejected.
   
c. All Shop Drawings prepared by the Contractor shall be prepared in ¼-inch or ½-inch scale. No exceptions.
   
d. One (1) original tracing and two (2) blueprints of the Contractor prepared Shop Drawings shall be submitted to the Mechanical Engineer for review and approval. At the completion of the Mechanical Engineer’s review the original tracing will be returned to the Contractor with review comments noted.
   
e. The Contractors Shop Drawings shall detail all equipment and piping systems including installed dimensions and elevations. All Shop Drawings shall be complete in every respect prior to submittal to the Mechanical Engineer.
   
f. The re-use of the Mechanical Engineer’s construction drawings for the preparation of the installing Contractor’s Field Shop Drawing Submittal is not acceptable.
   
g. It shall be the responsibility of the installing Contractor to submit copies of the final approved and coordinated Field Shop Drawings to all other trades for coordination with their work so that grouped pipes, ducts, and conduit will not interfere with each other.

2. Submit complete HVAC equipment and accessory submittals for each and every piece of equipment installed on the Project including:
   
a. Packaged Gas Heat / Electric Cool Air Conditioning Units – supply fan data, economizer data, dimensioned arrangement drawings, air aide performance data, gas heating performance data, refrigeration system tonnage and performance data, motor horsepower(s), voltage, and factory supplied accessories.
   
b. Exhaust Fans Systems – complete manufacturer computer selections, dimensioned arrangement drawings, fan curves and motor horsepower, voltage, and factory supplied accessories.

3. Submit complete HVAC ductwork and accessory submittals for all systems installed on the Project including:
a. Supply, return, exhaust, and fresh air ductwork including rectangular duct gauges and joint methods, round duct type, duct gauge, and joint methods, duct fittings – rectangular and round, duct joint sealing method, supports and seismic bracing details.

b. Duct system appurtenances including fire damper assemblies, fire / smoke damper assemblies, manual volume dampers – round and rectangular ducts, flexible ductwork, register boxes, turning vanes, housings and plenums, roof flashing, and duct instrument test ports.

c. Air distribution products including supply diffusers, return / exhaust registers, mounting frames, and manual dampers.

d. Duct insulation and duct liner including proposed thickness, RValue for each type, manufacturer & model and installation methods.

e. Ductwork vibration isolation including fabric connections at each unit or where passing through building seismic separations where specified herein.

4. Submit complete HVAC, Plumbing and accessory submittals for all systems installed on the Project including:

a. Complete piping submittals including piping material – schedule & type and ASTM grade, pipe fittings - type and ASTM grade, joint methods, supports and seismic bracing details.

b. Piping system appurtenances and accessories including each type of valve(s), – grade, rating, catalog number and manufacturer.

c. Piping system specialties including thermometers with separable wells, pressure gauges, automatic air vents, Pete’s Plugs, circuit balancing valves, strainers, check valves, plug cocks, and butterfly valves.

d. Piping system expansion loops including joint type – manufacturer, material & duty, pipe guides and anchors – manufacturer & model number, material, duty and expansion calculations.

e. Piping system flow or temperature measuring taps – quantity and type, coordinated with Division 13800.

f. Pipe insulation including proposed thickness, R-Value for each type, rigid inserts, manufacturer & model and installation methods.

g. Piping vibration isolation including flex connections at each unit or where passing through building seismic separations where specified herein.

h. Piping installation appurtenances including sleeves, fireproofing, caulking, waterproofing, roof flashing and escutcheons.

5. Submit complete Plumbing and accessory submittals for all systems installed on the Project including:

a. Complete fixture submittal including manufacturer & model number, fixture carrier manufacturer & model number, fixture faucets set(s), trim & supplies.

b. Complete Plumbing system specialties including backflow preventer, clean-outs – floor and wall, hose bibbs, pipe isolators, water hammer arrestor(s), and access panel(s).
c. Provide complete domestic piping submittals as detailed in item #4 – a thru h above.

1.10 RECORD DRAWINGS AND MANUALS

A. Record Set During the Work: At site, maintain at least one set of Drawings as a Field Record Set. Also maintain at least one copy of all Addenda, Modifications, approved submittals, correspondence, and transmittals at site. Keep Drawings and data in good order and readily available to Mechanical Engineer and City.

B. Changes: Clearly and correctly mark Record Drawings to show changes made during the construction process at the time the changed work is installed. No such changes shall be made in the work unless authorized by the Architect.

C. Final Record Drawings: Conform to Division 1 requirements.

D. Preparation of Final Record Drawings: Contractor shall transfer recorded changes in the work indicated on the Field Record Set to the record set. Changes shall be neatly and clearly drawn and noted by skilled draftsmen, and shown technically correct.

E. Approval: Prior to Architect's inspection for Substantial Completion, submit the Final Record Drawings to the Architect for review, and make such revisions as may be necessary for Final Record Drawings to be a true, complete, and accurate record of the work.

F. Manuals: Obtain data from the various manufacturers and submit instruction, operation, and maintenance manuals as required for each piece of equipment installed under Division 15.

G. Contents: Each manual shall have an index listing the contents. Information in the manuals shall include not less than:

1. General introductions and overall equipment description, purpose, functions and simplified theory of operation.

2. Specifications

3. Installation instructions, procedures, sequences, and precautions, including tolerances for level, horizontal and vertical alignment.

4. Grouting requirements.

5. List showing lubricants for each item of mechanical equipment and recommended lubrication intervals.

6. Start-up and beginning operation procedures.

7. Operational procedures.

8. Shutdown procedures.

9. Maintenance and calibration procedures

10. Parts lists
11. Name, address and telephone number of each manufacturer's local representative.

H. Manual Submittals: Unless otherwise specified, each submittal shall include two (2) copies of each manual, one of which will be returned to the Contractor, marked to show the required review. When approved, deliver four copies to Architect unless otherwise specified. Manuals shall be bound in ring type binder. Refer to 1.9 for specific requirements.

1.11 QUALITY OF EQUIPMENT, MATERIALS AND WORKMANSHIP

A. Unless otherwise specified, equipment and materials used in the installation shall be new and in perfect condition when installed. Articles provided for the same general purpose or use shall be of the same make. Workmanship shall be of the best quality and none but competent mechanics skilled in their trades shall be employed. Furnish the services of an experienced superintendent, who shall be constantly in charge of the work, and who will remain on the project through completion together with all necessary journeymen, helpers and laborers required.

1.12 SEISMIC DESIGN

A. Contractor shall be responsible for anchors and connections of mechanical work to the building structure including calculations for approval by the Mechanical Engineer for items or work, where alternate support or anchorage detail is proposed to prevent damage as a result of an earthquake, including manufactured equipment, the connection and integrity of shop fabricated and field fabricated materials and equipment. The anchorage of all pipes, ducts, conduits, fixtures, equipment, etc. shall withstand the lateral forces and shall accommodate calculated building displacement as required by the California Building Code, and local city/county codes. Building equipment and connections therefore shall be designed to resist lateral seismic forces equal to 1.0 of equipment weight to working allowable stress. Cantilever posts supporting equipment shall be designed to resist lateral seismic forces equal to 0.5 of equipment weight to allowable working stress. Conform to the following:

1. All mechanical equipment seismic anchorage shall conform to C.C.R. Title 24, 1998 CBC Section 1632A and Table 16A-0. Anchorage details for roof/floor mounted equipment shall be as shown on plans.

1.13 SUBSTITUTIONS AND CHANGES

A. The provisions of this clause shall override those contained in SUBMITTALS and SUBSTITUTIONS paragraphs in DIVISION 1.

B. The Division 15 Bid shall include products per paragraph 2.1 APPROVED MANUFACTURERS.

C. The Mechanical Engineer will consider formal written requests for the substitution of products in place of those products specified only if these are submitted with the Bid for evaluation and in accordance with all conditions specified hereafter.

D. Requests for substitutions after the award of Contract shall be considered only in the case of product unavailability. Product unavailability shall be verified in writing by the manufacturer. Verbal requests are not acceptable.

E. Submit separate request for each substitution at the time of Bid in the event of non-availability of the item included in the Bid. Each substitution request shall include:
1. Complete data substantiating compliance of the proposed substitution with all requirements stated in the project Contract Documents.

2. Submit complete data for the proposed substitution as it relates to changes in the project construction schedule.

3. Submit complete data for any effect of the proposed substitution on other Work in Division 15 and other Divisions, any other related Contracts, and any changes required in other work or products.

F. The Contractor shall be responsible at no extra cost to the City for any and all changes resulting from the proposed substitutions which affect the work of other Sections, Divisions, or related Contracts.

G. Claims for additional costs caused by the substitution which may subsequently become apparent shall be met by the Contractor.

H. Substitutions will not be considered for acceptance when the acceptance will require substantial revision of the Contract Documents, unless the Contractor bears the cost of the redesign.

I. Where any redesign of the Work of division 15 or other Work is required due to the substitution, arrangement or equipment layout other than herein specified or shown, the Contractor shall:

   1. Arrange for the required redesign by the Architect and Mechanical Engineer.
   2. Pay all costs associated with the redesign.

J. Substitute products shall not be ordered or installed without prior written approval / acceptance by the Mechanical Engineer through the Architect.

K. The Mechanical Engineer shall have sole discretion to determine the acceptability of the proposed substitutions and reserves the right to reject any such substitution.

L. Approval of any substitutions shall not relieve the Contractor from full compliance with the requirements of the Contract Documents.

1.14 APPROVALS

A. The Mechanical Engineer will have the right to accept or reject equipment, materials, workmanship, tests and determine when the Contractor has complied with the requirements herein specified.

1.15 SELECTION AND ORDERING OF EQUIPMENT AND MATERIALS

A. Immediately after award of the Contract and after the approval of submittals by the Mechanical Engineer, the Contractor shall arrange for the purchase and delivery of equipment and materials required, in ample quantities and at a time coordinated with the project management schedule. He shall deliver to the City a complete list of equipment and materials ordered, giving descriptions, plate numbers, brochures, name of the wholesalers, date of the orders and approximate delivery dates.

1.16 LOCATIONS AND ACCESSIBILITY
A. Drawings show pipe and ductwork diagrammatically. Conform to Drawings as closely as possible in layout work. Vary run of piping, run and shape of ductwork and make offsets during progress of work as required to meet structural and other interferences as approved by the Mechanical Engineer. Install piping and ductwork to best suit field conditions after coordinating with other trades. Run all piping and ductwork parallel to, or at right angle to, building walls. Keep horizontal lines as close to bottom of structures as possible. Conform to ceiling heights established on Drawings.

B. Install equipment in such a manner as to be readily accessible for maintenance and repairs. Install piping, ducts and conduit in such a manner as to preserve headroom, avoid obstructions and keep openings and passageways clear.

C. Installation of valves, thermometers, gauges, cleanouts, dampers, controls, water specialties, duct access doors or any other indicating equipment or specialties requiring reading, adjustment, inspection, maintenance shall be conveniently and accessibly located with reference to the finished building.

D. Where wall and ceiling access doors are required but not shown, such doors shall be furnished under other sections and as directed by the Architect. Coordinate this requirement with appropriate trade.

E. If changes in the indicated locations or arrangements are required, they shall be made without additional charges.

F. In an existing area, where required, remove, reinstall, reconnect or replace, etc., any existing work to accommodate new work without any additional cost to the City. Material shall match existing, unless otherwise specified or approved in writing by the Architect.

1.17 COORDINATION OF TRADES

A. Contractor shall coordinate with all trades in the interest of obtaining the most practical overall arrangement of equipment, piping, conduit, and ducts and to maintain maximum headroom and accessibility.

B. No extras will be allowed for changes made necessary by interference between trades.

C. Submit Composite Drawings; include dimensioned plans, elevations, sections and details and give complete information particularly as to the kinds and types of materials and equipment, size and location of sleeves, inserts, attachments, chases, openings, conduits, ducts, boxes, lighting, structural interferences. Coordinate these Composite Drawings and field layouts in the field for proper relationship to work of applicable trades based on field conditions. Contractor shall have competent personnel readily available for coordinating, checking, and supervision of field layouts. The procedures for submittals and resubmittals, and final distribution shall be as specified in Section 01300. Do not start installation of work involved under Composite Drawings until applicable submittal is reviewed by the Architect. Discrepancies between the Drawings and Composite Drawings shall be specifically noted and identified on the Composite Drawings. Drawings for the various trades involved shall be submitted as required and reviewed prior to preparation of Composite Drawings.

1. Equipment Foundations and Bases: Furnish certified details and drawings for approval before fabrication. Furnish parts necessary for each foundation sub base and support.

2. Pipe Sleeves and Inserts: Furnish and install pipe sleeves and pipe support inserts before concrete is poured.
3. Roof, Wall and Floor Openings: Furnish Shop Drawings showing exact locations and sizes of openings through roofs, walls and floors.

4. Concrete: Conform to Concrete Section of the Specifications.

1.18 GUARANTEES

A. Contractor shall guarantee workmanship, equipment and materials installed under this contract for a period of not less than one (1) year from the date of Substantial Completion. Should any defects occur during this period, the Contractor shall promptly repair or replace the defective item and any other damage caused to the building free of charge to the City, including cost of labor and materials.

B. Guarantee included in this section to cover:
   1. Faulty or inadequate design.
   2. Improper assembly or erection.
   3. Defective workmanship or material.
   4. Incorrect or inadequate operation or other failure.

C. Contractor shall guarantee the complete and perfect operation of the entire system and that equipment will be supported in such a way as to be free of objectionable vibration and noise.

D. Furnish the parts and labor to replace any items found to be defective in the refrigeration equipment within the guarantee period.

E. In addition to other guarantees, furnish maintenance for all the refrigeration equipment, including replacement of refrigerant and oil, for a period of one (1) year. This shall include regular monthly maintenance and "On Call" service. Identify this cost as a separate line item in the project bid.

F. For equipment bearing a manufacturer's warranty in excess of one (1) year, furnish a copy of the warranty to the City of Los Angeles, who shall be named as beneficiary.

1.19 PROTECTION OF EQUIPMENT AND MATERIALS

A. Provide adequate storage facilities at a location designated by the Construction Manager for all equipment and materials on the site and make provisions to protect such materials and equipment from damage.

1.20 CLOSING-IN OF UNINSPECTED WORK

A. Contractor shall not allow or cause any of the work to be covered up or enclosed until it has been inspected, tested, and approved by the Project Inspector. Should any of work be covered up or enclosed before such inspection and test, the Contractor shall at no cost to the City, uncover the work and after it has been inspected, tested, and approved, make repairs with such materials as may be necessary to restore work to its original and proper condition.

1.21 BUILDING FOOTING CLEARANCES
A. Under no circumstances shall pipes, ducts, or conduits penetrate footings. They shall cross below footings or through sleeves above footings. As approved by the Structural Engineer those running parallel to footings shall have the minimum clearance from the cone of influence indicated on the Structural Drawings or as required by Code.

1.22 DAMAGE BY LEAKS

A. Contractor shall be responsible for all damage to any part of the premises caused by rain leaks through or around ducts or pipes, leaks or breaks in piping, equipment or fixtures furnished or installed by him for a period of one (1) year from the date of Substantial Completion.

1.23 EQUIPMENT LABELS

A. Equipment provided under this Section shall be provided with the manufacturer's metal identification labels attached to each individual piece of equipment showing complete performance characteristics, size, model and serial number.

1.24 EXCAVATION, TRENCHING AND BACKFILLING

A. Excavating, trenching and backfilling for utilities within the building area shall be done in conformity with Division 2. Piping shall be installed promptly after excavation in order to keep the trenches open as short a time as possible.

B. Excavating, trenching and backfilling for utilities outside the building area shall be done in conformity with Division 2.

C. Any existing underground piping and conduit that is encountered shall be properly shored and protected from damage. Active piping shall be left intact and undamaged.

1.25 PRELIMINARY OPERATION

A. Should the City request that any portion of the plant, apparatus, or equipment be operated for the City's beneficial use prior to the final completion and acceptance of the work, the Contractor shall conform to the requirements of the General Conditions. Such operation shall be under the supervision and direction of the Contractor. Such preliminary operation shall not be construed as an acceptance of any of the work.

1.26 ELECTRICAL WORK

A. Coordinate with Division 16 in making the line and low voltage electrical connections and be responsible for the operation of the equipment furnished under this section.

B. Voltage for electrical work will be included in Division 16. However, any control wiring which is required that is not shown on the control diagram shall be as described under this Section. In the event that the Contractor chooses to provide equipment which requires extra expense in the power or control wiring, he shall pay additional electrical costs.

C. Safety switches, starters, circuit breakers, and the electrical connections of mechanical equipment to the electrical power service shall be provided under Division 16.

D. Interconnecting wiring, safety switches, relays, controllers and motor starters which are integral components of packaged equipment shall be provided as an integral part of that equipment.

E. All interconnecting power wiring and conduits shall be provided by Division 16.
F. Control wiring shall be provided by Division 15, unless otherwise indicated on the drawings.

G. Conduit for control wiring shall be provided by Division 16.

1.27 YEAR 2000 COMPLIANCE, WARRANTY, IDEMNIFICATION

A. All equipment, hardware, software and firmware product delivered under this Contract shall be able to accurately process date/time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999 and 2000, and leap year calculation to the extent that other information technology, used in combination with the information being acquired, properly exchanges date/time date with it.

B. The Contractor represents and warrants that all equipment, hardware, software, and firmware product delivered under this Contract shall be able to accurately process date/time data (including, but not limited to, calculating, comparing, and sequencing) from, into, and between the twentieth and twenty-first centuries, and the years 1999 and 2000, and leap year calculation to the extent that other information technology, used in combination with the information being acquired, properly exchanges date/time date with it.

C. If the Contract requires that specific listed products must perform, as a system in accordance with the foregoing warranty then the warranty shall apply to those listed products as a system.

D. The duration of this warranty and the remedies available to the City for breach of this warranty shall be defined in, and subject to, the terms and limitations of the Contractor’s standard commercial warranty or warranties contained in this Contract, provided that notwithstanding any provision to the contrary in such commercial warranty or warranties, the remedies available to the City under this warranty shall include the repair or replacement of any product whose non-compliance is discovered and made known to the Contractor in writing within one (1) year after acceptance.

E. Nothing in this warranty shall be construed to limit any rights of remedies the City may otherwise have under this Contract with respect to defects other than Year 2000 performance.

F. In addition to the remedies available in this Section, and elsewhere in the Contract, the Contractor shall indemnify, defend and hold the City harmless from and against any and all liability, losses, claims, damages, costs and expenses, including legal fees sustained or incurred by reason or failure of any of the equipment, hardware, software or firmware product to be delivered under this Contract to be Year 2000 compliant.

PART 2 - MATERIALS (NOT APPLICABLE)

PART 3 - EXECUTION (NOT APPLICABLE)

END OF SECTION
PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Provisions and Division 1A General Requirements, apply to work of this section.

B. Related Sections: Separate electrical components and materials required for field installation and electrical connections are specified in Division 16.

1.2 SUMMARY

A. This section specifies the basic requirements for electrical components which are an integral part of packaged mechanical equipment. These components include, but are not limited to factory installed motors, starters, and disconnect switches furnished as an integral part of packaged mechanical equipment.

B. Specific electrical requirements (i.e. horsepower and electrical characteristics) for mechanical equipment are scheduled on the Drawings.

1.3 REFERENCES

A. NEMA Standards MG 1: Motors and Generators

B. NEMA Standards ICS 2: Industrial Control Devices, Controllers, and Assemblies.

C. NEMA Standard 250: Enclosures for Electrical Equipment

D. NEMA Standard KS 1: Enclosed Switches

E. National Electrical Code (NFPA 70).

1.4 SUBMITTALS

A. No separate submittal is required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections.

1.5 QUALITY ASSURANCE

A. Electrical components and materials shall be UL labeled.
PART 2 – PRODUCTS

2.1 MOTORS

A. The following are basic requirements for simple or common motors. For special motors, more
detailed and specific requirements are specified in the individual equipment specifications.
1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
2. Motor sizes shall be large enough so that the driven load will not require the motor to operate
in the service factor range.
3. Temperature Rating: Rated for 40 deg. C environment with maximum 50 deg. C temperature
rise for continuous duty at full load (Class A Insulation).
4. Starting capability: frequency of starts as indicated by automatic control system, and not less
than 5 evenly time spaced starts per hour for manually controlled motors.
5. Service Factor: L15 for poly-phase motors and 1.35 for single phase motors.
6. Motor construction: NEMA Standard MG 1, general purpose, continuous duty, Design "B",
except "C" where required for high starting torque.
   a. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards
to suit specific application.
   b. Bearing:
      1) ball or roller bearings with inner and outer shaft seals;
      2) re-greasable, except permanently sealed where motor is normally inaccessible for
regular maintenance;
      3) designed to resist thrust loading where belt drives or other drives produce lateral or
axial thrust in motor;
      4) for fractional horsepower, light duty motors, sleeve type bearings are permitted.
   c. Enclosure Type:
      1) open drip-proof motors for indoor use where satisfactorily housed or remotely located
during operation;
      2) guarded drip-proof motors where exposed to contact by employees or building
occupants;
      3) weather protected Type 1 for outdoor use, Type II where not housed;
   d. Overload protection: built-in thermal overload protection and, where indicated, internal
sensing device suitable for signaling and stopping motor at starter.
   e. Noise rating: "Quiet" rating on motors located in occupied spaces of building.
   f. Nameplate: indicate the full identification of manufacturer, ratings, characteristics,
construction, special features and similar information.

2.2 STARTERS, ELECTRICAL DEVICES, AND WIRING

A. Motor Starter Characteristics:
1. Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations
shall be NEMA 3R with conduit hubs, or units in hazardous locations which shall have NEC
proper class and division.
2. Type and size of starter shall be as recommended by motor manufacturer and the driven
equipment manufacturer for applicable protection and start-up condition.

B. Manual switches shall have:
1. Pilot lights and extra positions for multi-speed motors.
2. Overload protection: melting alloy type thermal overload relays.

C. Magnetic Starters:
1. Maintained contact push buttons and pilot lights, properly arranged for single speed or multi-
   speed operation as indicated.
2. Trip-free thermal overload relays, each phase.
3. Interlocks and similar devices as required for coordination with control requirements of Division-15 Controls sections.
4. Built-in 120 volts control circuit transformer, fused from line side, where service exceeds 240 volts.
5. Externally operated manual reset.
6. Under-voltage release or protection.

D. Motor connections:
   1. Flexible conduit, except where plug-in electrical cords are specifically indicated.

2.3 CAPACITORS

A. Features:
   1. Individual unit cells
   2. All welded steel housing
   3. Each capacitor internally fused
   4. Non-flammable synthetic liquid impregnant
   5. Craft tissue insulation
   6. Aluminum foil electrodes
   7. KVAR size shall be as required to correct motor power factor to 90 percent or better and shall be installed on all motors 1 horsepower and larger, that have an uncorrected power factor of less than 85 percent at rated load.

B. Disconnect Switches:
   1. Fusible switches: fused, each phase; general duty; horsepower rated; non-teasible quick-make, quick-break mechanism; dead front line side shield; solderless lugs suitable for copper or aluminum conductors; spring reinforced fuse clips; electro silver plated current carrying parts; hinged doors; operating lever arranged for locking in the "OPEN" position; arc quenchers; capacity and characteristics as indicated.
   2. Non-fusible switches: for equipment 2 horsepower and smaller, shall be horsepower rated; toggle switch type; quantity of poles and voltage rating as indicated. For equipment larger than 2 horsepower, switches shall be the same as fusible type.

PART 3 – EXECUTION (NOT APPLICABLE)

END OF SECTION
SECTION 15050
BASIC MECHANICAL MATERIALS AND METHODS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following basic mechanical materials and methods to complement other Division 15 Sections.
   1. Piping materials and installation instructions common to most piping systems.
   2. Concrete equipment base construction requirements.
   3. Equipment nameplate data requirements.
   4. Labeling and identifying mechanical systems and equipment is specified in Division 15190 Section "Mechanical Identification."
   5. Field-fabricated metal and wood equipment supports.
   6. Installation requirements common to equipment specification sections.
   7. Cutting and patching.
   8. Touch-up painting and finishing.

B. Pipe and pipe fitting materials are specified in piping system Sections.

1.3 DEFINITIONS

A. Pipe, pipe fittings, and piping include tube, tube fittings, and tubing.

B. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct shafts, unheated spaces immediately below the roof, spaces above ceilings, unexcavated spaces, crawl spaces, and tunnels.

C. Exposed Interior Installations: Exposed to view indoors. Examples include finished occupied spaces and mechanical equipment rooms.

D. Exposed Exterior Installations: Exposed to view outdoors, or subject to outdoor ambient temperatures and weather conditions. Examples include rooftop locations.

E. Concealed Interior Installations: Concealed from view and protected from physical contact by building occupants. Examples include above ceilings and in duct shafts.

F. Concealed Exterior Installations: Concealed from view and protected from weather conditions and physical contact by building occupants, but subject to outdoor ambient temperatures. Examples include installations within unheated shelters.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specifications Sections.

B. Product data for following piping specialties:
1. Mechanical sleeve seals.
2. Identification materials and devices.

C. Samples of color, lettering style, and other graphic representation required for each identification material and device.

D. Shop drawings detailing fabrication and installation for metal and wood supports and anchorage for mechanical materials and equipment.

E. Coordination drawings for access panel and door locations.

F. Prepare coordination drawings according to Division 1 Section Submittals to a 1/4 inch equals 1 foot scale or larger. Detail major elements, components, and systems of mechanical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Show where sequence and coordination of installations are important to the efficient flow of the Work. Include the following:

1. Proposed locations of piping, ductwork, equipment, and materials. Include the following:
   a. Planned piping layout, including valve and specialty locations and valve stem movement.
   b. Planned duct systems layout, including elbows radius and duct accessories.
   c. Clearances for installing and maintaining insulation.
   d. Clearances for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.
   e. Equipment service connections and support details.
   f. Exterior wall and foundation penetrations.
   g. Fire-rated wall and floor penetrations.
   h. Sizes and location of required concrete pads and bases.

2. Scheduling, sequencing, movement, and positioning of large equipment into the building during construction.

3. Floor plans, elevations, and details to indicate penetrations in floors, walls, and ceilings and their relationship to other penetrations and installations.

4. Reflected ceiling plans to coordinate and integrate installations, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

G. Welder certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" Article of this Section.

1.5 QUALITY ASSURANCE

A. Qualify welding processes and operators for piping according to ASME "Boiler and Pressure Vessel Code," Section IX, "Welding and Brazing Qualifications."

1. Comply with provisions of ASME B31 Series "Code for Pressure Piping."
2. Certify that each welder has passed AWS qualification tests for the welding processes involved and that certification is current.

B. ASME A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
C. Equipment Selection: Equipment of greater or larger power, dimensions, capacities, and ratings may be furnished provided such proposed equipment is approved in writing and connecting mechanical and electrical services, circuit breakers, conduit, motors, bases, and equipment spaces are increased. No additional costs will be approved for these increases, if larger equipment is approved. If minimum energy ratings or efficiencies of the equipment are specified, the equipment must meet the design requirements and commissioning requirements.

1.6 DELIVERY, STORAGE, AND HANDLING
A. Deliver pipes and tubes with factory-applied end-caps. Maintain end-caps through shipping, storage, and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.
B. Protect stored pipes and tubes from moisture and dirt. Elevate above grade. When stored inside, do not exceed structural capacity of the floor.
C. Protect flanges, fittings, and piping specialties from moisture and dirt.

1.7 SEQUENCING AND SCHEDULING
A. Coordinate mechanical equipment installation with other building components.
B. Arrange for chases, slots, and openings in building structure during progress of construction, to allow for mechanical installations.
C. Coordinate the installation of required supporting devices and set sleeves in poured-in-place concrete and other structural components, as they are constructed.
D. Sequence, coordinate, and integrate installations of mechanical materials and equipment for efficient flow of the Work. Coordinate installation of large equipment requiring positioning prior to closing in the building.
E. Coordinate connection of mechanical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
F. Coordinate requirements for access panels and doors where mechanical items requiring access are concealed behind finished surfaces.
G. Coordinate installation of identifying devices after completion of covering and painting, where devices are applied to surfaces. Install identifying devices prior to installation of acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.1 PIPE AND PIPE FITTINGS
A. Refer to individual piping system specification Sections for pipe and fitting materials and joining methods.
B. Pipe Threads: ASME B1.20.1 for factory-threaded pipe and pipe fittings.

2.2 JOINING MATERIALS
A. Refer to individual piping system specification Sections in Division 15 for special joining materials not listed below.

B. Pipe Flange Gasket Materials: Suitable for the chemical and thermal conditions of the piping system contents.

1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness, except where thickness or specific material is indicated.
   a. Full-Face Type: For flat-face, Class 125 cast-iron and cast-bronze flanges.
   b. Narrow-Face Type: For raised-face, Class 250 cast-iron and steel flanges.

2. ASME B16.20 for grooved, ring-joint, steel flanges.

3. AWWA C110, rubber, flat face, 1/8-inch thick, except where other thickness is indicated; and full-face or ring type, except where type is indicated.

C. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, except where other material is indicated.

D. Solder Filler Metal: ASTM B 32.

E. Flanged, Ductile-Iron Pipe Gasket, Bolts, and Nuts: AWWA C110, rubber gasket, carbon steel bolts and nuts.

F. Couplings: Iron body sleeve assembly, fabricated to match outside diameters of plain-end, pressure pipes.

2. Followers: ASTM A 47, Grade 32510 or ASTM A 536 ductile iron.
5. Finish: Enamel paint.

G. Copper tubing:

1. Joining for copper pipes 4 - inch and smaller; no lead, City of Los Angeles (approved type) for all copper pipe above ground under.
2. Sil-Fos silver alloy for pipe underground and for piping above ground having a continuous street main pressure of 100-lbs or more.
3. Wire solder only; paste mixed solder not permitted.

H. Flux: As recommended by manufacturer of solder.

2.3 PIPING SPECIALTIES

A. Escutcheons: Manufactured wall, ceiling, and floor plates; deep-pattern type, where required to conceal protruding fittings and sleeves.

1. Inside Diameter: Closely fit around pipe, tube, and insulation of insulated piping.
2. Outside Diameter: Completely cover opening.
3. Cast Brass: One-piece, with set-screw.
   a. Finish: Rough brass.
   b. Finish: Polished chrome plate.
a. Finish: Rough brass.
b. Finish: Polished chrome plate.

B. Dielectric Fittings: Assembly or fitting having insulating material isolating joined dissimilar metals, to prevent galvanic action and stop corrosion.

1. Description: Combination of copper alloy and ferrous; threaded, solder, plain, and weld neck end types and matching piping system materials.
2. Insulating Material: Suitable for system fluid, pressure, and temperature.
3. Dielectric Unions: Factory-fabricated, union assembly, for 250 psig minimum working pressure at 180 deg F temperature.
4. Dielectric Flanges: Factory-fabricated, companion-flange assembly, for 150 or 300 psig minimum pressure to suit system pressures.
5. Dielectric-Flange Insulation Kits: Field-assembled, companion-flange assembly, full-face or ring type. Components include neoprene or phenolic gasket, phenolic or polyethylene bolt sleeves, phenolic washers, and steel backing washers.
   a. Provide separate companion flanges and steel bolts and nuts for 150- or 300-psig minimum working pressure to suit system pressures.
6. Dielectric Couplings: Galvanized-steel coupling, having inert and non-corrosive, thermoplastic lining, with threaded ends and 300 psig minimum working pressure at 225 deg F temperature.
7. Dielectric Nipples: Electroplated steel nipple, having inert and non-corrosive, thermoplastic lining, with combination of plain, threaded, or grooved end types and 300 psig working pressure at 225 deg F temperature.

C. Mechanical Sleeve Seals: Modular, watertight, mechanical type. Components include interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve. Connecting bolts and pressure plates cause rubber sealing elements to expand when tightened.

D. Sleeves: The following materials are for wall, floor, slab, and roof penetrations:

1. Steel Sheet-Metal: 24 gage or heavier, galvanized sheet metal, round tube closed with welded longitudinal joint.
2. Steel Pipe: ASTM A53, Type E, Grade A, Schedule 40, galvanized, plain ends.
3. Cast-Iron: Cast or fabricated "wall pipe" equivalent to ductile-iron pressure pipe, having plain ends and integral water stop, except where other features are specified.
4. Wall Penetration Systems: Wall sleeve assembly, consisting of housing, gaskets, and pipe sleeve, with 1 mechanical-joint end conforming to AWWA C110 and 1 plain pipe-sleeve end.
   a. Penetrating Pipe Deflection: 5 percent without leakage.
   b. Housing: Ductile-iron casting having waterstop and anchor ring, with ductile-iron gland, steel studs and nuts, and rubber gasket conforming to AWWA C111, of housing and gasket size as required to fit penetrating pipe.
   c. Pipe Sleeve: AWWA C151, ductile-iron pipe.
   d. Housing-to-Sleeve Gasket: Rubber or neoprene, push-on type, of manufacturer's design.
5. Cast-Iron Sleeve Fittings: Commercially-made, sleeve having integral clamping flange, with clamping ring, bolts, and nuts for membrane flashing.
a. Underdeck Clamp: Clamping ring with set-screws.

2.4 IDENTIFYING DEVICES AND LABELS

A. General: Manufacturer's standard products of categories and types required for each application as referenced in other Division 15 Sections. Where more than single type is specified for listed application, selection is Installer's option, but provide single selection for each product category.

B. Equipment Nameplates: Metal nameplate with operational data engraved or stamped; permanently fastened to equipment.
   1. Data: Manufacturer, product name, model number, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data.
   2. Location: An accessible and visible location.

C. Stencils: Standard stencils, prepared for required applications with letter sizes conforming to recommendations of ASME A13.1 for piping and similar applications, but not less than 1-1/4-inches-high letters for ductwork and not less than 3/4-inch-high letters for access door signs and similar operational instructions.
   3. Stencil Paint: Standard exterior type stenciling enamel; black, except as otherwise indicated; either brushing grade or pressurized spray-can form and grade.
   4. Identification Paint: Standard identification enamel of colors indicated or, if not otherwise indicated for piping systems, comply with ASME A13.1 for colors.

D. Plastic Duct Markers: Manufacturer's standard laminated plastic, color coded duct markers. Conform to following color code:
   1. Green: Cold air.
   2. Yellow: Hot air.
   3. Yellow/Green: Supply air.
   4. Blue: Exhaust, outside, return, and mixed air.
   5. For hazardous exhausts, use colors and designs recommended by ASME A13.1.
   6. Nomenclature: Include following:
      a. Direction of air flow.
      b. Duct service (supply, return, exhaust, etc.).

E. Plastic Equipment Markers: Laminated-plastic, color-coded equipment markers. Conform to following color code:
   1. Green: Cooling equipment and components.
   2. Yellow: Heating equipment and components.
   3. Yellow/Green: Combination cooling and heating equipment and components.
   5. Blue: Equipment and components that do not meet any of above criteria.
   6. For hazardous equipment, use colors and designs recommended by ASME A13.1.
   7. Nomenclature: Include following, matching terminology on schedules as closely as possible:
      a. Name and plan number.
b. Equipment service.
c. Design capacity.
d. Other design parameters such as pressure drop, entering and leaving conditions, and rpm.

8. Size: Approximate 2-1/2 by 4 inches for control devices, dampers, and valves; and 4-1/2 by 6 inches for equipment.

I. Lettering and Graphics: Coordinate names, abbreviations, and other designations used in mechanical identification, with corresponding designations indicated. Use numbers, lettering, and wording indicated for proper identification and operation/maintenance of mechanical systems and equipment.

1. Multiple Systems: Where multiple systems of same generic name are indicated, provide identification that indicates individual system number as well as service such as "Boiler No. 3" and "Air Supply No. 1H."

PART 3 - EXECUTION

3.1 PIPING SYSTEMS - COMMON REQUIREMENTS

A. General: Install piping as described below, except where system Sections specify otherwise. Individual piping system specification Sections in Division 15 specify piping installation requirements unique to the piping system.

B. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated, except where deviations to layout are approved on coordination drawings.

C. Install piping at indicated slope.

D. Install components having pressure rating equal to or greater than system operating pressure.

E. Install piping in concealed interior and exterior locations, except in equipment rooms and service areas.

F. Install piping free of sags and bends.

G. Install exposed interior and exterior piping at right angles or parallel to building walls. Diagonal runs are prohibited, except where indicated.

H. Install piping tight to slabs, beams, joists, columns, walls, and other building elements. Allow sufficient space above removable ceiling panels to allow for ceiling panel removal.

I. Install piping to allow application of insulation plus 1-inch clearance around insulation.

J. Locate groups of pipes parallel to each other, spaced to permit valve servicing.

K. Install fittings for changes in direction and branch connections.

L. Install couplings according to manufacturer's printed instructions.
M. Install pipe escutcheons for pipe penetrations of concrete and masonry walls, wall board partitions, and suspended ceilings according to the following:

1. Chrome-Plated Piping: Cast-brass, one-piece, with set-screw, and polished chrome-plated finish. Use split-casting escutcheons where required, for existing piping.

2. Uninsulated Piping Wall Escutcheons: Cast-brass or stamped-steel, with set-screw.

3. Uninsulated Piping Floor Plates in Utility Areas: Cast-iron floor plates.

4. Insulated Piping: Cast-brass or stamped-steel, with concealed hinge, spring clips, and chrome-plated finish.

5. Piping in Utility Areas: Cast-brass or stamped-steel, with set-screw or spring clips.

N. Sleeves are not required for core drilled holes.

O. Install sleeves for pipes passing through concrete and masonry walls, concrete floor and roof slabs, and where indicated.

P. Install sleeves for pipes passing through concrete and masonry walls, gypsum-board partitions, concrete floor and roof slabs, and where indicated.

1. Cut sleeves to length for mounting flush with both surfaces.
   a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring where specified.

2. Build sleeves into new walls and slabs as work progresses.

3. Install large enough sleeves to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation. Use the following sleeve materials:
   a. Steel Pipe Sleeves: For pipes smaller than 6 inches.
   b. Steel Sheet-Metal Sleeves: For pipes 6 inches and larger, penetrating gypsum-board partitions.
   c. Cast-Iron Sleeve Fittings: For floors having membrane waterproofing. Secure flashing between clamping flanges. Install section of cast-iron soil pipe to extend sleeve to 2 inches above finished floor level. Flashing is specified in Division 7 Section "Flashing and Sheet Metal."

1) Seal space outside of sleeve fittings with nonshrink, nonmetallic grout.

4. Except for below-grade wall penetrations, seal annular space between sleeve and pipe or pipe insulation, using elastomeric joint sealants specified in Division 7 Section "Joint Sealants."

Q. Above Grade, Exterior Wall, Pipe Penetrations: Seal penetrations using sleeves and mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.
1. Install steel pipe for sleeves smaller than 6 inches.
2. Install cast-iron "wall pipes" for sleeves 6 inches and larger.
3. Assemble and install mechanical seals according to manufacturer's printed instructions.

R. Below Grade, Exterior Wall, Pipe Penetrations: Install cast-iron "wall pipes" for sleeves. Seal pipe penetrations using mechanical sleeve seals. Size sleeve for 1-inch annular clear space between pipe and sleeve for installation of mechanical seals.

S. Below Grade, Exterior Wall, Pipe Penetrations: Install ductile-iron wall penetration system sleeves according to manufacturer's printed installation instructions.

T. Fire Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestopping sealant material. Firestopping materials are specified in Division 7.

U. Verify final equipment locations for roughing-in.

V. Refer to equipment specifications in other Sections of these Specifications for roughing-in requirements.

W. Piping Joint Construction: Join pipe and fittings as follows and as specifically required in individual piping system specification Sections.

1. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
2. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
5. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full inside diameter. Join pipe fittings and valves as follows:
   a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   b. Apply appropriate tape or thread compound to external pipe threads (except where dry seal threading is specified).
   c. Align threads at point of assembly.
   d. Tighten joint with wrench. Apply wrench to valve end into which pipe is being threaded.
   e. Damaged Threads: Do not use pipe or pipe fittings having threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
7. Flanged Joints: Align flange surfaces parallel. Select appropriate gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use
suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

X. Piping Connections: Except as otherwise indicated make piping connections as specified below.

1. Install unions, in piping 2 inches and smaller, adjacent to each valve and at final connection to each piece of equipment having 2-inches or smaller threaded pipe connection.
2. Install flanges, in piping 2-1/2-inches and larger, adjacent to flanged valves and at final connection to each piece of equipment having flanged pipe connection.
3. Dry Piping Systems (Gas, Compressed Air, and Vacuum): Install dielectric unions and flanges to connect piping materials of dissimilar metals.

3.2 EQUIPMENT INSTALLATION - COMMON REQUIREMENTS

A. Install equipment to provide the maximum possible headroom, where mounting heights are not indicated.

B. Install equipment according to approved submittal data. Portions of the Work are shown only in diagrammatic form. Refer conflicts to the Architect.

C. Install equipment level and plumb, parallel and perpendicular to other building systems and components in exposed interior spaces, except where otherwise indicated.

D. Install mechanical equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations. Extend grease fittings to an accessible location.

E. Install equipment giving right-of-way to piping systems installed at a required slope.

3.3 LABELING AND IDENTIFYING

A. Piping Systems: Install pipe markers on each system. Include arrows showing normal direction of flow and as indicated in other Division 15 sections.

2. Plastic markers, with application systems. Install on pipe insulation segment where required for hot non-insulated pipes.
3. Locate pipe markers as follows wherever piping is exposed in finished spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
   a. Near each valve and control device.
   b. Near each branch, excluding short take-offs for fixtures and terminal units. Mark each pipe at branch, where flow pattern is not obvious.
   c. Near locations where pipes pass through walls, floors, ceilings, or enter non-accessible enclosures.
   d. At access doors, manholes, and similar access points that permit view of concealed piping.
   e. Near major equipment items and other points of origination and termination.
f. Spaced at a maximum of 50 feet intervals along each run. Reduce intervals to 25 feet in congested areas of piping and equipment.
g. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

B. Equipment: Install engraved plastic laminate sign or equipment marker on or near each major item of mechanical equipment.
   1. Lettering Size: Minimum 1/4-inch-high lettering for name of unit where viewing distance is less than 2 feet, 1/2-inch-high for distances up to 6 feet, and proportionately larger lettering for greater distances. Provide secondary lettering 2/3 to 3/4 of size of principal lettering.
   2. Text of Signs: Provide text to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations, in addition to name of identified unit.

C. Duct Systems: Identify air supply, return, exhaust, intake, and relief ducts with duct markers; or provide stenciled signs and arrows, showing duct system service and direction of flow.
   1. Location: In each space where ducts are exposed or concealed by removable ceiling system, locate signs near points where ducts enter into space and at maximum intervals of 50 feet.

D. Adjusting: Relocate identifying devices which become visually blocked by work of this Division or other Divisions.

3.4 PAINTING AND FINISHING
A. Refer to Division 9 Section "Painting" for field painting requirements.
B. Damage and Touch-Up: Repair marred and damaged factory painted finishes with materials and procedures to match original factory finish.

3.5 CONCRETE BASES
A. Construct concrete equipment bases of dimensions indicated, but not less than 4 inches larger in both directions than supported unit. Follow supported equipment manufacturer's setting templates for anchor bolt and tie locations. Use 3000 psi, 28-day compressive strength concrete and reinforcement as specified in Division 3 Section "Cast-In-Place Concrete."

3.6 ERECTION OF METAL SUPPORTS AND ANCHORAGE
A. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor mechanical materials and equipment.
B. Field Welding: Comply with AWS D1.1 "Structural Welding Code - Steel."

3.7 ERECTION OF WOOD SUPPORTS AND ANCHORAGE
A. Cut, fit, and place wood grounds, nailers, blocking, and anchorage to support and anchor mechanical materials and equipment.
B. Select fastener sizes that will not penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood members.

C. Attach to substrates as required to support applied loads.

3.8 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces necessary for mechanical installations. Perform cutting and patching as specified in other section.

B. Repair cut surfaces to match adjacent surfaces.

3.9 TEST AND TESTING

A. General: Tests shall be as required by the various Sections under Division 15, as well as by this Section.

B. Tests required by other Sections and the Sections where they are specified include the following:

1. Tests and Balance of Mechanical Equipment and System: Section 15990.
2. Hydrostatic Tests of Boilers: Section 15990.
3. Tests of Smoke or Fire Detectors: Division 16.

C. Tests may be required in the case of materials and equipment submittals and substitutions:

1. For items submitted which are altered, substituted, or which cannot readily be determined by the City Engineer as exactly conforming to the Specifications, Contractor may be required to submit certified test results to prove that the items in question meet Specification requirements.
2. Tests may also be required on certain items which are as specified, including fan and pump performance. Should such tests be required of specified items and tests prove that items do meet Specification requirements, the City will pay for applicable portions of tests.

D. Piping Tests:

1. Perform engineering tests required to demonstrate that operation of mechanical systems and their parts are in accordance with Specifications covering each item or system, and furnish materials, instruments and equipment necessary to conduct such tests. Tests shall be made in presence of the City Engineer, the Architect or the Field Inspector, and the representatives of any governmental agency having jurisdiction. Work shall not be concealed or covered until required approvals are obtained.
2. Should Contractor refuse or neglect to perform any test required by Specifications, the City Engineer may perform such tests and Contractor shall pay charges in connection therewith.
3. Pressure gages used in testing shall have one pound graduations; vacuum gages shall have one-inch mercury graduations. Air shall be bled from lines requiring hydrostatic or water tests.
4. Systems shall be pressure tested in accordance with Pipe Test Schedule below. Pipe test shall show no loss in pressure after a minimum duration of 4 hours at test
Where local codes require higher test pressures than specified herein for Fire Sprinkler Systems, local codes shall govern.

5. Flue gas lines shall be tested twice: First with piping exposed, before backfilling trenches or lathing; second with pipe in finished arrangement, ground backfilled (paved where required) and walls finished.

6. Refrigerant piping may be tested using a halide detector or calibrated electronic testing equipment.

7. Piping systems may be tested as a unit or in sections as directed by the City Engineer, but entire system shall successfully meet requirements specified herein, before acceptance by the City Engineer.

8. Repair of damage to pipes and their appurtenances, or to any other structures resulting from or caused by these tests, shall be performed by Contractor.

E. Pipe Testing Schedule:

<table>
<thead>
<tr>
<th>System Tested</th>
<th>Test Pressure (psig)</th>
<th>Test With</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vent and roof drain (except pipes running under a slab or underground)</td>
<td>Fill with water to top of highest vent, allow to stand two hours, or longer, as directed by Inspector. Minimum head required for any joint shall be 10-feet in building.</td>
<td>Water</td>
</tr>
<tr>
<td>Cast-iron soil, waste and interior downspout, condensate drain from air conditioning equipment</td>
<td>10-feet of water vertically</td>
<td></td>
</tr>
<tr>
<td>Storm water disposal lines</td>
<td>Running water test</td>
<td>Water</td>
</tr>
<tr>
<td>Hot water heating system piping</td>
<td>150</td>
<td>Water</td>
</tr>
<tr>
<td>Domestic water piping (metallic)</td>
<td>200</td>
<td>Water</td>
</tr>
<tr>
<td>Fire Sprinkler piping</td>
<td>200</td>
<td>Water</td>
</tr>
<tr>
<td>Gas piping (steel threaded or plastic)</td>
<td>60 (both tests)</td>
<td>Air</td>
</tr>
<tr>
<td>Gas piping (steel welded)</td>
<td>100 (both tests)</td>
<td>Air</td>
</tr>
<tr>
<td>Refrigeration Suction Freon R407C</td>
<td>150</td>
<td>Nitrogen &amp; Freon</td>
</tr>
</tbody>
</table>
Puron R410A   250
Refrigeration Liquid & Hot Gas Piping  150  Nitrogen
Freon R407C       & Freon
Puron R410A   300

F. Operational Tests:

1. Before operating any equipment or systems, a thorough check shall be made to determine that all systems have been flushed and cleaned as required and that all equipment has been properly installed, aligned, lubricated, and serviced.

Factory instructions shall be checked to see that installations have been made accordingly and that recommended lubricants have been used in all bearings, gearboxes, crankcases, and similar equipment. Particular care shall be used in lubricating bearings to avoid damage by over-lubrication and blowing out seals. Equipment shall also be checked for any damage that may have occurred during shipment, after delivery, or during installation. In event of any damage, equipment shall be replaced, renewed, or repaired at Contractor’s expense.

2. Contractor shall provide, maintain, and pay costs for equipment, instruments, and operating personnel as required for all tests hereinafter specified.

3. Contractor shall pay for electric energy and fuel required for tests.

4. Any final adjustment to equipment or systems shall meet specified performances requirements.

5. Any equipment, system, or work found deficient during any test shall be replaced or corrected. Retest and obtain approval from the City Engineer.

G. Project Completion Tests:

1. Upon completion of Mechanical work, or such a time prior to completion as may be determined by the City Engineer, all mechanical equipment and systems shall be operated and tested for a period of at least 5 consecutive 8-hour days to demonstrate satisfactory over-all operation of building or project as a completed unit. Tests shall include operation of heating, ventilating, and air conditioning equipment and systems for a period of not less than 2, 8-hour, days at not less than 90% of full, specified heating and cooling capacities.

2. Tests shall commence after preliminary balancing and adjustments to equipment and systems have been completed, and all running equipment has been checked and thoroughly lubricated.

3. Immediately before starting tests all air filter media shall be cleaned or renewed. Roll type filters shall be advanced to provide new clean media. Cleanable type media shall be thoroughly cleaned and shall be re-oiled with new clean oil as recommended by manufacturer if they are of viscous impingement type. Disposable type filters shall be replaced with new filters. Replaceable media shall be replaced with new media.

4. An accurate means of measuring air flow and temperatures shall be used to balance air supply, return, and exhaust systems, so that uniform temperatures occur in every room and design air flow is obtained through registers, diffusers and grilles.

5. Systems shall be adjusted to provide air flows indicated including maximum fresh air and maximum return air. Dampers shall be checked for proper settings and operation. Air and water inlet and leaving temperatures at coils shall be checked. Complete operational data including air flows, room temperatures, fan speeds, motor currents, plenum and duct static pressures shall be tabulated.
6. Welding done on this project may be subject to radiographic inspections at random.

H. Post Contract Tests: If required full load operating conditions cannot be obtained at time of project completion test, due to unfavorable outdoor temperatures or conditions, Contractor shall return to job site when requested by the City Engineer and operate and test equipment and systems at such times of year when proper loading of system can be accomplished. Such tests shall be conducted within a one-year period from completion date. Contractor will be notified at least 10 days prior to start.

3.10 LOCATION

A. Location of piping, apparatus and equipment as indicated on Drawings is approximate only and shall be altered to avoid all obstructions, preserve headroom and keep openings and passageways clear.

B. Placement of equipment in locations and spaces indicated shall be Contractor's responsibility. Any disassembling and reassembling of equipment, or other work necessary, shall be done without extra cost to the City.

3.11 CUTTING, NOTCHING AND BACKING:

A. Conform to State Building Code, Title 24, Part 2, Section 2517(9) 8, 9, for notches and bored holes in wood; Section 2606, for pipes and sleeves embedded in concrete and for cuts in steel, as detailed on Structural Drawings.

B. Where pipes or ducts pass through, or are located within 1" of any construction element, install a resilient pad, 1/2" thick minimum, to prevent contact.

C. Contractor shall make provisions for recesses, chases, accesses, and provide sheet metal spacers, channel and backing as necessary for proper reception and installation of Mechanical work.

3.12 SERVICE INTERRUPTIONS, OFFSITE, GAS AND WATER

A. Arrange work so that there will be NO service interruptions of any existing systems.

B. When service interruptions are mandatory, arrange in advance with the City Engineer as to time and date of such interruptions.

C. Systems, which are interrupted, shall be put back into operation in such manner that they will function as they were originally intended.

3.13 OPERATION AND MAINTENANCE MANUALS AND REPAIR MANUAL

A. General: Submit 2 copies of operation and maintenance manuals in acceptable form and content. If no revisions are required, furnish one additional acceptable copy. If revisions are required, one copy will be returned with instructions for changes; make such changes and return 3 copies of acceptable manuals. Manuals shall be bound in hard-back, three-ring, loose-leaf binders. Deliver manuals to the City Engineer Inspector.

B. Contents of Manual:

1. Title sheet with job name, and names, addresses and telephone numbers of Contractor, Subcontractor and related equipment suppliers.
2. Typewritten manufacturer's operating instructions describing how to start and stop each piece of equipment, how to set temperature control systems for normal operation and normal restarting procedures, and caution and warning notices.
3. Manufacturer's product data and parts and maintenance booklet for each item of equipment furnished under Division 15.
4. Project Record drawings of Electrical and control diagrams.
5. Test and balance reports.
6. Valve directory.
7. Pipe and component identification chart.

C. Submit one complete copy of repair manual.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section includes pipe and equipment supports, hangers, anchors, bases sleeves and the sealing of work to adjacent construction.

B. Related Sections:
   1. Division 3 Concrete: the execution requirements for placement of inserts and sleeves in concrete forms specified by this division.
   2. Section 03300 – Cast-in-Place Concrete: Execution requirements for placement of concrete housekeeping pads specified by this section.
   3. Section 07811 – Sprayed Fire Resistive Material
   4. Section 07840 - Fire Stopping.

1.2 REFERENCES

A. ASME B31.1 (American Society of Mechanical Engineers) - Power Piping
B. ASME B31.9 (American Society of Mechanical Engineers) - Building Services Piping.
C. ASTM F708 - Design and Installation of Rigid Pipe Hangers.
D. MSS SP58 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Materials, Design and manufacturer.
E. MSS SP69 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Selection and Application.
F. MSS SP89 (Manufacturers Standardization Society of the Valve and Fittings Industry) - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.3 SUBMITTALS

A. Section 01330 - Submittal Procedures: Submittal procedures.
B. Shop Drawings: Indicate system layout with location and detail of trapeze hangers.
C. Product Data: Submit manufacturers catalog data including load capacity.
D. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers.
E. Manufacturer's Installation Instructions: Submit special procedures and assembly of components.
F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
1.4 QUALITY ASSURANCE
   A. Perform Work in accordance with applicable authority code for piping support.
   B. Maintain one copy of each document on site.

1.5 QUALIFICATIONS
   A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.
   B. Installer: Company specializing in performing Work of this section with minimum three years documented experience approved by manufacturer.

1.6 PRE-INSTALLATION MEETING
   A. Division 1 – Project Meetings: Pre-installation meeting.
   B. Convene minimum one week prior to commencing Work of this section.

1.7 FIELD MEASUREMENTS
   A. Verify field measurements prior to fabrication.

1.8 WARRANTY
   A. Section 01611 – Guaranty/Warranty.
   B. Provide five year manufacturer warranty for pipe hangers and supports.

PART 2 - PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS
   A. Manufacturers:
      1. Carpenter & Paterson Inc.
      2. Globe Pipe Hanger Products Inc.
      3. Superior Valve Co.
      4. Substitutions: Section 01630 – Substitutions and “or equal” submittal.
   B. Plumbing Piping - DWV:
      2. Hangers for Pipe Sizes to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
      3. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.
      4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Copper-plated, carbon-steel adjustable, ring.

C. Plumbing Piping - Water:
2. Hangers for Pipe Sizes to 1-1/2 inches: Malleable iron, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
5. Wall Support for Pipe Sizes to 3 inches: Cast iron hook.
8. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Floor Support for Hot Pipe Sizes to 4 inches: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
10. Copper Pipe Support: Copper-plated, carbon-steel ring.

D. Hydronic Piping:
2. Hangers for Pipe Sizes to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.
3. Hangers for Cold Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.
5. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.
6. Wall Support for Pipe Sizes to 3 inches: Cast iron hooks.


9. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

10. Floor Support for Hot Pipe Sizes to 4 Inches (100 mm): Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

11. Copper Pipe Support: Copper-plated, carbon steel ring.

2.2 ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

2.3 INSERTS

A. Inserts: Malleable iron case of galvanized steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.4 FLASHING

A. Metal Flashing: 26 gage thick galvanized steel.

B. Metal Counterflashing: 22 gage thick galvanized steel.

C. Lead Flashing:
   1. Waterproofing: 5 lb./sq. ft. sheet lead
   2. Soundproofing: 1 lb./sq. ft. sheet lead.

D. Flexible Flashing: 47 mil thick sheet butyl; compatible with roofing.

E. Caps: Steel, 22 gage minimum; 16 gage at fire resistant elements.

2.5 EQUIPMENT CURBS

A. Fabrication: Welded 18 gage galvanized steel shell and base, mitered 3 inch cant, variable step to match root insulation, 1-1/2 inch thick insulation, factory installed.

2.6 SLEEVES

A. Sleeves for Pipes Through Non-fire Rated Floors: 18 gage thick galvanized steel.

B. Sleeves for Pipes Through Non-fire Rated Beams, Walls, Footings, and Potentially Wet Floors: Steel pipe or 18 gage thick galvanized steel.

C. Sleeves for Round Ductwork: Galvanized steel.

D. Sleeves for Rectangular Ductwork: Galvanized steel or wood.
E. Fire-stopping Insulation: Glass fiber type, non-combustible; refer to Section 07840.

F. Sealant: Acrylic; refer to Section 07920 – Joint Sealants.

PART 3 - EXECUTION

3.1 INSERTS

A. Provide inserts for placement in concrete forms.

B. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.2 PIPE HANGERS AND SUPPORTS

A. Support horizontal piping as scheduled.

B. Install hangers to provide minimum 6 inch space between finished covering and adjacent work.

C. Place hangers within 12 inches of each horizontal elbow.

D. Use hangers with 1-1/2 inch minimum vertical adjustment.

E. Support horizontal cast iron pipe adjacent to each hub, with 5 feet maximum spacing between hangers.

F. Support vertical piping at every floor. Support vertical cast iron pipe at each floor at hub.

G. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Provide copper plated hangers and supports for copper piping.

J. Design hangers for pipe movement without disengagement of supported pipe.

K. Prime coat exposed steel hangers and supports. Refer to Section 09900 - Painting. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

3.3 EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 3-1/2 inches thick and extending 6 inches beyond supported equipment. Refer to Section 03300 – Cast-in-Place Concrete.
B. Provide templates, anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.4 FLASHING

A. Provide flexible flashing and metal counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

B. Flash vent and soil pipes projecting 3 inches minimum above finished roof surface with lead worked 1 inch minimum into hub, 8 inches minimum clear on sides with 24 x 24 inches sheet size. For pipes through outside walls, turn flanges back into wall and caulk, metal counter-flash, and seal.

C. Flash floor drains in floors with topping over finished areas with lead, 10 inches clear on sides with minimum 36 x 36 inches sheet size. Fasten flashing to drain clamp device.

D. Seal floor drains watertight to adjacent materials.

E. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms for sound control.

F. Provide curbs for mechanical roof installations 14 inches minimum high above roofing surface. Flash and counter-flash with sheet metal; seal watertight. Attach Counterflashing mechanical equipment and lap base flashing on roof curbs. Flatten and solder joints.

G. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.5 SLEEVES

A. Set sleeves in position in forms. Provide reinforcing around sleeves.

B. Size sleeves large enough to allow for movement due to expansion and contraction. Provide for continuous insulation wrapping.

C. Extend sleeves through floors 1 inch above finished floor level. Caulk sleeves.

D. Where piping or ductwork penetrates floor, ceiling, or wall, close off space between pipe or duct and adjacent work with fire stopping insulation and caulk airtight. Provide close fitting metal collar or escutcheon covers at both sides of penetration.

E. Install chrome plated steel escutcheons at finished surfaces.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS
   A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to this section.
   B. Requirements of the following Division 15 Sections apply to this section:
      1. "Basic Mechanical Requirements."
      2. "Basic Mechanical Materials and Methods."

1.2 SUMMARY
   A. This Section includes general duty valves common to most mechanical piping systems.
      1. Special purpose valves are specified in individual piping system specifications.
   B. Valve tags and charts are specified in Division 15 Section "MECHANICAL IDENTIFICATION."

1.3 SUBMITTALS
   A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
   B. Product data, including body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.

1.4 QUALITY ASSURANCE
   A. Single Source Responsibility: Comply with the requirements specified in Division 1 Section "MATERIALS AND EQUIPMENT," under "Source Limitations."
   B. American Society of Mechanical Engineers (ASME) Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.
   C. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Compliance: Comply with the various MSS Standard Practices referenced.

1.5 DELIVERY, STORAGE, AND HANDLING
   A. Preparation For Transport: Prepare valves for shipping as follows:
      1. Ensure valves are dry and internally protected against rust and corrosion.
      2. Protect valve ends against damage to threads, flange faces, and weld-end preps.
      3. Set valves in best position for handling. Set globe and gate valves closed to prevent rattling; set ball and plug valves open to minimize exposure of functional surfaces; set butterfly valves closed or slightly open; and block swing check valves in either closed or open position.
B. Storage: Use the following precautions during storage:

1. Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.
2. Protect valves from weather. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.

C. Handling: Use a sling to handle valves whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels and stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, those listed in valve schedule.

B. Manufacturer: Subject to compliance with requirements, provide products from one of the manufacturers listed in valve schedule.

2.2 VALVE FEATURES, GENERAL

A. Valve Design: Rising stem or rising outside screw and yoke stems.

1. Nonrising stem valves may be used where headroom prevents full extension of rising stems.

B. Pressure and Temperature Ratings: As scheduled and required to suit system pressures and temperatures.

C. Sizes: Same size as upstream pipe, unless otherwise indicated.

D. Operators: Provide the following special operator features:

1. Handwheels, fastened to valve stem, for valves other than quarter turn.
2. Lever handles, on quarter-turn valves 6-inch and smaller, except for plug valves. Provide plug valves with square heads; provide one wrench for every 10 plug valves.

E. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.

F. Bypass and Drain Connections: Comply with MSS SP-45 bypass and drain connections.

G. End Connections: As indicated in the valve specifications.

a. Caution: Where soldered end connections are used, use solder having a melting point below 840 deg F for gate, globe, and check valves; below 421 deg F for ball valves.

2.3 GATE VALVES

A. Gate Valves, 2-Inch and Smaller: MSS SP-80; Class 150, body and bonnet of ASTM B 62 cast bronze; with threaded or solder ends, solid disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron handwheel. Provide Class 200 valves meeting the above where system pressure requires.

B. Gate Valves, 2-1/2-Inch and Larger: MSS SP-70; Class 200 iron body, bronze mounted, with body and bonnet conforming to ASTM A 126 Class B; with flanged ends, "Teflon" impregnated packing, and two-piece backing gland assembly.

C. Gate Valves - 2 Inch and Smaller:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>THREADED NRS</th>
<th>THREADED RS</th>
<th>SOLDER NRS</th>
<th>SOLDER RS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane</td>
<td>438</td>
<td>428</td>
<td>1701S</td>
<td>1700S</td>
</tr>
<tr>
<td>Grinnell</td>
<td>3000</td>
<td>3010</td>
<td>3000SJ</td>
<td>3010SJ</td>
</tr>
<tr>
<td>Nibco</td>
<td>T113</td>
<td>T111</td>
<td>S113</td>
<td>S111</td>
</tr>
</tbody>
</table>

D. Gate Valves - 2-1/2 Inch and Larger:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>OS&amp;Y RS</th>
<th>NRS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane</td>
<td>465-1/2</td>
<td>461</td>
</tr>
<tr>
<td>Grinnell</td>
<td>6020A</td>
<td>6060A</td>
</tr>
<tr>
<td>Nibco</td>
<td>617-O</td>
<td>F-619</td>
</tr>
</tbody>
</table>

2.4 BALL VALVES

A. Ball Valves, 1 Inch and Smaller: Rated for 150 psi saturated steam pressure, 400 psi WOG pressure; two-piece construction; with bronze body conforming to ASTM B 62, standard (or regular) port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout-proof stem, and vinyl-covered steel handle. Provide solder ends for condenser water, chilled water, and domestic hot and cold water service; threaded ends for heating hot water and low-pressure steam.

B. Ball Valves, 1-1/4-Inch to 2-Inch: Rated for 150 psi saturated steam pressure, 400 psi WOG pressure; 3-piece construction; with bronze body conforming to ASTM B 62, conventional port, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout proof stem, and vinyl-covered steel handle. Provide solder ends for condenser water, chilled water, and domestic hot and cold water service; threaded ends for heating hot water and low-pressure steam.

C. Ball Valves - 1 Inch and Smaller:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>THREADED ENDS</th>
<th>SOLDER ENDS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane</td>
<td>9302</td>
<td>9322</td>
</tr>
<tr>
<td>Grinnell</td>
<td>3500</td>
<td>3500SJ</td>
</tr>
<tr>
<td>Nibco</td>
<td>T-580</td>
<td>S-580</td>
</tr>
</tbody>
</table>

D. Ball Valves - 1-1/4 Inch to 2 Inch:
2.5  PLUG VALVES

A. Plug Valves, 2-Inch and Smaller: Rated at 150 psi WOG; bronze body, with straightaway pattern, square head, and threaded ends.

B. Plug Valves, 2-1/2-Inch and Larger: MSS SP-78; rated at 175 psi WOG; lubricated plug type, with semisteel body, single gland, wrench operated, and flanged ends.

C. Plug Valves – 2 Inch and Smaller:
   1. Lunkenheimer: 454.

D. Plug Valves – 2-1/2 Inch and Larger:
   1. Powell: 2201.

2.6  GLOBE VALVES

A. Globe Valves, 2-Inch and Smaller: MSS SP-80; Class 150; body and screwed bonnet of ASTM B 62 cast bronze; with threaded or solder ends, brass or replaceable composition disc, copper-silicon alloy stem, brass packing gland, “Teflon” impregnated packing, and malleable iron handwheel. Provide Class 200 valves meeting the above where system pressure requires.

B. Globe Valves, 2-1/2-Inch and Larger: MSS SP-85; Class 150 iron body and bolted bonnet conforming to ASTM A 126, Class B; with outside screw and yoke, bronze mounted, flanged ends, and “Teflon” impregnated packing, and two-piece backing gland assembly.

C. Globe Valves - 2 Inch and Smaller:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>CLASS 150</th>
<th>CLASS 150</th>
<th>CLASS 150</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>THREADED</td>
<td>SOLDER</td>
<td>THREADED</td>
</tr>
<tr>
<td>Crane</td>
<td>1</td>
<td>1310</td>
<td>17TF</td>
</tr>
<tr>
<td>Grinnell</td>
<td>3210</td>
<td>3210SJ</td>
<td>3240</td>
</tr>
<tr>
<td>Nibco</td>
<td>T-211-B</td>
<td>S-211-B</td>
<td>T-235-Y</td>
</tr>
<tr>
<td></td>
<td>T-211-Y</td>
<td>S-211-Y</td>
<td>x</td>
</tr>
</tbody>
</table>

D. Globe Valves - 2-1/2 Inch and Larger:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>STRAIGHT BODY</th>
<th>ANGLE BODY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane</td>
<td>351</td>
<td>353</td>
</tr>
<tr>
<td>Grinnell</td>
<td>6200A</td>
<td>x</td>
</tr>
<tr>
<td>Nibco</td>
<td>F-718-B</td>
<td>F-818-B</td>
</tr>
<tr>
<td>Stockham</td>
<td>G-512</td>
<td>G-515</td>
</tr>
</tbody>
</table>

x means not available.

2.7  BUTTERFLY VALVES
A. Butterfly Valves, 2-1/2-Inch and Larger: MSS SP-67; rated at 200 psi; cast-iron body conforming to ASTM A 126, Class B. Provide valves with field replaceable EPDM sleeve, nickel-plated ductile iron disc (except aluminum bronze disc for valves installed in condenser water piping), stainless steel stem, and EPDM O-ring stem seals. Provide lever operators with locks for sizes 2 through 6 inches and gear operators with position indicator for sizes 8 through 24 inches. Provide lug or wafer type as indicated. Drill and tap valves on dead-end service or requiring additional body strength.

B. Butterfly Valves - 2-1/2 Inch and Larger:

1. The following are model numbers for wafer-type, with nickel-plated ductile-iron disc:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>LEVER</th>
<th>GEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Grinnell</td>
<td>WC-8209-7</td>
<td>WC-8202-7</td>
</tr>
<tr>
<td>Nibco</td>
<td>WD-20103</td>
<td>WD-20105</td>
</tr>
</tbody>
</table>

CHECK VALVES

A. Swing Check Valves, 2-Inch and Smaller: MSS SP-80; Class 150, cast-bronze body and cap conforming to ASTM B 62; with horizontal swing, Y-pattern, and bronze disc; and having threaded or solder ends. Provide valves capable of being reground while the valve remains in the line. Provide Class 200 valves meeting the above specifications, with threaded end connections, where system pressure requires or where Class 150 valves are not available.

B. Swing Check Valves, 2-1/2-Inch and Larger: MSS SP-71; Class 150 (Class 175 FM approved for fire protection piping systems), cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal swing, and bronze disc or cast-iron disc with bronze disc ring; and flanged ends. Provide valves capable of being refitted while the valve remains in the line.

C. Wafer Check Valves: Class 250, cast-iron body; with replaceable bronze seat, and non-slam design lapped and balanced twin bronze flappers and stainless steel trim and torsion spring. Provide valves designed to open and close at approximately one foot differential pressure.

D. Lift Check Valves, 2-Inch and Smaller: Class 150; cast-bronze body and cap conforming to ASTM B 62; horizontal or angle pattern, lift-type valve, with stainless steel spring, bronze disc holder with renewable "Teflon" disc, and threaded ends. Provide valves capable of being refitted and ground while the valve remains in the line.

E. Swing Check Valves - 2 Inch and Smaller:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>CLASS 150</th>
<th>CLASS 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane</td>
<td>37</td>
<td>1342</td>
</tr>
<tr>
<td>Grinnell</td>
<td>3300</td>
<td>3300SJ</td>
</tr>
<tr>
<td>Nibco</td>
<td>T-413</td>
<td>S-413</td>
</tr>
</tbody>
</table>

1. For grooved connections, use Victaulic Series 712.

F. Swing Check Valves - 2-1/2 Inch and Larger:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>CLASS 150</th>
<th>CLASS 175 OR 200</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane</td>
<td>373</td>
<td>x</td>
</tr>
</tbody>
</table>
1. For grooved connections, use Victaulic Series 712.
2. x means not available.

G. Wafer Check Valves:

1. Center Line: CLC.
2. Stockham: WG970.

H. Lift Check Valves 2 Inch and Smaller:

<table>
<thead>
<tr>
<th>MANUFACTURER</th>
<th>HORIZONTAL</th>
<th>ANGLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hammond</td>
<td>x</td>
<td>IB954</td>
</tr>
<tr>
<td>Jenkins</td>
<td>655-A</td>
<td>x</td>
</tr>
<tr>
<td>Lunkenheimer</td>
<td>233</td>
<td>x</td>
</tr>
</tbody>
</table>

x means not available.

I. Balance Valve: 1 inch and smaller.

1. Bell & Gossett pre-set control valve.
   a. Model # CB-3/4” set at 1.5 GPM.
   b. Model # CB-1” set at 3.0 GPM.

2. Flow Design Inc. approved equal.

3. Griswold Control MFG. approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior through the end ports for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks used to prevent disc movement during shipping and handling.

B. Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the shipping position.

C. Examine threads on both the valve and the mating pipe for form (i.e., out-of-round or local indentation) and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.
E. Prior to valve installation, examine the piping for cleanliness, freedom from foreign materials, and proper alignment.

F. Replace defective valves with new valves.

3.2 VALVE ENDS SELECTION

A. Select valves with the following ends or types of pipe/tube connections:

1. Copper Tube Size, 2-Inch and Smaller: Solder ends, except provide threaded ends for heating hot water service.

2. Steel Pipe Sizes, 2-Inch and Smaller: threaded or grooved end.


3.3 VALVE INSTALLATIONS

A. General Application: Use gate, ball, and butterfly valves for shut-off duty; globe, ball, and butterfly for throttling duty. Refer to piping system specification sections for specific valve applications and arrangements.

B. Locate valves for easy access and provide separate support where necessary.

C. Install valves and unions for each fixture and item of equipment arranged to allow equipment removal without system shutdown. Unions are not required on flanged devices.

D. Install valves in horizontal piping with stem at or above the center of the pipe.

E. Install valves in a position to allow full stem movement.

F. Installation of Check Valves: Install for proper direction of flow as follows:

1. Swing Check Valves: Horizontal position with hinge pin level.
2. Lift Check Valve: With stem upright and plumb.

3.4 SOLDER CONNECTIONS

A. Cut tube square and to exact lengths.

B. Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket in same manner.

C. Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.

D. Open gate and globe valves to full open position.

E. Remove the cap and disc holder of swing check valves having composition discs.

F. Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to ensure even distribution of the flux.

G. Apply heat evenly to outside of valve around joint until solder will melt upon contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.

3.5 THREADED CONNECTIONS
A. Note the internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.

B. Align threads at point of assembly.

C. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).

D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.6 FLANGED CONNECTIONS

A. Align flange surfaces parallel.

B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

C. For dead-end service, butterfly valves require flanges both upstream and downstream for proper shutoff and retention.

3.7 FIELD QUALITY CONTROL

A. Tests: After piping systems have been tested and put into service, but before final adjusting and balancing, inspect valves for leaks. Adjust or replace packing to stop leaks; replace valves if leak persists.

3.8 ADJUSTING AND CLEANING

A. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare valves to receive finish painting or insulation.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.
B. Requirements of the following Division 15 Sections apply to this section:
   1. "Basic Mechanical Requirements."
   2. "Basic Mechanical Materials and Methods."
   3. "Basic Piping Materials and Methods."
C. This Section includes the following:
   1. Packless expansion joints.
   2. Slip joints.
   3. Flexible ball pipe joints.
   4. Expansion joints for grooved piping.
D. Related Sections: The following sections contain requirements that relate to this section:
   1. Division 05500 Section "Metal Fabrications" for materials for anchoring piping systems to building structure.
   2. Division 09910 Section "Painting" for field-applied painting requirements.
   3. Division 15060 Section "Supports and Anchors" for pipe alignment guides and anchors.
   4. Division 15240 Section "HVAC Equipment Seismic Restraints & Vibration Isolation" for flexible pipe connectors.

1.2 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.
   1. Product data for each type of pipe expansion joints specified. Submit expansion compensation schedule showing Manufacturer's figure number, size, location, and features for each required expansion joint.
   2. Assembly-type shop drawings for each type of expansion compensation product, indicating dimensions, weights, required clearances, and methods of assembly of components.
   3. Shop drawings for field-fabricated expansion loops indicating location, dimensions, pipe sizes, calculations for compression or tension required, and location.
   4. Maintenance data for expansion joints for inclusion in Operating and Maintenance Manuals specified in Division 1 and Division 15 Section "Basic Mechanical Requirements."

PART 2 - PRODUCTS

2.1 MANUFACTURERS
A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include but are not limited to the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Packless Expansion Compensators:
   a. Adsco Manufacturing Corp.
   b. Anamet, Inc.
   d. Hyspan Precision Products, Inc.
   e. Keflex HVAC Products, Flex-Weld, Inc.
   f. Metraflex Co.

2. Packless Rubber Expansion Joints:
   a. Garlock Mechanical Packing Div., Colt Industries
   b. Keflex HVAC Products Div., Flex-Weld, Inc.
   c. MG Piping Products Co.
   d. Mason Industries, Inc.
   e. Metraflex Co.
   f. Vibration Mountings and Controls, Subsidiary of ARX.

3. Slip Joints:
   a. Adsco Manufacturing Corp.
   b. Advanced Thermal Systems, Inc.

4. Flexible Ball Pipe Joints:
   a. Advanced Thermal Systems, Inc.

5. Grooved Piping Couplings and Nipples Expansion Joints:
   a. Grinnell Corp.
   b. Gustin - Bacon Div., Tyler Pipe
   c. Stockham Valves & Fittings, Inc.
   d. Victaulic Co. of America.

6. Grooved Piping Slip-Type Expansion Joints:
   a. Victaulic Co. of America

2.2 PIPE EXPANSION JOINTS, GENERAL

Pipe expansion joints shall provide 200 percent absorption capacity of piping expansion between anchors.

2.3 PACKLESS EXPANSION JOINTS

A. Expansion Compensators: Conform to the standards of the Expansion Joint Manufacturers Association and shall be pressure rated for 60 psi for low-pressure
systems and for 175 psi for high-pressure systems. Units shall have 2-ply phosphor bronze bellows, brass shrouds, and end fittings for copper piping systems and 2-ply stainless steel bellows, carbon steel shrouds, and end fittings for steel piping systems. Expansion compensators shall have internal guides and antitorque device and removable end clip for proper positioning.

B. Rubber Expansion Joints: Fabric-reinforced butyl rubber with full-faced integral flanges, external control rods and shall be internally reinforced with steel retaining rings over entire surface of flanges, drilled to match flange bolt holes.

2.4 SLIP JOINTS

A. Slip Joints: Carbon steel slip type, designed for repacking under pressure. Slip joints shall have drip connections for steam piping systems and flanged or weld ends to mate with piping system. Packing shall be an asbestos-teflon compound.

2.5 FLEXIBLE BALL PIPE JOINTS

A. Joints shall be designed for 360 degree rotation and with minimum of 30 degree angular deflection for sizes 6 inches and smaller; 15 degree for sizes 8 inches and larger.

B. Joints shall be carbon steel and shall comply with Section II of ASME Boiler and Pressure Vessel Code and ASME B31.9 "Building Service Piping" for materials and design of pressure containing parts and bolting. Packing shall be asbestos composition.

1. Each assembly shall be factory tested with steam at working pressure of piping system for zero leaks before shipment.

2.6 EXPANSION JOINTS FOR GROOVED PIPING

A. Combination Couplings and Nipples: Cut grooved short ASTM A 53 steel pipe nipples and ductile iron or malleable iron couplings, with removable ties to hold joint compressed or expanded during piping fabrication. Select suitable gasket materials for piping system.

B. Slip-Type Expansion Joints: Ductile iron or malleable iron housing, ASTM A 53 steel pipe body, and polytetrafluoroethylene (PTFE) modified polyphenylene coated steel pipe slide. Select suitable gasket material for piping system.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

Install expansion joints and expansion loops where indicated and required for adequate expansion of installed piping system.

3.2 EXPANSION JOINTS

A. Install expansion joints in accordance with manufacturer's instructions.

B. Align joints to avoid end loading and torsional stress.

3.3 EXPANSION COMPENSATION FOR RISERS AND TERMINALS
Install connection between piping mains and risers with at least 5 pipe fittings including tee in main. Install connections between piping risers and terminal units with at least 4 pipe fittings including tee in riser.

3.4 EXPANSION LOOPS

Fabricate expansion loops to dimensions indicated and subject loop to cold spring tension or compression necessary to absorb 50 percent of the total compression or tension during anticipated change in temperature.

END OF SECTION
SECTION 15135
METERS AND GAGES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary
   Conditions and Division 1 Specification sections, apply to work of this section.

B. Requirements of the following Division 15 Sections apply to this section:
   1. "Basic Mechanical Requirements."
   2. "Basic Mechanical Materials and Methods."
   3. "Basic Piping Materials and Methods."

1.2 SUMMARY

A. This Section includes the following types of meters and gages:
   1. Temperature gages and fittings.
   2. Pressure gages and fittings.
   3. Flow meters.

B. Related Sections: The following sections contain requirements that relate to this section:
   1. Division 02510 Section "Site Water Distribution Systems" for water meters.

C. Meters and gages furnished as part of factory-fabricated equipment are specified as part of
   equipment assembly in other Division 15 sections.

1.3 SUBMITTALS

A. General: Submit the following in accordance with conditions of Contract and Division 1
   Specification Sections.
   1. Product data for each type of meter and gage. Include scale range, ratings, and
      calibrated performance curves, certified where indicated. Submit meter and gage
      schedule showing manufacturer's figure number, scale range, location, and
      accessories for each meter and gage.
   2. Product certificates signed by manufacturers of meters and gages certifying accuracies
      under specified operating conditions and products' compliance with specified
      requirements.
   3. Maintenance data for each type of meter and gage for inclusion in Operating and
      Maintenance Manuals specified in Division 1 and Division 15 Section "Basic
      Mechanical Requirements."

1.4 QUALITY ASSURANCE

A. UL Compliance: Comply with applicable UL standards pertaining to meters and gages.

B. ASME and ISA Compliance: Comply with applicable portions of ASME and Instrument
   Society of America (ISA) standards pertaining to construction and installation of meters and
   gages.
PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include but are not limited to the following:

1. Mercury-In-Glass Thermometers:
   a. Marshalltown Instruments, Inc.
   b. Trerice (H.O.) Co.
   c. Weiss Instruments, Inc.

2. Direct-Mount Filled-System Dial Thermometers:
   b. Trerice (H.O.) Co.
   c. Weiss Instruments, Inc.

3. Remote-Reading Filled-System Dial Thermometers:
   b. Trerice (H.O.) Co.
   c. Weiss Instruments, Inc.

4. Bimetal Dial Thermometers:
   b. Trerice (H.O.) Co.
   c. Weiss Instruments, Inc.

5. Thermometer Wells: Same as for thermometers.

6. Insertion Dial Thermometers:
   b. Trerice (H.O.) Co.
   c. Weiss Instruments, Inc.

7. Pressure Gages:
   b. Trerice (H.O.) Co.
   c. Weiss Instruments, Inc.

8. Pressure Gage Accessories: Same as for pressure gages.

9. Water Orifice-Type Measurement System:
   a. Armstrong Pumps, Inc.
   b. Bell & Gossett, ITT, Fluid Handling Div.

10. Venturi-Type Flow Measurement System:
    a. Armstrong Pumps, Inc.
    c. Gerand Engineering Co.

11. Pitot Tube-Type Flow Measurement System:
    a. Dieterich Standard, A Dover Industries Co.
    b. Taco, Inc.

12. Window Type Flow Meters:
    a. Armstrong Pumps, Inc.
b. Metraflex Co.

13. BTU Meters:
   a. Data Industries Corp.
   b. ISTA Energy Systems Corp.
   c. Monitoring Systems & Controls, Inc.
   d. QMI

14. Test Plugs:
   a. Peterson Equipment Co., Inc.
   b. Trerice (H.O.) Co.
   c. Watts Regulator Co.

2.2 THERMOMETERS, GENERAL
   A. Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.
   B. Scale range: Temperature ranges for services listed as follows:
      1. Domestic Hot Water: 30 to 240 with 2 scale divisions.
      2. Domestic Cold Water: 0 to 100 F with 2 scale divisions.
      3. Hot Water: 30 to 300 with 2 scale divisions.

2.3 MERCURY-IN-GLASS THERMOMETERS
   A. Case: Die cast, aluminum finished, in baked epoxy enamel, glass front, spring secured, 9 inches long.
   B. Adjustable Joint: Finished to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.
   C. Tube: Red reading, mercury filled, magnifying lens.
   D. Scale: Satin-faced, nonreflective aluminum, with permanently etched markings.
   E. Stem: Copper-plated steel, aluminum or brass, for separable socket, length to suit installation.

2.4 DIRECT-MOUNT FILLED-SYSTEM DIAL THERMOMETERS
   A. Type: Vapor actuated, universal angle.
   B. Case: Drawn steel or cast aluminum, glass lens, 4-1/2-inch diameter.
   C. Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.
   D. Thermal Bulb: Copper with phosphor bronze bourdon pressure tube.
   E. Movement: Brass, precision geared.
   F. Scale: Progressive, satin faced, nonreflective aluminum, permanently etched markings.
   G. Stem: Copper-plated steel, aluminum, or brass, for separable socket, length to suit installation.
2.5 REMOTE-READING FILLED-SYSTEM DIAL THERMOMETERS

A. Type: Vapor actuated.
B. Case: Drawn steel or cast aluminum, glass lens, 4-1/2-inch diameter.
C. Movement: Brass, precision geared.
D. Scale: Progressive, satin faced, nonreflective aluminum, permanently etched markings.
E. Tubing: Bronze double-braided armor over copper capillary, length to suit installation.
F. Bulb: Copper with separable socket for liquids, averaging element for air.

2.6 BIMETAL DIAL THERMOMETERS

A. Type: Direct mounted, bimetal, universal angle.
B. Case: Stainless steel, glass lens, 5-inch diameter.
C. Adjustable Joint: Finish to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.
D. Element: Bimetal coil.
E. Scale: Satin faced, nonreflective aluminum, permanently etched marking.
F. Stem: Stainless steel for separable socket, length to suit installation.

2.7 DIAL-TYPE INSERTION THERMOMETERS

Type: Bimetal, stainless steel case and stem, 1-inch-diameter dial, dust- and leakproof, 1/8-inch-diameter tapered-end stem with nominal length of 5 inches.

2.8 THERMOMETER WELLS

Thermometer Wells: Brass or stainless steel, pressure rated to match piping system design pressure; with 2-inch extension for insulated piping and threaded cap nut with chain permanently fastened to well and cap.

2.9 PRESSURE GAGES

A. Type: General use, ASME B40.1, Grade A, phosphor bronze bourdon-tube type, bottom connection.
B. Case: Drawn steel or brass, glass lens, 4-1/2-inches diameter.
C. Connector: Brass, 1/4-inch NPS.
D. Scale: White coated aluminum, with permanently etched markings.
E. Accuracy: Plus or minus 1 percent of range span.
F. Range: Conform to the following:
   1. Vacuum: 30 inches Hg to 15 psi.
2. All fluids: 2 times operating pressure.

2.10 PRESSURE GAGE ACCESSORIES

A. Syphon: 1/4-inch NPS straight coil constructed of brass tubing with threads on each end.

B. Snubber: 1/4-inch NPS brass bushing with corrosion-resistant porous metal disc. Disc material shall be suitable for fluid served and rated pressure.

2.11 FLOW METERS, GENERAL

Flow rate of elements and meters shall be same as connected equipment or system.

2.12 WAFER ORIFICE-TYPE FLOOD ELEMENTS

A. Type: Differential-pressure wafer-type orifice insert flow elements designed for installation between pipe flanges.

B. Construction: Cast-iron body, brass valves with integral check valves and caps, and calibrated nameplate. Elements shall be pressure rated for 300 psig and 250 deg F (120 deg C).

2.13 VENTURI-TYPE FLOW ELEMENTS

A. Type: Differential-pressure venturi type, designed for installation in piping.

B. Construction: Bronze or cadmium-plated steel with brass fittings and attached tag with flow conversion data. Ends shall be threaded for 2 inches and smaller elements and flanged or welded for 2-1/2 inches and larger elements.

2.14 PITOT TUBE-TYPE FLOW ELEMENTS

A. Type: Differential-pressure pitot tube-type design with probe for insertion into piping.

B. Construction: Stainless steel probe of length to span inside of pipe, with brass fittings and attached tag with flow conversion data. Elements shall be pressure rated for 150 psig and 250 deg F (120 deg C).

2.15 METERS

A. Permanently Mounted Meters: Suitable for mounting on wall or bracket, 6-inch dial or equivalent with fittings and copper tubing for connecting to flow element.

B. Scale shall be in gpm unless otherwise indicated.

C. Accuracy: Plus or minus 1 percent between 20 to 80 percent of range.

D. Portable Meters: Differential-pressure gage and two 12-foot hoses in carrying case with handle.

E. Scale: In inches of water unless otherwise indicated.

F. Accuracy: Plus or minus 2 percent between 20 to 80 percent of range.

G. Each meter shall be complete with operating instructions.
2.16 WINDOW-TYPE FLOW METERS

A. Type: Window-type flow meters designed for installation on hydronic piping and measure flow directly in gpm.

B. Construction: Bronze body and impact tube, integral self-closing valve, glass calibrated tube with indicator ball, and protection shield. Meters shall be pressure rated for 150 psig and temperature rated for 240 deg F (116 deg C).

C. Accuracy: Plus or minus 5 percent.

2.17 BTU METERS

A. Type: BTU meters consisting of turbine wheel flow meter, 2 temperature sensors, solid-state calculator with integral battery pack, integral stop valves, strainer, and magnetic trap.

B. Construction: Bronze housing, 125 psig rating.

C. Temperature Ranges: 40 to 250 deg F (5 to 120 deg C).

D. Data Output: 6-digit electromechanical counter with readout in KWH or BTU.

E. Accuracy: Plus or minus 1 percent.

F. Battery Pack: 5-year lithium battery.

2.18 TEST PLUGS

A. Test Plugs shall be nickel-plated brass body, with 1/2-inch NPS fitting and 2 self-sealing valve-type core inserts, suitable for inserting a 1/8-inch O.D. probe assembly from a dial-type thermometer or pressure gage. Test plug shall have gasketed and threaded cap with retention chain and body of length to extend beyond insulation. Pressure rating shall be 500 psig.

B. Core Material: Conform to the following for fluid and temperature range:

2. Air and Water, minus 30 deg to 275 deg F (minus 35 to 136 deg C): EPDM.

C. Test Kit: Provide test kit consisting of 1 pressure gage, gage adapter with probe, 2 bimetal dial thermometers, and carrying case.

D. Ranges of pressure gage and thermometers shall be approximately 2 times systems operating conditions.

PART 3 - EXECUTION

3.1 THERMOMETERS INSTALLATION

A. Install thermometers in vertical and tilted positions to allow reading by observer standing on floor.

B. Install in the following locations and elsewhere as indicated:

1. At inlet and outlet of each hydronic zone.
2. At inlet and outlet of each hydronic boiler and chiller.
3. At inlet and outlet piping of each storage tank.

C. Remote-Reading Dial Thermometers: Install in control panels, with tubing connecting panel and thermometer bulb supported to prevent kinks. Use minimum tubing length.

D. Thermometer Wells: Install in piping tee where thermometers are indicated, in vertical position. Fill well with oil or graphite and secure cap.

3.2 INSTALLATION OF PRESSURE GAGES

A. Install pressure gages in piping tee with pressure gage valve, located on pipe at most readable position.

B. Install in the following locations, and elsewhere as indicated:
   1. At suction and discharge of each pump.
   2. At discharge of each pressure-reducing valve.
   3. At building water service entrance.

C. Pressure Gage Needle Valves: Install in piping tee with snubber. Install syphon in lieu of snubber for steam pressure gages.

3.3 INSTALLATION OF TEST PLUGS

Test Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

3.4 INSTALLATION OF FLOW-MEASURING ELEMENTS AND METERS

A. General: Install flow meters for piping systems located in accessible locations at most readable position.

B. Locations: Install flow measuring elements and meters in the following locations and elsewhere as indicated.
   1. At discharge of each pump.
   2. At inlet of each hydronic coil.

C. Differential-Pressure-Type Flow Elements: Install minimum straight lengths of pipe upstream and downstream from element as prescribed by the manufacturer's installation instructions.

D. Install wafer orifice-type element between 2 Class 125 pipe flanges, ANSI B16.1 (cast iron) or ANSI B16.24 (bronze).

E. Install connections for attachment to portable flow meters in a readily accessible location.

F. Meters For Use With Flow Elements: Install meters on wall or bracket in accessible location.

G. Install connections, tubing, and accessories between flow elements and meters as prescribed by the manufacturer's installation instructions.

H. Window Flow Meters: Install in vertical upward position with impact tube mounted in bushing centered on pipe with 10 pipe diameters upstream and 5 pipe diameters downstream of straight unrestricted piping for 1-1/4 inches and smaller, 20 pipe diameters upstream and 10
pipe diameters downstream for 1-1/2 inches and larger. Calibrate meter after installation in accordance with manufacturer's installation instructions.

I. BTU Meters: Install in piping where indicated in hydronic supply line. Install thermal well in return line for remote sensor. Mount meter on wall if accessible; if not, provide bracket to support meter.

3.5 ADJUSTING AND CLEANING

A. Adjusting: Adjust faces of meters and gages to proper angle for best visibility.

B. Cleaning: Clean windows of meters and gages and factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touch-up paint.

3.6 CONNECTIONS

Piping installation requirements are specified in other sections of Division 15. The drawings indicate the general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

1. Install meters and gages piping adjacent to machine to allow servicing and maintaining of machine.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Provide marking and identification required on all mechanical piping systems, ducts, controls, valves, apparatus, etc., as specified in this Section or any related Sections.

1.2 SUBMITTALS

A. Submit in accordance with Division 01 and Section 15010.

B. Submit samples of materials.

1.3 QUALITY ASSURANCE

A. Comply with provisions of Section 15010.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: All piping systems, controls, valves, apparatus, etc., except those that are installed in inaccessible locations in partitions, walls, and floors, and those buried underground, shall be permanently identified.

2.2 VALVES

A. Carefully prepare chart or diagram for each piping system, indicating thereon by identifying letter or number each valve in the system, its location, and function.

B. Mount charts in aluminum frame with clear glass front and secure on wall where designated by the City Engineer.

C. Bind copies of each chart in Operating Instructions Manual.

D. Provide each valve with brass, aluminum or plastic disc, not less than 1-1/4” diameter bearing engraved numbers corresponding to those indicated on chart. Fasten discs to valve with No. 14 brass wire.

E. Provide an additional tag for all safety valves and other valves that could be hazardous to safety and health of occupants. Distinguish these tags from regular valve tags by color (such as yellow with black letters, and marked "Danger") submit sample tag to the City Engineer.

2.3 INSTRUMENTS AND CONTROLS

A. Identify all panel-mounted instruments and controls with engraved bakelite nameplates permanently affixed to Panel boards.

B. Identify all alarm indicating devices and alarm reset devices by nameplates.
C. Identify all damper motors and automatic valves, flow switches, pressure switches, etc., with embossed aluminum or plastic tape affixed to controller, indicating service and setting.

2.4 EQUIPMENT

A. Identify each major piece of equipment with stenciled designation corresponding to its designation on the Contract Drawings.

2.5 PIPELINES IDENTIFICATION

A. Identify all pipes by means of colored labels with directional arrows as indicated in schedule.

B. Materials: Waterproof plastic cloth, all-temperature, self-adhering, or markers similar to Western "Tel-A-Pipe", Type I, or equal by W.H. Bradley Co.

C. Size: For pipes up to 3" diameter, 2-1/4" x 9" minimum, with 1/2" letters; for pipes over 3" diameter, 2-1/4" x 9" minimum, with 1-1/2" letters.

D. Colors:
   1. Backgrounds: As indicated in schedule.
   2. Letters: White on red background; black on all other backgrounds.

E. Locations:
   1. On all accessible piping, whether insulated or not (including mechanical rooms, attic and ceiling spaces); except that labels shall be omitted from piping where use is obvious due to its connection to fixtures (such as faucets, water closets, etc.).
   2. Near each valve and branch connection in such accessible piping.
   3. At each pipe passage through wall or floor.
   4. At not more than 40'-0" spacing on straight pipe run between bands required in 2 and 3 above.
   5. At each change in direction.

F. Application: Apply on clean surfaces free of dust, grease, oil or any material that will prevent proper adhesion. Replace all non-adhering or curling labels with new labels, as approved by the City Engineer.
   1. Use spray adhesive on insulated pipes in addition to adhesive on marker.
   2. Finish all exposed markers with one coat of lacquer.

G. Schedule:

<table>
<thead>
<tr>
<th>Content of Pipe</th>
<th>Legend</th>
<th>Color</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Domestic cold water</td>
<td>Dom. c.w.</td>
<td>G</td>
<td>*</td>
</tr>
<tr>
<td>Domestic hot-water</td>
<td>Dom h.w.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
140 F     140F     Y     *
Sanitary waste     San waste     G     *
Motor Oil     MO     Y     *
Gear Oil     GO     Y     *
Chassis Grease     CG     Y     *
Automatic Transmission Fluid     ATF     Y     *
Sanitary vent     San vent     G     *
Storm drain or downspout     Storm drain     G     *
Indirect drain     Ind drain     G (1)     *
Sump pump discharge     Pump discharge     G     *
Fire sprinkler supply     Sprinkler supply     R     *
Fire sprinkler drain     Sprinkler drain     R     *
Hot water supply     Hot water supply     G     *
Hot water return     Hot water Return     G     *
Industrial Cold Water     ICW     G     *
Anti Freeze     Anti F     G     *

H. Notes on Schedule:

1. Symbol * indicates flow arrow required.
2. Symbol (1) indicates 2-1/4" x 1" yellow label with 1/2" letters reading UNSAFE WATER at one end of primary label.
3. Hyphen between words indicates 2 separate stock labels are required, although a single special label with all lettering is equally acceptable.
4. Background colors: Symbol Y indicates yellow background color. Symbol G indicates green background color. Symbol R indicates red background color.

2.6 UNDERGROUND PIPE MARKERS

A. Pipe markers shall be furnished to grade at each horizontal change in direction for all non-metallic underground pipe. Markers shall be concrete plaque inscribed with the appropriate word “gas”, “water”, “sewer”, “air”, etc. Cleanouts to grade may serve as direction markers for waste lines. An electrically continuous #14 plastic covered copper tracer wire, Type TW, shall be run in trench along pipe. Wire shall be fastened to pipe at not greater than 20'-0"
intervals. Wire shall terminate above ground with a 12" lead taped around each riser. Straight line transitions of metallic to non-metallic pipe shall have lead brought to grade under a marker.

B. Tracer wires for non-metallic pipe shall be color-coded as follows:

1. Gas/gasoline/motor oil/ tank vent       Yellow
2. Domestic Water:                      Blue
3. Fire Sprinkler:                       Red

2.7 IDENTIFICATION OF AIR CONDITIONING EQUIPMENT

Identify location of air conditioning equipment above Tee Bar Ceilings. Install 3/4" to 1" diameter colored self adhesive dots to Tee Bar Ceiling grid showing access. Please note that the following identification shall be included on as built control drawings.

A Fire Damper                      Red
B Manual Volume Dampers            Blue
   1. Supply Air                    Full Dot
   2. Return Air                    Half Dot.
C Fan coil unit                    Green
D Filter Location if separate from fan coil    Yellow

PART 3 - EXECUTION

3.1 INSTALLATION

A. Report any conditions detrimental to proper and timely completion of work. Apply markers and identification tags as specified using approved materials and installation procedures recommended by manufacturer.
PART 1 – GENERAL

1.1 SCOPE

A. All general conditions and supplementary general conditions apply to the work of this section. Provide and perform the vibration isolation work as indicated, specified, and required.

1. Work Included in this Section.
   a. All seismic restraints.
   b. All vibration isolators.
   c. All vibration isolation frames and brackets.
   d. Flexible pipe connections and couplings.
   e. All leveling valves and supplementary piping for air spring isolators.

2. Related Work Not Included in this Section.
   a. Flexible electrical connections to all motors.
   b. Pipe clamps and hanger rods.
   c. Canvas connections.

1.2 GENERAL REQUIREMENTS

A. Submittal.
   Refer to general conditions for requirements pertaining to submittals, including preparation and transmittals. The submittal shall contain the following information:
   1. Catalog cuts and data sheets on specific vibration isolators to be utilized, showing compliance with the specification.
   2. An itemized list showing the items of equipment, piping, etc., to be isolated, the isolator type and model number selected, isolator loading and deflection including isolator free height and deflected height, and reference to specific drawing showing frame construction where applicable. For steel spring isolators include solid height and diameter of spring coil.
   3. Drawings showing equipment frame construction for each item of equipment, including dimensions, structural member sizes, support point locations, etc.
   4. Written approval of the frame design to be used, obtained from the manufacturer.
   5. Drawings showing methods for suspension, support, guides, etc., for piping and ductwork, etc.

B. Drawings showing methods for isolation of pipes, etc., piercing walls, slabs, beams, etc.

C. Seismic restraint requirements including:
   1. Seismic restraints.
   2. Seismic restraint calculations.
   3. Number and location of seismic restraints for each piece of equipment.
   4. Specific details for restraints including anchor bolts for mounting and maximum loading at each location.
   5. Provide signature of a licensed engineer for all calculations on the seismic snubbers.

D. Coordination.
   The contractor shall coordinate his work with other trades to avoid rigid contact with the building. He shall inform other trades following his work, such as plastering or electrical, to avoid any contact which would reduce the vibration isolation.
E. Conflicts and Discrepancies.
1. The contractor shall bring to the architect's attention prior to installation any conflicts with other trades which will result in unavoidable contact to the equipment, piping, etc., described herein, due to inadequate space, etc. Corrective work necessitated by conflicts after installation shall be at the responsible contractor's expense.
2. The contractor shall bring to the architect's attention any discrepancies between the specifications and field conditions, changes required due to specific equipment selection, etc., prior to installation. Corrective work necessitated by discrepancies after installation shall be at the contractor's expense.

F. Inspection and Instruction
1. The contractor shall obtain inspection and approval from the architect of any installation to be covered or enclosed prior to such closure.
2. The contractor shall notify the architect prior to the general installation of vibration isolation devices so that the vibration isolator manufacturer can instruct and demonstrate the technique of proper installation with the contractor's foremen.
3. The contractor shall obtain written and/or oral instructions from the vibration isolation manufacturer as to the proper installation and adjustment of vibration isolation devices and seismic restraints.

1.3 ISOLATOR CONFIGURATION FOR FLOOR MOUNTED OR SUSPENDED EQUIPMENT
A. Provide a maximum of four vibration isolators located at the corners of the equipment unless approval is obtained for additional isolators.
B. Where feasible, provide three isolators.

1.4 SEISMIC RESTRAINT REQUIREMENTS
A. Seismic restraint shall be in accordance with all relevant State and Local code requirements.
B. Restrain all equipment, piping and ductwork to resist a lateral force loading of not less than 0.5 G.

1.5 RESPONSIBILITY OF MANUFACTURER
A. Vibration isolation manufacturer shall have the following responsibilities:
1. Determine vibration isolation sizes and locations.
2. Provide piping and equipment isolation system as scheduled or specified.
4. Provide installation instructions and drawings.
5. Provide calculations by a licensed engineer substantiating seismic restraint capability to safely accept external forces of 0.5 G without failure and maintain equipment in captive position. Snubber shall be capable of withstanding 2.0 G load without any obvious deformation.
6. Provide approved resilient restraining devices as required to limit equipment and piping motion in excess of 3/8 inch.
7. Provide signature of a licensed engineer for all calculations on the seismic snubbers.
8. Provide final inspection report in accordance with submittal requirements of seismic restraints and vibration isolation.
PART 2 – PRODUCTS

2.1 VIBRATION ISOLATORS

A. General Properties

1. All vibration isolators shall have either known undeflected heights or other markings so that, after adjustment, when carrying their load, the deflection under load can be verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.

2. All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer and must be linear over a deflection range 50% above the design deflection.

3. The ratio of lateral to vertical stiffness shall not be less than 1.0 or greater than 2.0.

4. The vertical natural frequency for each support point, based upon the load per isolator and isolator stiffness, shall not differ by more than + or - 10%.

5. Wave motion through the isolator shall be reduced to the following extent: isolation above the resonant frequency shall follow the theoretical prediction based upon an undamped single degree of freedom system, with a minimum isolation of 50 decibels above 150 cycles per second.

6. All neoprene mountings shall have a shore hardness of 50 to 60 after minimum aging of 20 days or corresponding oven aging.

7. All vibration isolation equipment including but not limited to isolators, mountings, brackets, frames etc. that are exposed to moisture or an outdoor environment shall be coated as follows:
   a. All steel parts to be hot-dipped galvanized.
   b. All bolts to be cadmium plated.
   c. All springs to be cadmium plated and neoprene coated.

B. Isolator Type and Description

1. Type PN is a molded neoprene pad. The area of pad shall be chosen to match the load in order to achieve the required static deflection.

2. Type HN is a suspension hanger with a steel box frame and a molded neoprene in shear element. A neoprene grommet shall be provided at the location where the hanger rod passes through the hanger box so that no metal-to-metal contact occurs.

3. Type HMS is a single spring vibration isolator built into a welded steel mount assembly designed and engineered to limit movement of supported equipment during an earthquake without degrading the vibration isolation of the spring during normal equipment operating conditions. The spring type isolator shall be laterally stable without any housing. Spring diameters shall be no less than 0.8 of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. The mounts shall incorporate a welded steel angle and plate motion limit assembly and steel spring isolator, engineered as a system to accept a force in any direction equal to a minimum of 1.3 times the rated load capacity of the spring isolator without the yield or failure and shall limit movement of the point of level bolt connection to supported equipment to 0.75" in any direction, relative to any fixed point on the mount assembly, while subjected to the minimum force specified. The motion limit assembly shall be welded to a steel base plate having a 1/4" thick ribbed neoprene noise stop pad and drilled holes for bolting to supporting structures. A spring isolator drilled and taped load plate and leveling bolt assembly shall be positioned by weld studs on the base plate, and shall carry all normal equipment operating loads.

4. Type HMN is a neoprene isolator incorporating a steel housing capable of resisting a seismic load of 1.0 G in all directions. The mount shall consist of a captive steel insert embedded into a neoprene element which is enclosed by a steel housing which also includes floor mounting holes. The isolator shall have a rated deflection of 0.15 inches compression, 0.12 inches in tension and 0.09 inches in shear.
5. Type CMS- is a prefabricated spring isolation curb for rooftop equipment. The lower member shall consist of a rectangular steel tube containing adjustable and removable steel springs that support the upper floating section. The upper frame must provide continuous support for the equipment and must be captive so as to resiliently resist wind and seismic forces. All-directional neoprene snubber bushings shall be a minimum of 1/4 inch thick. Steel springs shall rest on 1/4 inch neoprene acoustical pads and be available with either 1 inch, 2 inch, or 3 inch static deflection. Hardware must be cadmium plated or galvanized and the springs plated or provided with an approved rust-resistant finish. Weatherproofing shall be provided by a continuous flexible aluminum seal joined at the corners by a flexible frictionless neoprene bellows. The aluminum seal must be nailed over and provide counterflashing to the curb’s waterproofing. Provision shall be made for access ports with waterproof covers at the spring location and 2 inch thermal insulation on the sides of the lower curb.

6. Type HS is a suspension hanger with a steel box frame and a steel spring resting on a neoprene cup. The cup shall contain a steel washer designed to distribute the load evenly to the neoprene and prevent its overload or extrusion. The spring diameter and hanger box lower hole size shall be large enough to permit the hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring. A neoprene grommet shall be provided at the location where the hanger rod passes through the hanger box so that no metal-to-metal contact occurs. Hangers shall be provided with an eye bolt, eye socket or hanger rod on the spring end as required.

7. Type MSL is a bare, stable, steel spring with a ribbed neoprene pad under the base plate. Bolt holes shall be provided in the baseplate to permit attachment to the building structure. Limit stops shall be provided to prohibit spring extension if the load is removed. These stops may also serve as rigid blocking during erection so that the installed and operating heights shall be the same. Clearance shall be maintained around restraining bolts and between the limit stops and the housing so as not to interfere with the spring action.

8. Type SF - Flexible Pipe Connectors: Flexible neoprene pipe connectors shall be used at pump connections as shown on the drawings. They shall be manufactured of multiple plies of nylon tire cord fabric and neoprene both molded and cured in hydraulic rubber presses. No steel wire or rings shall be used as pressure reinforcement. Straight connectors shall have two spheres. Neoprene elbows shall be manufactured with a single sphere forming the corner of the joint itself. Connectors up to and including 2 inch diameter may have threaded ends. Connectors 2-1/2 inches and larger shall be manufactured with floating steel flanges recessed to lock the connector’s raised face neoprene flanges. All connectors shall be rated a minimum of 150 psi at 220 degrees F. All straight through connections shall be made with either flanged or screwed twin spheres properly pre-extended as recommended by the manufacturer to prevent additional elongation under pressure. Connectors shall be provided with control units, in accordance with the manufacturer’s recommendations, to limit expansion.

C. Isolator MANUFACTURER’S COMPARISON

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Amber Booth</th>
<th>Mason Industries</th>
<th>Sausse Vibrex</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMS</td>
<td>Curb Mount Type</td>
<td>2</td>
<td>RSC</td>
<td></td>
</tr>
<tr>
<td>PN</td>
<td>Neoprene Mount</td>
<td>NR</td>
<td>W</td>
<td>R</td>
</tr>
<tr>
<td>HMN</td>
<td>Housed Neoprene Mount</td>
<td>BRD</td>
<td>HNM</td>
<td></td>
</tr>
<tr>
<td>HMS</td>
<td>Housed Spring Mount</td>
<td>SWPQ</td>
<td>SSLFH</td>
<td>RMSP</td>
</tr>
<tr>
<td>HN</td>
<td>Neoprene Hanger</td>
<td>BR</td>
<td>HD</td>
<td>FUP-EQ</td>
</tr>
<tr>
<td>MSL</td>
<td>Spring Mount with Limit Stop</td>
<td>CT</td>
<td>SLR</td>
<td>RMLS</td>
</tr>
<tr>
<td>HS</td>
<td>Spring Hanger</td>
<td>BSS</td>
<td>W30</td>
<td>RMX</td>
</tr>
<tr>
<td>SF</td>
<td>Flex Connector</td>
<td></td>
<td>MFTNC</td>
<td>CFLEX</td>
</tr>
</tbody>
</table>
D. Seismic Pipe Joints and Seismic Loop
   1. For seismic expansion loop, see details on plumbing drawings.

2.2 SEISMIC RESTRAINTS

A. Type II, Vibration Isolated Equipment:
   1. Mount all vibration isolated equipment on rigid steel frames as described in the vibration
      control specifications unless the equipment manufacturer certifies direct attachment
      capability.
   2. Each vibration isolated frame shall have a minimum of four all directional seismic snubbers
      that are double acting and located as close to the vibration isolators as possible to facilitate
      attachment to the base and the structure.
   3. The snubber shall consist of interlocking steel members restrained by snubbing material
      made of bridge bearing neoprene.
   4. The snubbers shall contain an elastomeric one-piece bushing that is replaceable and a
      minimum of 1/4 inch thick. Snubbers shall be manufactured with an air gap between hard
      and resilient material of not less than 1/8 inch or more than 1/4 inch. Shim snubbers will be
      supplied as required to maintain clearances.
   5. The snubber end cap shall be removable for inspection of snubber internal clearances.
   6. The neoprene bushing shall be capable of rotation to verify that no short circuiting of the
      vibration isolator exists.

B. Type III, Seismic Restraint of Vibration Isolated Suspended Piping:
   1. Use a slack cable system of a minimum of 1/4 inch of steel at a minimum of 40 feet on
      center.
   2. The cable size and attachment to the pipe and structure shall be designed and signed by a
      licensed engineer in the State of California.
   3. Submittal drawing shall indicate proposed method of vertical restraint. Cable shall be
      installed with sufficient slack to avoid short circuiting the vibration isolation.

C. Type V, Suspended Vibration Isolated Equipment:
   1. Utilize a slack cable restraint system.
   2. The cable size and attachment shall be designed and signed by an engineer licensed in the
      State of California.
   3. Submittal drawing shall indicate proposed method of vertical restraint.
   4. Cables shall be installed with sufficient slack to avoid short circuiting the vibration isolation.

2.3 SEISMIC COMPENSATOR PIPE ASSEMBLY

A. See detail on drawings.

PART 3 – EXECUTION

3.1 INSTALLATION OF VIBRATION ISOLATION DEVICES

A. General
   1. Transmission of perceptible vibration or structure borne noise to occupied area by equipment
      installed under this Contract will not be permitted.
   2. All vibration isolation devices, including auxiliary steel bases and pouring forms, shall be
      designed and furnished by a single manufacturer, or supplier, who will be responsible for
      adequate coordination of all phases of this work.
   3. The vibration isolation manufacturer, or his representative, shall be responsible for providing
      such supervision as may be necessary to assure correct installation and adjustment of the
isolators. Upon completion of the installation and after the system is put into operation, the manufacturer, or his representative, shall make a final inspection and submit his report to the Architect in writing, certifying the correctness of installation and compliance with approved submittal data.

4. The contractor shall not install any equipment or pipe which makes rigid contact with the "building" unless it is approved in this specification or by the architect. "Building" includes slabs, beams, studs, walls, lathe, etc.

5. The contractor shall provide access doors for all vibration isolators and snubbers if located above inaccessible ceilings or in shafts.

B. Equipment Isolator Installation

1. The equipment to be isolated shall be supported by a structural steel frame or by brackets attached directly to the machine where no frame is required.

2. Brackets shall be provided to accommodate the isolator and provide a mechanical stop as shown on the drawings. The vertical position and size of the bracket shall be specified by the isolator manufacturer.

3. The operating clearance between the bracket and the pad or floor shall be 3/8" ± 1/16". The minimum operating clearance between the frame and the pad or floor shall be 1".

4. The frame shall be placed in position and the brackets supported temporarily by 3/8" shims prior to the installation of the machine or isolators.

5. After the entire system installation is completed and under full operational load, the isolator shall be adjusted so that the load is transferred from the shims to the isolator. When all isolators are properly adjusted, the shims will be barely free and shall be removed. Thereafter, the shims shall be used as a gauge to check that the 3/8" clearance is maintained so that the system will remain free of stress.

3.2 INSTALLATION OF SEISMIC RESTRAINTS

A. All seismic restraints must be installed and adjusted so that the equipment and piping vibration isolation is not degraded by utilization of the restraints. Anchor all seismic restraints in place with equipment in operation for proper operating clearances.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Insulation shall be furnished and installed under this Section and meet minimum legal requirements of the Building Energy Efficiency Standards adopted and incorporated in the California Energy Commission, Title 24, Part 2, Chapters 2 through 53, unless otherwise noted, for following piping, ductwork, and equipment:

1. Condensate drain piping from air conditioning equipment.
2. High and low temperature equipment.
3. Hot water heating supply and return piping.
4. Refrigerant piping.
5. Supply and return heating and cooling systems air ducts.
6. Plumbing piping and equipment including hot and tempered domestic water supply and return piping.

1.2 SUBMITTALS

A. Submit in accordance with Division 01: Submittals.

1. Complete list of all items to be furnished and installed under this Section.


3. Shop drawings, catalog cuts and manufacturer's data showing insulation, jacketing, adhesives, and coating. Insulating materials shall be certified by manufacturer to comply with the California Quality standards for insulating material.

4. Display sample cutaway sections.

5. Manufacturer's recommended method of installation procedures, which will become part of this Section of Specifications.

1.3 QUALITY ASSURANCE

A. Manufacturer's and Installer's Qualifications: Comply with provisions stated under Section 15010 and 15500.

B. Insulation work shall be in accordance with the State of California Building Energy Efficiency Standards, CCR, Title 24, Part 2; and Uniform Mechanical Code.

C. Test Ratings:
1. Comply with ASTM E84, NFPA 255, or UL 723. ASTM C167, ASTM C302, Underwriters' Laboratories, Inc. label or listing of satisfactory test results from the National Bureau of Standards, or a satisfactory certified test report from an acceptable testing laboratory. Approval by the State Fire Marshal is required.

2. Ensure that labels (legibly printed with the name of the manufacturer) or listings indicate that fire hazard ratings do not exceed those specified for materials proposed for use. Flame spread not more than 25 and smoke developed not exceeding 50.

3. Test each item individually, when insulation, vapor barrier covering, wrapping materials, or adhesives are applied separately in the field.

4. Test insulation, vapor barrier covering, wrapping materials and adhesives as an assembly when they are factory composite systems.

1.4 PRODUCT HANDLING

A. Protection, Replacement, Delivery and Storage: Comply with provisions stated under Sections 15010.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. Insulating material shall be fire resistant, non-corrosive, shall not break, settle, sag, pack or disintegrate under vibration, nor absorb more than 1% moisture by weight.

2. Insulating material shall have thickness indicated in Table 1, and shall have thermal resistance in the range of \( R = 4.0 \) to \( 4.6 \) per inch at \( 75^\circ \text{F} \). For any other value of \( R \), insulation thickness shall be calculated accordingly and submitted for approval.

3. Asbestos in any quantity in insulating material shall not be permitted.

4. Provide insulation materials, adhesives, coatings, sealants, fitting covers, and other accessories with a fire hazard rating not to exceed 25 for flame spread, 25 for fuel contributed and 50 for smoke developed, except for materials listed as follows:

   a. Nylon anchors for securing insulation to ducts or equipment.

5. Flameproofing treatments subject to moisture damage are not acceptable.
### TABLE 1
MINIMUM PIPING INSULATION THICKNESS (1)

<table>
<thead>
<tr>
<th>PIPING SYSTEM TYPE</th>
<th>NOMINAL PIPE DIAMETER (INCHES)</th>
<th>FLUID TEMPERATURE RANGE °F</th>
<th>Insulation Thickness Required (in inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Space Heating Systems (Hot Water)</td>
</tr>
<tr>
<td>Domestic Hot Water</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Up to 160</td>
<td>0.5</td>
<td>1.0</td>
<td>1.5</td>
</tr>
<tr>
<td>Service Water Heating Systems (recirculating, all piping supply and return)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hot Water</td>
<td>Up to 200</td>
<td>0.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Space Cooling Systems (Refrigerant)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refrigerant</td>
<td>40-60</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Below 40</td>
<td>1.0</td>
<td>1.0</td>
<td>1.5</td>
</tr>
<tr>
<td>Condensate Drain</td>
<td>1/2” Minimum insulation thickness.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>From A/C Equipment</td>
<td>Insulate all condensate drain lines within building, in room and in ceilings.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**NOTES:**

1. For piping exposed to ambient temperatures, increase thickness by 0.5”.
2. Runouts to individual terminal units (not exceeding 12’-0” in length).

**B. Lagging Adhesives:** All insulation finished with canvas shall have their laps adhered with Childers "Chil-Seal" CP50A/AHV2 or Foster's "Sealfas" 30-36, or approved equal. A finish coat of CP50A or 30-36 shall be applied to entire outer surface of lagging cloth at coverage specified by manufacturer.

**C. Canvas Jackets:** Shall be 6 oz. per square foot minimum, 48 x 48 thread count canvas jacketing.

**D. Insulation Jackets:**

1. All exterior insulation exposed to weather shall be weatherproofed with Childers aluminum jacketing or equal. Jacketing is to be manufactured from 1100, 3105 or 5010 aluminum alloy with 3/16” corrugations. Smooth or embossed jackets may be approved in special situations to match an existing installation. All jacketing shall have an integrally bonded moisture barrier over entire surface in contact with insulation. A minimum thickness of 0.016 aluminum jacketing is to be used on ducts and piping. A minimum thickness of 0.020 is to be used on tanks, equipment and heat exchangers.
2. All 90 and 45 degree insulated elbows having a nominal iron pipe size of 1/2" to 8" shall be protected with Childers aluminum Ell-Jacs insulation covers, or approved equal, manufactured from 1100 aluminum alloy of 0.024" thickness. Insulated elbows having a nominal pipe size of 10" thru 18" shall be protected by Childers 4-piece aluminum Ell-Jacs.

3. All Tees, Flanges, and Valve Insulation in Conjunction with Aluminum Jacketing: Use Childers Aluminum Special Fabrications Insulation Covers as manufactured by Childers Products Company.

E. Adhesives: Adhesives shall be acceptable to the State Fire Marshal. Name, type and method of application shall be submitted for approval. Acceptable products are stated under each category of insulation work in following Paragraphs:

1. Duct Liner Edge Sealing - (Adhesive exposed to air stream): Childers "Chil-Spray NF" CP-89 or 3M "Fastbond" 38-NF for spray applications. For brush applications use Childers "Chil-Stix" CP-82 or Foster's "Spark-Fas" 85-20.

2. Duct Joint Sealing:
   a. Childers "Chil-Seal" CP50A/50AHVZ
   b. Foster's "Sealfas" 30-36
   c. Borden "Arabol" 60-89-05 with canvas tape, minimum 2" width.

3. Duct Joint Calking:
   a. Childers "Veloseal" CP-72
   b. 3M 321.

4. Valve and Fitting Cover: When applied in conjunction with PVC jacketing, use Zeston 25/50 rated polyvinyl chloride fitting covers as manufactured by Manville.

2.2 SPACE HEATING PIPING SYSTEM AND DOMESTIC HOT WATER PIPING SYSTEM INSULATION

A. General: Insulate condensate, hot water space heating supply and return, domestic hot water supply and return piping, including valves, strainers and fittings with insulation thickness as indicated on Table 1.

B. Materials:

1. Classes of Insulation:
   a. Class C: Flexible open-cell melamine (foam insulation) suitable for service temperature -320° F. to 400° F. Thermal conductivity at 75° F. K=.26. Pipe insulation, one piece pre-formed, laminated to heavy non-reinforced PVC jacket, with locking trac, factory applied to jacket, to snap insulation and jacket onto pipe. Similar or equal to Thermazip insulating or Techlite Melamine Form Insulation System as manufactured by Accessible Products Co. Installation to conform to manufacturers recommendations.
   b. Class D: Mineral fiber pipe insulation suitable for service temperatures up to 1200° F. Pipe insulation shall be one-piece preformed up to 3"
thickness and have a minimum R factor of 4.0 at 75° F. mean temperature. Insulation shall be faced with all-purpose fire-retardant vapor barrier jacket. Pipe insulation shall be 8 pounds per cubic foot density by Industrial Insulation of Texas, Inc. "Delta Snap Wrap", Bradford Enercon "Enerok", "Lapinus 1200", or approved equal.

2. **Locations and Class of Insulation Required:**

<table>
<thead>
<tr>
<th>LOCATION</th>
<th>CLASS OF INSULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boiler and Mechanical Equipment Room</td>
<td>C or D</td>
</tr>
<tr>
<td>All Other Locations</td>
<td>C or D</td>
</tr>
</tbody>
</table>

3. Fittings on indoor piping shall be covered with flush, hand-wrapped Class C or D insulation, to match the adjoining pipe insulation and covered with polyvinyl chloride fitting covers: Zeston 2000 25/50 by Manville.

4. **Adhesive:** Childers "Fibrous Adhesive" CP97, or equal, to bond calcium silicate to itself and non-porous surfaces.

### 2.3 COOLING PIPING SYSTEM INSULATION

#### A. General: Insulate refrigerant piping.

#### B. Materials:

1. **Classes of Insulation:**

   a. **Class D:** Foamed plastic pipe insulation, self-extinguishing type, ASTM C534 Type 1 - tubular. Pipe insulation shall be one-piece preformed, flexible tubing type and have a minimum K factor of 0.28 at 75° F. mean temperature. Pipe insulation shall be Manville "Rubatex", Armstrong "Armaflex II" or approved equal.

   b. **Class E:** Mineral fiber pipe insulation ASTM C547. Pipe insulation shall be one piece preformed up to 3" thickness and have a minimum R factor of 4 at 75° F. mean temperature. Insulation shall be faced with all-purpose fire-retardant vapor barrier jacket. Pipe insulation shall be Industrial Insulation of Texas, Inc. "Delta Snap Wrap", Bradford Enercon "Enerok", "Lapinus 1200", or approved equal.

2. **Locations and Class of Insulation Required:**

<table>
<thead>
<tr>
<th>SERVICE</th>
<th>LOCATION</th>
<th>CLASS OF INSULATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Condensate drains from air conditioning equipment</td>
<td>Indoors at ceilings and in rooms</td>
<td>D</td>
</tr>
<tr>
<td>Refrigerant suction. Liquid line as required</td>
<td>All locations except underground</td>
<td>D</td>
</tr>
</tbody>
</table>
3. **Thickness**: See Table 1, this Section.

4. **Adhesives**:
   a. **Polystyrene adhesives**: Childers "Chil-Rene" CP-96 or King Adhesive Co. 15-165.
   b. **Vapor barrier laps and penetrations**: Use Childers "Chil-Perm NF" CP-32 or Epolux 660 on all butt joints of foil-faced vapor barriers, and also where pins and staples puncture facings.

### 2.4 DUCTWORK AND PLENUM INSULATION

A. **General**: Insulate ductwork and plenums with no less than the amount of insulation tabulated in Table 2. Insulation may be omitted on that portion of a duct which is located within a wall- or a floor- ceiling space where:

1. Both sides of the space are exposed to conditioned air.
2. Space is not ventilated.
3. Space not used as a return plenum.
4. Space not exposed to unconditioned air
5. Ceilings, which form plenums, need not be insulated.
### TABLE 2

<table>
<thead>
<tr>
<th>Duct Location</th>
<th>Cooling Only</th>
<th>Heating Only</th>
</tr>
</thead>
<tbody>
<tr>
<td>On roof or exterior of building</td>
<td>F-3 (supply, return, relief &amp; exhaust duct)</td>
<td>F-3 (supply, return, relief &amp; exhaust duct)</td>
</tr>
<tr>
<td>Attics, Garages, and Crawl Spaces</td>
<td>F-2</td>
<td>F-1</td>
</tr>
<tr>
<td>In walls, within floor-ceiling spaces and hot and cold plenums</td>
<td>F-2</td>
<td>F-1</td>
</tr>
<tr>
<td>Within the conditioned space or in basement</td>
<td>None Required</td>
<td>None Required</td>
</tr>
<tr>
<td>Cement slabs or within ground</td>
<td>None Required</td>
<td>None Required</td>
</tr>
</tbody>
</table>

#### B. Insulation Types:

- **F-1**: Provide 1" blanket fiberglass, factory-laminated with all-service jacket vapor barrier. See "MATERIALS" for external insulation below. And, provide 1" duct liner as indicated on drawings.

- **F-2**: Provide 1-1/2" blanket fiberglass factory-laminated with all-service jacket vapor barrier. See "MATERIALS" for external insulation below. And, provide 1" duct liner as indicated on drawings.

- **F-3**: Provide 2" duct liner as indicated.

#### 6. Weatherproof Jacket: 0.016 thick aluminum or stainless steel.

### NOTES:

1. Where ducts are used for both heating and cooling, minimum insulation shall be as required for most restrictive condition.

2. See "Materials" for external insulation and internal lining, this Section, below.

3. Thickness of duct liners is based on Type of mounting.

#### C. Materials:

1. **Fire Resistive Insulation Materials and Coatings**: Submit for approval to the State Fire Marshal.

2. **Adhesives**: See Articles 2.01, Paragraphs F, G and H for applicable products.

3. **External Insulation**: A minimum "R" value of 4.0 to 6.3 at 75° F. (installed) glass fiber blanket, factory-laminated with reinforced foil Kraft (FRK) vapor barrier facing; Manville "Microlite", Owens Corning all-service faced duct wrap, Ultralite # 100, Pittsburgh Plate Glass "Superfine", Silvercote "Silvercel", or equal.
4. Internal Lining: Manville Permacote® Linacoustic® and/or Permacote® Spiracoustic®, Certainteed, or approved equal. Internal lining shall conform to NFPA 90A, shall be UL listed, and meet ASTM G21, 22 Specifications Compliance and State Fire Marshal approved.

a. Noise Regulatory Criteria (NRC)

(1) Duct Lining: Minimum NRC of 0.75 for interior spaces and minimum NRC of 0.90 for exposed to weather.

(2) Hot and Cold Plenums separated by single partition: Minimum NRC of 0.75, both sides.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Except as specified herein, install all material in accordance with recommendations of manufacturer. Do not apply insulation materials until tests specified in other Sections are completed. Remove foreign material such as rust, scale, or dirt. Make sure that surfaces are clean and dry. Keep insulation clean and dry at all times.

B. On cold surfaces where a vapor barrier must be maintained, insulation shall be applied with a continuous, unbroken moisture and vapor seal. All hangers, supports, anchors, or other projections that are secured to cold surfaces shall be insulated and vapor sealed to prevent condensation.

C. All surface finishes shall be extended in such a manner as to protect all raw edges, ends and surfaces of insulation.

D. All pipe or duct insulation shall be continuous through walls, ceiling or floor openings, or sleeves; except where firestop or firesafing materials are required.

E. Metal shields shall be installed between hangers or supports and the piping insulation. Rigid insulation inserts shall be installed between the pipe and the insulation shields. Inserts shall be of equal thickness to adjacent insulation and shall be vapor sealed accordingly.

F. Insulation shall not be installed in following locations (unless otherwise noted):

   1. On unions, flanged connections or valve handles.
   2. Over edges of any manhole, clean-out hole, clean-out plug, access door or opening to a fire damper, so as to restrict opening or identification of access.
   3. Over any label or stamp showing make, approval, rating, inspection, or similar data, unless provision is made for identification and access to label or stamp.

3.2 INSTALLATION OF HEATING PIPING SYSTEM INSULATION

A. General: Space heating hot water, domestic hot water, tempered water supply and return piping and condensate piping, after having been tested, shall be cleaned and insulated.
B. **Application**: Hot water heating supply and return piping, domestic hot water supply and return, including tempered supply and return piping as per manufacturer's instructions and as specified herein.

1. Extend insulation on valve bodies up to valve bonnet. Fill void in saddles, provided under "Hangers and Supports", Section 15050: Basic Mechanical Materials and Methods, with insulation and seal all joints.

2. Apply insulating material to fittings, valves, and strainers and smooth to thickness of adjacent covering. Leave strainer clean-out plugs accessible. Covers fabricated from polyvinyl chloride shall be used.

C. **Insulation Jackets**:

1. **Exposed Indoor Locations**:
   a. Cover completed insulation with canvas jacket tightly pasted to covering with lagging adhesive. Lap jacket seams 1-1/2" minimum. Finish entire jacket with coating of undiluted adhesive.
   b. Equivalent factory applied pre-sized, glass fiber reinforced, or glass fiber jackets may be used. Seal jacket seams with adhesive per manufacturer's instructions.
   c. In addition to above requirements, cover exposed insulated piping within a distance of 8'-0" above floors with #26 gage galvanized steel jacket. Omit jacket in areas accessible only to maintenance personnel, such as mechanical equipment rooms, utility corridors, accessible pipe tunnels and manholes.

2. **Concealed Indoor Locations**: Cover insulation over fittings, valves, and strainers with canvas. Provide pipe insulation with factory or field applied standard jacket of 4 oz. minimum canvas, fiberglass cloth, or glass fiber reinforced jacket. Seal jacket laps with adhesive per manufacturer's instructions.

3. **Exposed Outdoors**: In addition to canvas or fiberglass cloth cover, pipe insulation exposed to weather shall be provided with an additional 0.016" thick aluminum jacket with 2" lap connected with 1" hem overlap joint located on side of pipe and turned down to shed water. Jacket shall be strapped 12" on center with 1/2" wide stainless steel strapping and wing seals. Aluminum jacket shall be mitered to fit fittings.

3.3 **INSTALLATION OF COOLING PIPING SYSTEM INSULATION**

A. **General**: Refrigerant piping and condensate drain lines, after having been tested, shall be cleaned and insulated.

B. **Application**: Insulation on chilled water lines, refrigerant suction lines and liquid lines, if indicated, and air conditioner interior drain lines shall be jacketed with fire-resistant vapor barrier of laminated aluminum foil consisting of 2 plies with glass-yarn reinforcing. All jacket joints shall be lapped and sealed with an approved adhesive. Insulation shall be secured with aluminum bands not less than 0.005" thick by ¾" wide, spaced not over 12" on centers, or as recommended by manufacturer.

1. **Longitudinal Seams**: Butt hinged sections of covering tightly together and seal down jacket flap with adhesive, Childers CP-82, Foster’s 85-20, or approved equal,
or with factory-applied, self-sealing lap with pressure-sensitive sealer protected with release paper.

2. **End Joints**: Wrap joint with a 3-inch wide (minimum) self-sealing tape.

3. **Fittings and Valves**: Fittings and valves shall be covered with same material of same thickness as pipe insulation, sealed with an approved, vapor-sealing tape or compound and covered with Zeston polyvinyl-chloride cover.

4. Pipe hangers shall be insulated or attached to pipe by an insulating insert, butted between adjoining insulation sections.

C. **Additional Jackets**:

1. **Exposed Indoor Insulation**: Cover to 8'-0" above floors, except in mechanical equipment rooms and accessible pipe tunnels with #26-gage galvanized sheet metal jacket.

2. **Exposed Outdoor Insulation**: In addition to canvas or fiberglass cloth cover, provide .016" thick aluminum jacket with 1" wide aluminum bands and seals. Use appropriate jackets on valves and fittings.

3.4 **INSTALLATION OF DUCTWORK AND PLENUM INSULATION**

A. **External Covering**:

1. Before applying duct insulation, sheet metal ducts shall be clean, dry, and tightly sealed at all joints and seams.

2. Duct exterior insulation shall be firmly wrapped around ductwork with all joints lapped a minimum of 2". Insulation shall be securely held in place with #18 gage copper-lined steel wire, or #16 gage soft-annealed galvanized wire spaced approximately 12" on centers and at all loose ends, presenting a neat and workmanlike appearance. Where duct width is such that wiring will not hold insulation firmly against duct, an approved adhesive shall be used to fasten insulation to duct; wiring may then be at ends of insulation segment.

3. Duct insulation in finished rooms shall be covered with wrapped fiberglass cloth cover. Install on each corner of duct #26 gage galvanized steel small nose, wide flange corner bead of appropriate height. In unfinished rooms the insulation shall have a vinyl or similar coating. In all rooms, insulation shall be attached to the ducts with an approved adhesive instead of wire. Corners shall be cut and formed instead of bending the insulating material. Raw edges shall be taped.

4. All insulation on ductwork carrying conditioned air, both supply and return, and outside air intake ducts shall have a factory applied, fire-resistant vapor barrier.

5. **Exposed Ducts or Plenum**:

a. Apply insulation to ducts or plenum using butt joints, without voids and with adhesive over entire surface of duct. Cover insulation with canvas jacket, pasted tightly to insulation with lagging adhesive. Apply 2 finish coats of undiluted adhesive.

b. When applying jacket finished covering shall be even and level, without humps, and constant diameters on round ducts maintained.
c. For non-lined insulated ducts or plenums exposed to weather: Insulation finish shall be 0.016" thick aluminum sheet with joints lapped not less than 3", sealed, and secured with #6 by 3/8" aluminum sheet metal screws, or aluminum handgun-type rivets.

B. Lining:

1. General:
   a. Floors of cold plenums and fan enclosure plenums shall not be insulated.
   b. Cover short damper sections on lined ducts on outside to permit free operation of dampers and linkage.
   c. Dimensions of ducts indicated are net inside dimensions and must include thickness of duct liners to obtain the correct duct size.
   d. Install insulation in square turns, where required, to cover interior surfaces before duct turns are installed.

2. Interior insulation (lining) of ducts shall be as specified in Article 2.06, Paragraph C.4. Lining may only be one of following assemblies:
   a. Factory installed, integral with sheet metal outer duct and interior perforated or non-perforated sheet metal liner, non-metal components not exposed to air stream; United Sheet Metal, Type P-27 or K-27.
   b. Liner material installed during fabrication of duct with sealed face only exposed to air stream. Insulation shall be fastened to sheet metal with an approved fire-retardant adhesive, with minimum 90% coverage and all edges firmly adhered. Mechanical fasteners shall supplement the adhesive on top sections of ducts more than 12" wide and on sides of ducts more than 24" high, and shall be spaced on 16" centers maximum. Fastener posts shall be cut off approximately 1/4" from metal disc.

3. Interior insulation in ducts or plenums shall not have any exposed edges. Edges open to entering or leaving air streams shall be covered, secured in place and sealed with approved duct liner edge sealers.

END OF SECTION
PART 1 – GENERAL

1.1 SUMMARY

A. Work Included: Design, fabricate, install, and secure required approvals for a complete automatic fire protection sprinkler system and combined standpipe system as indicated on the Contract Drawings and in these Specifications. System shall be connected and placed in 100 percent reliable operating conditions. The following list of major items is for the convenience of the Contractor only and does not describe the complete scope of the work to be done.

1. Preparation of Shop Drawings by the Contractor and obtaining required permits and approvals, coordination, etc., starting supply from Detector Check Meter.

2. Piping, inside and outside building, including connections to water service drain connections and piping; valves, hangers, sleeves and accessories required for a complete installation.

3. Alarm check valve and alarm bell.

4. Sprinkler heads.

5. Pressure gauges.

6. Flow transmitter.

7. System control valve, vault and cover.

8. Fire Department connection.


10. Concrete work.

11. Identification and labeling.

12. Tests.

13. Painting.

14. Disinfecting and flushing the system.

15. Approval

16. Tamper Switch

17. Fire Department Outlets

18. Fire Hose Cabinets

B. Service Connection: Make all arrangements with the proper authorities for the sprinkler main service including detector check meter installation vaults and valving. See Civil and Plumbing Drawings for coordination. Contractor will pay all fees and charges. Water for construction to be separately arranged and paid for by Contractor.
C. Openings: Provide as necessary for passage of pipes through walls, floors, partitions and other construction whether indicated on the Contract Drawings or not.

D. Cutting and Repairing:
   1. Cutting: Only as authorized by the City Engineer.
   2. Repairing: By appropriate craft persons to restore construction to a condition approved by the City Engineer.

E. Permits and Inspections:
   1. Permits: As required by Los Angeles City Building and Safety and Fire Department; to be obtained and paid for by the Contractor, including plan check fees, except permits and costs otherwise provided for in these Specifications.
   2. Inspections: Required of all installations prior to concealment and completion of the work; by the Los Angeles City Department of Building and Safety and the City Engineer. A final certificate of approval for the entire sprinkler system required.

F. Related Documents: Documents affecting work of this Section include, but are not necessarily limited to the GENERAL CONDITIONS, SUPPLEMENTARY CONDITIONS and Sections in DIVISION 1 -GENERAL REQUIREMENTS of these Specifications.

G. Related Work
   1. Suggested locations for underground supply lines are indicated on the Contract Drawings.
   2. Concrete Work except thrust blocks in Section 03300.
   3. Finish Painting in Section 09900.
   4. Floor Sinks and Drains in Plumbing, Section 15400.
   5. Supports and Anchors for fire protection.
   6. Electrical Connections to water flow indicators, alarm bells, including wiring and conduit in DIVISION 16.
   8. Basic Mechanical Requirements, Section 15010.
   9. Basic Mechanical Materials & Methods, Section 15050.
   11. Hangers and Supports, Section 15060.

1.2 SYSTEM DESCRIPTION

A. Description of the System: Protect entire police station building and entire maintenance building by complete hydraulically calculated automatic fire sprinkler systems designed for light and/or ordinary hazard coverage and as required per NFPA No. 13 including attic space. Coordinate with Plumbing Drawings for sprinkler service line and riser location. Provide combined standpipe
system in parking garage with fire department outlets & fire hose cabinets (see contract drawings) at each floor and one wet standpipe booster pump on the ground floor (see contract drawings). Provide separate AFS zone for jail area (one each floor).

B. Rules and Regulations: Make the complete installation in compliance with the requirements of the latest rules and regulations of the National Fire Protection Association, the State Fire Marshall's Office and the Los Angeles City Department of Building and Safety. The Drawings and Specifications shall take precedence only when their requirements are greater than that of the National Fire Protection Association.

1.3 SUBMITTALS

A. Product Data: Submit complete brochures giving names of manufacturer’s and catalog figure numbers, trade names, technical data and requested information of each item to be furnished.

B. Shop Drawings: Conform to applicable provisions of SUBMITTALS Section of DIVISION 1 - GENERAL REQUIREMENTS of these Specifications. Submit Hydraulic Calculations.

1. Drawing Preparation: Submit within 45 days after award of Prime Contract, completely prepared Shop Drawings of the combined standpipe system and automatic fire sprinkler system including sprinkler risers, sprinkler heads, hangers and supports, wiring diagrams and alarm system, and piping layouts, coordinated with lighting, plumbing and air conditioning layouts, including a plot plan showing the location of supply connections, control valves, standpipe booster pump, Fire Department connections and related devices, concrete vault detail, and other equipment to be used, for approval to the local authorities having jurisdiction. It shall be understood that there will be no compensation to the Contractor for any changes made necessary to obtain approval from local authorities, with said approval indicated on each set thereof.

2. If any discrepancy between the fire sprinkler plan and actual field condition occur, the Contractor shall make the necessary modifications with the approval of City Engineer. Modification made shall be marked on the record drawings. It shall be understood that there will be no compensation to the Contractor for any changes made necessary to obtain approval from local authorities, with said approval indicated on each set thereof.

3. Coordinate the location of sprinkler heads with the City Engineer and indicate on reflected ceiling plans their relationship to ceiling tiles, lighting fixtures, air-conditioning outlets and structural beams. Alignment of Fire Sprinklers and relationship to ceiling tile locations are subject to approval by the City Engineer.

4. Complete Working Drawings and Specifications of all trades will be furnished or will be available for the design and installation of this system. Carefully check these Drawings and Specifications. This Contractor shall in all cases consider the work of all other trades and shall coordinate his work with that of the ventilation, plumbing and electrical contractors so that the best arrangement of all equipment, piping, conduits, ducts, etc., can be obtained.

5. Call the attention of the City Engineer to any points of conflict between his work and that of the other trades, so that the conflict may be properly adjusted. Remove and reinstall any installed work which interferes with the work of other trades at this Contractor's expense when so directed by the City Engineer or his authorized representative. It shall be understood that no extras to the Contract will be permitted to accomplish the above results.

6. Original Transparency: Provide the City Engineer with original transparencies (mylar) obtained by photocopy processing of "Record Drawings" specified herein.
7. Verify dimensions on the Drawings with field conditions. Inspect related work and adjacent surfaces. Report in writing to the City Engineer all inaccuracies and all conditions which prevent proper execution of this work.

8. Include construction details of pipe supports, sway bracing, anchors, inserts, trapeze hangers, equipment supports, and restraints with seismic calculations sized by a California Licensed Structural Engineer.

C. Certification: Submit one copy of California approved seismic bracing details.

D. Certificates of Approval: Upon completion of work of this Section, furnish the City Engineer with a certificate of approval from all legally constituted authorities having jurisdiction or in lieu thereof, a certified copy of same.

E. Record Drawings: Provide accurate dimension locations, including depths of piping, valves, and all equipment as installed, in strict accordance with applicable GENERAL CONDITIONS of these Specifications.

1.4 QUALITY ASSURANCE

A. Qualification of Contractor: The Contractor for the design and the installation of the automatic fire sprinkler system shall be duly licensed and regularly engaged in the installation of automatic sprinkler equipment as listed by Underwriters' Laboratories, Inc., or other nationally recognized testing laboratories.

B. Laborers: Use adequate numbers of skilled laborers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this Section.

C. Codes and Regulations: In addition to complying with the requirements specified in these Specifications, the Contractor shall perform all fire sprinkler work in accordance with the following Codes and Standards:

1. NFPA National Fire Protection Association (Standard 13, 14, 24, 70, 72 and 101)
2. AWWA American Water Works Association
3. UPC Uniform Plumbing Code
4. UFC Uniform Fire Code
5. UL Underwriter’s Laboratories
6. ANSI American National Standards Institute
7. FM Factory Mutual Laboratories
8. City of Los Angeles Fire Code
9. State and/or City Fire Marshal’s Requirements
10. AISCS American Institute of Steel Construction Standards
11. ASTM American Society of Testing and Materials
12. In the event of conflict between codes, the State and Municipal Codes shall govern. Where these Specifications or drawings call for describing materials, workmanship, or construction of a better quality, higher standard, or larger size than is required by the Codes and Ordinances, the Provisions of these Specifications and drawings shall take precedence over the requirements of those Codes and Ordinances.


1.5 WARRANTY

A. General Warranty: Special project warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Project Warranty:

1. All materials, apparatus, and equipment furnished and installed here under shall be new and free from all defects.

2. The Contractor shall guarantee the fire sprinkler system including equipment and labor for a period of one year from the date of final acceptance.

3. Should any trouble develop within one (1) year from date of acceptance of the work, due to faulty material and/or workmanship, the trouble shall be corrected by the Contractor without expense to the City.

1.6 OPERATING INSTRUCTIONS

A. Operation Instructions: Upon completion and approval of the installed system, provide an experienced engineer to instruct the City's operators in all details in operating and maintaining the system. Provide seven (7) sets of typewritten operating instructions, part lists and service manuals of all equipment, wiring diagrams, control diagrams and test reports suitable bound.

1.7 MAINTENANCE

A. Extra Stock: Provide heads of each type, enclosed in a suitable receptacle, and one-head wrench for each type of head. Mount receptacle where directed by the City Engineer. Number of extra heads in accordance with NFPA-13.

PART 2 – PRODUCTS

2.1 GENERAL

A. Provide new and undamaged materials. Materials for similar uses shall be of the same type and same manufacturer unless otherwise approved by the City Engineer, U.L. approved and conforming AWWA Specifications as required.

B. Available Manufacturers: Subject to compliance with the requirements of the Contract Drawings and the Specifications, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Alarm Bell: Potter-Roemer, Honeywell, Notifier or Reeve.

2. Valves: Grinnell, Viking, Jenkins, Crane, Victaulic, or Kennedy.
3. Tamper, pressure operated, and water flow switches: Potter, Viking or Victaulic.

4. Fire Sprinkler Heads: Grinnell, Gem, or Viking.

2.2 MATERIALS

A. Underground Equipment (for piping material more than 5'-0" from building, see civil drawings):

1. Pipe: Ductile iron Class 51 for 4" diameter pipe, class 50 for larger than 4" diameter, meeting ANSI/AWWA C150/A21.50. Provide anchors, thrust blocks, clamps, and tie rods to prevent joint separation. Coat tie rods, clamps and bolts after installation with heavy coating of asphalt.

2. Fitting: Mechanical joints, ductile iron, 175 psi WWP, and U.L. listed or FM approved.

3. Valves: Non-rising stem, iron body bronze mounted, mechanical joint ends, U.L. Listed or FM approved, conforming to AWWA Standard C-500, and suitable for 175 psi, as manufactured by Kennedy or approved equivalent.

B. Aboveground Equipment:


2. Fitting: Cast iron Class 150, screwed or victaulic grooved end malleable iron fittings with style 77 couplings, and U.L. listed or FM approved.

3. Alarm Bell: 10-inch round red enamel steel bell with 24 VDC electric motor, activated by electric pulse from a flow switch. Provide with bell guard model No. 6235, Cadmium plated wire cage with center hole for attachment to bell, as manufactured by Potter-Roemer model No. PBD2410-BBK-1 or approved equivalent.

4. Pressure Gauge: Stainless steel 3-1/2-inch case with 1/4-inch male N.P.T. connection, glass enclosed dial with pressure range of 0-300 psi, U.L. listed or FM approved, as manufactured by Potter-Roemer model No. 6240 or approved equivalent.

5. Control Valve with Tamper Switch: Iron body gate valve 175 lbs., non-shock cold water, outside screw and joke, solid wedge, rising stem, flanged ends, malleable iron handwheel, and U.L. listed or FM approved type as manufactured by Crane model No. 467 or approved equivalent and tamper switch Potter Model # OSYSU-1-30VDC.

6. Check Valve: Iron body swing check valve, 175 lbs., non-shock cold water, bolted cover, flanged ends, mounted horizontally, U.L. listed or FM approved type as manufactured by Crane model No. 375 or approved equivalent.

7. Fire Department Connection: FDC-4, Potter-Roemer, Model No. 5023 with Plate No. 5604-F, concealed siamese type with double clappers, plugs and chains, cast brass with polished brass fittings, U.L. listed or F.M. approved type. Plate shall be labeled “AUTO SPKR”. Potter-Roemer, model No. 5786-F, ductile iron with plate labeled “combined standpipe”, with #5867 test outlet and #4335 floor outlets.

8. Drainage and Test Valves: Bronze, gate, globe, or angle valves, 175 psi WWP, and U.L. listed or FM approved.
9. Hangers and Supports: Designed and installed in accordance to NFPA Standard 13 and authorities having jurisdiction.

10. Alarm swing check valve Viking-J-1- or approved equal.

11. Booster Pump: Armstrong/Darling Model 4X3LAF, Series F4515 with all components listed on drawings for complete installation.

C. Sprinkler Heads:

1. In Areas With Gypsum Board or T-Bar Ceiling: The sprinkler shall be concealed pendent head, 1/2-inch orifice size, with brass plated cover escutcheon plate, brass finish, 155 degrees Fahrenheit rating, and U.L. listed or approved type, as manufactured by Central model No. GB Royal Flush or approved equivalent.

2. In Areas Above a Ceiling: The sprinkler shall be upright head, 1/2-inch orifice size, black finish, 200 degrees Fahrenheit rating, and U.L. listed or FM approved type, as manufactured by Central model GB or approved equivalent.

3. In Areas With Exposed Ceiling: The sprinkler shall be upright head, 1/2-inch orifice size, white finish, 155 degrees Fahrenheit rating, and U.L. listed or FM approved type, as manufactured by Central model GB or approved equivalent.

4. Sidewall Sprinkler Extended Coverage: Horizontal sidewall extended coverage head, 1/2-inch orifice size, brass finish, 155 degrees Fahrenheit rating, with mating brass plated escutcheon plate, and U.L. listed or FM approved type, as manufactured by Central model GBEC or approved equivalent.

5. Sidewall Sprinkler Standard Coverage: Horizontal sidewall head, 1/2-inch orifice size, brass finish, 155 degrees Fahrenheit rating, with brass plated escutcheon plate, and U.L. listed or FM approved type, as manufactured by Central model GB or approved equivalent.

6. Shower curtain sprinkler: The sprinkler head shall be pendent head, 1/2-inch orifice size, brass finish, 155 degrees Fahrenheit rating, and U.L. listed or FM approved type, as manufactured by Central model GB or approved equivalent.

7. Sprinkler Guard: Provide where required.

8. Furnish and install one metal cabinet containing a stock of spare sprinkler heads of all types and ratings installed.

9. In all jail & jail access areas provide Tyco Model TFP Max Pendant & sidewall units as applies.

D. Flexible Pipe Connections: Victaulic Co. Of America Fig. 77D installed where required by local Fire Department and for pressure required.

E. Fire Seal: Required wherever pipe penetrates through fire wall or floor to maintain a fire protective boundary. Install as per manufacturer's recommendations. Required to be U.L. listed.

F. Controls and Supervisory:

1. Waterflow Switch: Vane-type waterflow switch with retard, 175 lbs. Maximum static pressure rating, red tamper proof switch housing with flow paddle, adjustable pneumatic retard setting 0 to 70 seconds, two single pole, double throw micro switches to operate separate circuits,
10.0 amps. At 120 volts A.C., and U.L listed or FM approved type, as manufactured by Potter Electric Signal Co., model VSR-F, or approved equal.

2. Valve Supervisory Switches: Control valves shall be equipped with a tamper switch, U.L. listed for the particular location and type of valve supervised. The switch shall initiate a supervisory signal upon a maximum of two turns of a valve wheel or closer of 10% whichever is less.

G. Fire Alarm Panel (FACP): The Panel shall be provided under Electrical Specifications Section 16720 (Fire Alarm & Detection System).

H. Central Station: Contractor shall arrange and pay for connecting the FACP to a remote central Monitoring Station selected by the City. Contractor shall pay in advance, one year of monitoring and maintenance service. Contractor shall coordinate with the City for the installation of two dedicated telephone lines.

I. Hangers and Supports:

1. Support all horizontal piping at not to exceed 10-foot intervals, except for pipes of size 1-1/2-inch and larger which shall be supported at not to exceed 15-foot intervals, with approved hangers with rod supports and sway braces, installed according with NFPA requirements.

2. Support furred-in vertical piping by means of heavy wrought iron clamps or wall brackets.

3. See support and anchors for Hangers & Supports Section 15060. Where NFPA standards exceed Section 15060 requirements, comply with NFPA standards.

J. Sleeves:

1. For Use in Slab Construction: Schedule 40 black steel pipe.

2. For Use in Concrete Walls: Schedule 40 black steel pipe.

3. For Use Through Waterproof Membranes: Cast iron or steel with non puncturing flashing clamp device with corrosion resistant clamping bolts.

4. For Use in Lath and Plaster Partition and Ceilings: 24 gage galvanized iron or steel.

K. Identification Signs: All sign material shall be backed with minimum thickness of 1/8 inch. Lettering heights shall be 1/4-inch minimum. Lettering shall be white engraved on a red surface and shall be vertical capital letters. It shall be rigidly fastened to brackets which shall be fastened to equipment or walls in the proximity of the equipment.

L. Owners Control Valve Vault and Cover: Construct in accordance with applicable Architectural Specifications and Los Angeles City Building and Fire Sprinkler Code and regulation standards.

M. Other Materials: Provide other materials, not specifically described, but required for a complete and proper installation, as selected by the Contractor subject to the approval of the City Engineer.

2.3 SEQUENCE OF OPERATION

A. Upon activation of any fire flow switch, the FACP shall:

1. Energize a red alarm light at the panel.
2. Activate the buzzer in the Panel.

3. Activate the fire alarm bell throughout the building.

4. Send a fire alarm to a remote Central Monitoring Station.

B. All fire sprinkler valves including the alarm valve, control valve, underground control valves, and the backflow preventer valves shall be supervised with a tamper switch through the FACP. Upon detection of any trouble and supervisory alarm of the tamper switches, the FACP shall:

1. Energize a yellow alarm light at the panel.

2. Activate the buzzer in the panel.

3. Send a trouble alarm to a remote Central Monitoring Station.

C. Upon detection of any trouble and supervisory alarm of the fire Sprinkler system, including water flow switch and pressure operated switches, the FACP shall:

1. Energize a yellow alarm light at the panel.

2. Activate the buzzer in the panel.

3. Send a trouble alarm to a remote Central Monitoring station.

2.4 FIRE HOSE CABINETS

A. Steel box and door with steel frame, continuous hinge, welded corner seams, surface mounted, powder coated with an electrostatically applied thermally-fused, recoatable white polyester finish. By Potter-Roemer, Standard or Sierra.

1. FHC-1, Potter-Roemer #6040/4119/2830/2934/2901 (100 feet)/2962.

2. FHC-1, Potter-Roemer #1054/2510 with -E break glass door.

2.5 COMBINED STANDPIPE FIRE DEPARTMENT CONNECTIONS

1. FDC-1: Valve, Fire hose: Regular weight angle valves 2-1/2" for 300 psig working pressure. Cast brass, replaceable composition disc, rough chromium plated body with hand wheel cap and chain.
2. FDC-2: Valve, Fire Hose: Cast brass angle inlet body, 3-way outlet, with (3) 2-1/2” straight, caps and chains. Provide with pressure gauge.

STANDARD ALLENCO POTTER-ROEMER
5867/(3) 4115

3. FDC-3: Valve, Fire Hose: Ductile iron 4-way inlet with clapper body. UL and Factory Mutual End inlet and labeled cover plate.

STANDARD ALLENCO POTTER-ROEMER
5786-C

PART 3 – EXECUTION

3.1 GENERAL

A. Surface Conditions: Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until detrimental conditions are corrected.

B. Conceal all sprinkler lines within the building when structure permits. Install risers in janitor's room, heater rooms, supply rooms or similar service rooms whenever possible. Risers shall not obstruct access, use of maintenance of any other equipment within the building. Provide all mains and risers with fire sprinkler protection unless otherwise approved by the fire authorities having jurisdiction. Pipes inside the wall shall be concealed properly within the metal or wooden studs.

C. Equip pipe through ceilings at head locations with approved escutcheons. Unless otherwise designated, make all escutcheons identical.

D. Provide 280 degree F Blue Head sprinkler heads in heater rooms. Provide 165 degree F heads in all other locations, unless otherwise noted.

E. Furnish all signs, extra heads, special wrenches and cabinet for spare heads recommended and/or required by N.F.P.A. No. 13.

F. Provide the complete sprinkler system in accordance with NFPA Standard No. 13. Show on plans complete fire sprinkler coverage of the entire building.

G. Do not cover up or enclose work until inspected, tested and approved by the City Engineer.

H. Replace defective pipe, fittings or joints with new materials. Repairing with dope, tar, cement or other materials not permitted.
I. Comply with all requirements of National Fire Protection Association Standards #13 and #24, and Fire Department requirements and Los Angeles City Building Code.

J. Unless otherwise shown on the plumbing plans, Fire Department inlet connection shall be located on the address side of the building and subject to approval by the City of Los Angeles Fire Department.

K. No pipe welding, hot and cold tapping works are allowed.

L. Attention is called to the requirements that the air conditioning, plumbing and electrical systems are to be installed in locations adjacent to sprinkler system piping, and that Contractor shall coordinate efforts with other trades doing work on the site to avoid interference.

3.2 EXCAVATION, TRENCHING AND BACKFILLING

A. Refer to Section 02318, Excavation Backfilling and Compacting for Utilities for requirements.

3.3 CONCRETE WORK

A. Provide all concrete grade beams, anchor and thrust blocks and reinforcing steel under the Work of this Section. All concrete and reinforcing steel provided under the work of this Section shall be in accordance with that specified under Section 03300.

3.4 PIPING INSTALLATION

A. Lay underground piping to bear along its entire length. Securely brace or clamp all elbows, bends, etc., and provide with concrete thrust blocks in an approved manner.

B. Provide hangers and supports as required by Code.

C. Provide inserts in accordance with approved Shop Drawings.

D. Provide all necessary clamps and rods for proper support of sprinkler risers and underground piping, all in strict accordance with requirements of NFPA Pamphlets Numbers 13 and 24 and Los Angeles City Code.

E. Inspector's Test Pipe: As required by Code for each system, extended down to globe valve not more than 6-feet above the floor with discharge as shown on the approved Drawings. Make extension of the drain to an approved location a part of this Section.

F. Protective Painting: Prime coats all hangers and hanger rods as hereinafter specified under Sub-Section 3.7 - Painting.

G. Test Connections: As required by Code, in riser at point opposite drain connection and equipped with a side outlet globe valve. Provide an Underwriters’ approved gauge, in one outlet. Discharge 2-inch drain to street gutter per code under this Section.

H. Drain automatic ball drip piping to nearest funnel drain or other approved receptor.

I. Joints: Make up screw joints with pipe paste applied to male threads only. Ream pipe as necessary to make bore at end pipe same diameter as within the pipe.

J. Reducers: Make reductions in pipe sizes with one-piece reducing fittings. Bushings will not be acceptable.
3.5 SLEEVES

A. Provide sleeves for all pipes passing through walls, floors, (except for framed opening) and lath and plaster partitions and ceilings. For concrete construction, set sleeves in forms before concrete is poured. Provide 1-inch clearance between sleeve and pipe. Where installed in firewalls, caulk space between pipe and sleeve with approved type fire seal.

In Slab Construction: Extend sleeves 2-inches above finished floor and seal upper surface with mastic.

In Concrete Walls: When installed in outside walls, caulk space between pipe and sleeve with approved caulking material with an outer surface sealed watertight.

Sleeves Through Waterproof Membranes: Set sleeves in walls and slabs with waterproof membrane; caulk space between pipe and sleeve with approved caulking material with an outer surface sealed watertight.

Escutcheons: Furnish and install steel (Prime coated) set screw type escutcheons on all exposed pipes passing through walls, floors, ceilings and partitions.

3.6 PAINTING

A. Finished Painting: All finish painting except for items specified to be a factory finished, will be provided under the Work of Section 09910 - PAINTING.

B. Protective Painting:

1. This Contractor shall do protective painting only.

2. As soon as practical after installation (maximum time of seven days), apply a coat of rust preventive paint to all installed piping including fittings, iron valves, hanger rods and hangers, and accessible undercoated cast iron or steel supports. All materials shall be properly cleaned and free of all rust and scale and foreign matter before painting.

3.7 FIELD QUALITY CONTROL

A. Required Testing: Upon completion of the system, subject all piping to a hydrostatic pressure of 200 pounds per square inch for a two-hour continuous period, and not have more than 2 pounds pressure loss during this period in any part of the system. Immediately and properly correct any defects due to materials or workmanship occurring during this test. System may be tested in sections as approved by the City Engineer.

3.8 CLEANING

A. Thoroughly clean all equipment, trim and exposed piping, of cement, plaster, grease, oil spots, and foreign matter. Carefully wipe surfaces clean and scrape cracks and corners clean.
B. Completed Work: Leave in a neat, clean condition, ready for use.

C. Flush and disinfect fire sprinkler system in accordance with requirements of NFPA #13 and AWWA C651 as required.

3.9 TRAINING

A. Prior to final acceptance, the Contractor shall provide operation and maintenance training. The training session shall include FACP operation, trouble shooting procedures, and unique maintenance and safety requirements. The Contractor shall furnish a course outline, training manuals, and equipment necessary to conduct the training. The equipment used for instruction shall be equivalent to the equipment furnished under the Contract.

3.10 PROTECTION

A. Protect Work as necessary to prevent damage of any kind to materials and installation: Adequately cover fixtures and equipment during construction as required by the City Engineer.

3.11 FINAL CLEAN-UP

A. Comply with applicable provisions of Section 01710 - CLEANING of DIVISION 1 - GENERAL REQUIREMENTS of these Specifications.

B. Remove all excess materials, equipment, rubbish and debris from the job-site. All areas in the library structure used by the Contractor to be left in a clean and safe condition.

END OF SECTION
PART 1 - GENERAL

1.1 WORK INCLUDED

A. This section covers design equipment, installation, testing and all materials required for the dry-pipe pre-action fire sprinkler protection system, double interlock with electric/pneumatic release.

B. Contractor shall be responsible for the complete system design, layout, hydraulic calculations, preparation of shop drawings, field installation, coordination and completion in accordance with project requirements and applicable codes and standards.

C. Work or equipment not indicated or specified which is necessary for the complete and proper operation of the work of this section in accordance with the true intent and meaning of the contract documents shall be provided by this Contractor and incorporated under this section of the work at no additional cost to the owner.

1.2 RELATED WORK

A. Section 15140 - Supports and Anchors.

B. Section 15190 - Mechanical Identification.

C. Division 16 - Electrical

1.3 REFERENCES

A. The system shall meet all requirements of the National Fire Protection Association (NFPA 13), Installation of Fire Sprinkler Systems, and all other applicable codes and ordinances, whichever are more stringent shall apply. All fire protection equipment shall be listed by Underwriters’ Laboratories (UL) for fire protection use and/or approved by Factory Mutual (FM). Test system in accordance with requirements of the authority having jurisdiction with the fire inspector present for system certification.

B. Prior to installation, the contractor shall submit his/her qualifications, shop drawings and hydraulic calculations stamped and signed by a California State Registered Professional Engineer or a C-16 Licensed Contractor, with a minimum of three (3) years related experience, to the authority having jurisdiction. No installation work shall be started until shop drawings and hydraulic calculations have been approved.

C. California Building Code (CBC) Chapter 9, Fire Protection System

1.4 SYSTEM DESCRIPTION

A. System to provide coverage for communication rooms and as indicated on drawings. The method of release of the deluge valve priming water pressure shall be by an electric solenoid valve and a pneumatic actuator. Electric solenoid valve will open upon activation of the electrical supplemental detection system. Pneumatic actuator shall open upon activation of a sprinkler head on the sprinkler system. The opening of the deluge valve shall not be dependent on the order of activation of the release devices, only that both devices must activate before the deluge valve will open. The preaction system riser shall be of a listed and approved assembly. The system riser shall be equipped with a rubber seated check valve.
downstream of the deluge valve and prior to the supervisory air connection. The preaction system shall be provided with all necessary appurtenances to complete the system. The system shall be installed in conformance with the current Edition of N.F.P.A. 13, Standard for Installation of Sprinkler Systems.

B. Interface system with building fire and smoke alarm system.

C. Provide system to hazard occupancy classification required by the authority having jurisdiction.

1.5 QUALITY ASSURANCE

A. Shop Drawing and Product Data: Shop drawings, hydraulic calculations and product literature shall be furnished to the authority having jurisdiction in conformance with NFPA 13, Installation of Sprinkler Systems.

B. Equipment and Components: Bear UL/FM label or marking and State Fire Marshal listing.

C. Specialist Firm: Company specializing in sprinkler systems with three (3) years experience.

1.6 REGULATORY REQUIREMENTS

A. Hydraulic Calculations, Product Data, and Shop Drawings: Bear stamp of approval of Fire Marshal.

1.7 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 01300.

B. Include hydraulic calculations, detailed pipe layout, hangers and supports, components and accessories.

C. Submit shop drawings and hydraulic calculations to Fire Protection Plan Checker for approval. Submit proof of approval to Architect.

1.8 PROJECT RECORD DOCUMENTS

A. Submit documents under provisions of Section 01700.

B. Contractor shall provide and keep up-to-date a complete "as-built" record set of blueline prints which shall show every change from the original drawings and the exact "as-built" locations and sizes of the work provided under this section of the specifications. This set shall include locations, dimensions, depth of buried piping, shut-off valves, etc. On completion of the work, this set of prints shall be delivered to the Owner.

1.9 OPERATION AND MAINTENANCE DATA

A. Submit manufacturer's operation and maintenance data under provisions of Section 01700.

B. Include written maintenance data on components of system, servicing requirements, and Record Drawings.

C. Include maintenance, and inspection data, replacement and part numbers and availability, location and numbers of service depot.

1.10 EXTRA STOCK
A. Provide extra sprinklers as required by NFPA 13.
B. Provide suitable wrenches for each sprinkler type.
C. Provide metal storage cabinet in location designated by the architect.

1.11 DESIGN REQUIREMENTS

A. These specifications (Section 15335) are general and are not intended to define specific types of features, devices and appurtenances that are necessary to meet the requirements of the governing authorities mentioned herein.

B. It shall be the contractor's complete responsibility to determine in advance of submitting a bid for the work under Section 15335 any areas requiring special consideration due to the type of occupancy or storage of materials. These special requirements shall be incorporated into the automatic fire sprinkler design as necessary to conform to the requirements of NFPA 13, Owner's Insurance Underwriter and all other authorities having jurisdiction.

C. It is the contractor's responsibility to verify existing water supply flow and pressure at all points of connection and base hydraulic calculations on this information.

D. Prior to design and installation of any work, the contractor shall carefully prepare complete working drawings of the automatic fire sprinkler system. The contractor shall examine the Structural, Architectural, Mechanical, Plumbing and Electrical drawings for the construction of the building in order to fully inform himself as to the scope and detail for the work which will be required of him before proceeding.

1.12 COORDINATION

A. Clearances and Openings: Contractor shall cooperate and coordinate his/her work with all other trades to avoid conflict and permit for a neat and orderly appearance of the entire installation. The contractor shall, in advance of the work, furnish instructions to the general contractor as to his/her requirements for equipment and material installation of any kind, whether or not specifically mentioned on drawings or in the specifications, and shall include recesses, chases in walls, and all required openings in the structure. Should furnishing this information be neglected, delayed or incorrect and additional cuttings are found to be required, the cost of the same shall be charged to this contractor.

B. Piping runs found to be in conflict with work of other trades, as a result of neglected coordination, shall be removed and reinstalled in new locations designated by the architect at no additional expense to the owner.

1.13 PROTECTION

A. All work, equipment and materials shall be protected at all times. Contractor shall repair all damage caused either directly or indirectly by his/her own work persons. Contractor shall also protect his/her own work from damage. He shall close all pipe openings with caps or plugs during installation. He shall protect all his/her equipment and materials against direct, water, chemical and mechanical injury. Upon completion, all work shall be thoroughly cleaned and delivered in a new condition.

B. Contractor shall be held responsible for all damage to equipment and materials until he has received written notice from the architect that his/her work has been accepted.

1.14 UNINSPECTED WORK:
A. Contractor shall not allow or cause of his/her work to be covered up before it has been duly inspected, tested and approved by the authorized inspectors having legal jurisdiction over his/her work. Should he fail to observe the above, he shall uncover his/her work and after it has been inspected, tested and approved, recover it at his/her own expense.

PART 2- PRODUCTS

2.1 PIPING MATERIALS

A. Above Ground Inside Building Piping: Steel, Schedule 40 black as per NFPA 13.

2.2 PIPING SPECIALTIES

A. Water Control Valve: Furnish and install a 90° pattern type of deluge valve. Deluge valve shall employ a positive vent on the priming line to ensure that the deluge valve will not prematurely reset. Inlet and outlet connections of deluge valve can be flanged by flanged or flanged by grooved, respectively. Deluge valve shall be UL listed and Factory Mutual approved. Deluge valve shall have a working pressure of 250 PSI. Valve trim shall be compatible and shall be installed following the manufacturer's specifications. Acceptable Deluge Valve manufacturer is "Viking" Model E-1.

B. Water Control Valve Trim: Deluge valve trim shall incorporate a prime shut-off valve (PSOV) of the same manufacturer as the deluge valve, to provide a hydraulic means to positively close the supply of priming water to the priming chamber. All deluge valve trim piping and devices shall be listed for use on a deluge system. Deluge valve trim shall be rated for 250 PSI working pressure. Deluge valve trim shall be galvanized. Deluge valve trim shall be equipped with an emergency manual release enclosed in a steel box with appropriate labeling. Deluge valve trim shall be equipped with alarm connections for the electrical or mechanical activation of water flow alarms.

C. Release System: The release system shall incorporate as part of the operation of the system, a compatible electric detection system consisting of smoke detectors coordinated the scope of Division 16. The detection devices installed shall be compatible with the Deluge Valve Release Control Panel.

D. System Control Panel: System control panel shall be capable of a dual hazard split release, dual hazard combined release, single hazard cross-zone release, single hazard two-zone release. Control panel shall be equipped with a local tone alarm to annunciate loss of A/C power, system trouble, circuit trouble and low auxiliary D/C power supply. Control panel shall be capable of supervising trouble and alarm audible alarms. Trouble and alarm audible alarms shall be able to be silenced at the control panel. The control panel shall be housed in a vented enclosure with ambient temperature compatibility of 32°F to 120°F. Panel enclosure shall be of adequate size to house auxiliary DIC power supply. Auxiliary D/C power supply shall consist of (2) 12 volt lead acid batteries of the same ampere hour rating. Actual ampere hour rating to be established by auxiliary D/C power requirement. Acceptable Control Panel is a Viking B-1 Par-3 Panel.

E. Release Device: The water release device shall be an electrically operated solenoid valve. Solenoid valve shall be constructed of a V2" brass body with a stainless steel core tube, core, plugnut and springs. Solenoid valve shall have a maximum working pressure of 250 PSI. Solenoid valve shall be UL listed for its intended use. Solenoid Valve shall be compatible with the proposed system.
F. Water Supply Control Valve: Preaction system control valve shall be a listed indicating type valve. Control valve shall be UL listed and Factory Mutual approved for fire protection installations. System control valve shall be rated for normal system pressure but in no cases less than 175 PSI.

G. Compressed Air Supply: An air supply capable of restoring system pressure within 30 minutes shall be provided. Acceptable air supply arrangements are:

1. A tank with an air maintenance device between the tank compressed air and the air supply inlet on the system riser.
2. A riser mounted air compressor feeding an air reservoir. An air maintenance device shall be placed between the air reservoir and the system riser.
3. The air compressor shall be General or Gast and shall be sized according to gallon capacity and set pressures required by system.

H. System Check Valve: Check valves shall be UL listed and Factory Mutual approved for use on fire protection systems. Sprinkler riser check valves shall be manufactured with supply side and system side gauge connections and a main drain outlet in conformance with N.F.P.A. 13, Standard for Installation of Sprinkler Systems. Check valves shall be constructed of a ductile iron body with a brass seat and a rubber faced clapper assembly hinged to a removable access cover. Check valves shall be equipped with a removable access cover for periodic inspection as required in N.F.P.A. 25, Standard for Inspection, Testing and Maintenance of Water-Based Fire Protection Systems. Check valves shall have a working water pressure of 250 PSI. Acceptable Check Valve manufacturer is Viking Model F-1 Easy Riser.

I. High-Low Air Pressure Switch: Supervisory air pressure shall be maintained on all preaction systems with 20 sprinklers or more on the system piping. Low air pressure alarm will activate by way of a pressure supervisory alarm pressure switch. The low air pressure alarm switch shall be compatible with system devices. Low air pressure alarm switch enclosure shall be UL listed and Factory Mutual approved for the application in which it is used. Low air pressure alarm switch shall have the ability to be wired for Class A or Class B service. Acceptable Low Air Pressure Supervisory Switch is Viking, part number 09472 or 09473.

J. Water Flow Pressure Switch: Water flow will activate an alarm by way of an alarm pressure switch pressure enclosure shall be UL listed and Factory Mutual approved. Alarm pressure switch shall have the ability to be wired for Class A or Class B service. Acceptable Alarm Pressure Switch is Viking, part number 09471.

2.3 ACCEPTABLE MANUFACTURERS - SPRINKLER HEADS

A. Refer to Section 15330 - Fire Protection.

2.4 SPRINKLER HEADS

A. Refer to Section 15330 – Fire Protection.

PART 3 - EXECUTION

3.1 PREPARATION

Coordinate work of this Section with other affected work.

3.2 INSTALLATION - PIPING
A. Supervision: The Contractor shall furnish the services of an experienced Superintendent who shall be qualified in all phases of the work of this section and who shall constantly be in charge of the work of this Section.

1. All installations shall be per referenced standards. Follow manufacturer's directions and recommendations in all cases as required for all approvals and warranty enforcement.

2. Any cutting of structure shall be subject to approval by the architect. Beams, decks and other structural components shall not be cut or altered in any way unless previously approved.

3. Provide flexible couplings where required to provide extension capability and sway bracing for earthquake protection per NFPA 13.

4. Entire sprinkler system shall be installed in such a manner so that it can be drained in accordance with NFPA 13. Drains shall be located at suitable points as approved by architect. No primary or auxiliary drain shall be located in any public area, electrical or communications room. All drains shall discharge into dedicated receptors.

B. Place pipe runs to minimize obstruction to other work.

C. Place piping in concealed spaces above finished ceilings.

D. Center heads in two directions in ceiling tile and provide piping offsets as required.

E. Apply strippable tape or paper cover to ensure concealed sprinkler head cover plates do not receive field paint finish.

F. No work shall be covered or enclosed until inspected, tested and approved by architect and authority having jurisdiction. Should any work be concealed before inspection, the contractor shall, at his/her own expense, uncover such work and after it has been inspected, tested and approved, provide for all repairs as may be necessary to restore any other affected work to its original and proper condition.

G. Use best of workmanship in the installation of all piping and in particular all piping exposed in areas having no suspended ceilings. Install all piping as high as possible and where possible, install branch piping between structural framing and run main piping only below beams.

H. Sprinkler head and detector layout must accommodate ceiling mounted HVAC register and lighting locations. Coordination with work of these trades is the responsibility of contractor.

I. Without exception, no piping shall be run under or through any skylight or skylight well. Any additional upright or pendent sprinklers, which may be required by skylight locations, shall be the responsibility of this contractor.

J. All pipe penetrations at fire rated walls and floors shall be sealed with fire rated material in accordance with approved UL listed fire seal system assembly.

3.3 FABRICATION

A. General: All pipe, fittings, etc., shall be prepared by qualified and trained personnel experienced with the products involved and the recommended methods of preparation. All cuts, threads and grooves shall be made according to applicable codes, standards and accepted good practices. Pipe shall be free of damage, flaws and burrs. Threads and groove shall not be excessively shallow or deep. Fittings shall be made onto pipe no
tighter than necessary. Cracked or broken fittings shall be replaced by contractor, without exception. Excess dope and oils shall be removed before shipment to job site.

B. Welding:
   1. All welding to be shop welded. Contractor shall obtain approval from the Inspector of Records prior to any welding on field.
   2. Welding methods shall comply with AWS D10.9, Level AR-3 and ANSI B31.1. Contractor shall be responsible for all welded joints and any qualifying procedures of certification required for welders and related personnel.
   3. Holes in pipe for welded outlets shall be cut to full inside diameter of fitting prior to welding in place. Holes shall be free of slag and welding residue and of smooth, continuous bore. Fittings shall not penetrate internal diameter of run piping. Holes shall be cut by hole saw or other rotary bit. Torch cutting of holes is strictly prohibited.
   4. All welded pipe shall be subject to inspection by the Inspector of Records before it is installed. Provide documentation of acceptance, as required, at time of project closeout.

3.4 CLEANING
   A. Thoroughly clean all parts of apparatus and equipment. Exposed parts that are to be painted shall be thoroughly cleaned of cement, plaster and other materials, and all oil and grease spots shall be removed. Such surfaces shall be carefully wiped and all cracks and corners scraped out.
   B. Exposed metal work shall be carefully brushed down with steel brushes to remove the rust and other spots, and left smooth and clean.
   C. All pipe to be free of cutting oil prior to installation.
   D. Flush entire piping system of foreign matter.

3.5 SYSTEM TESTS
   A. Hydrostatically test entire system. Pressure test at 200 psig or a 50 psig above static pressure where static pressure is in excess of 150 psig. Repair all leaks and replace piping, fittings and other system components as required, at no additional cost to the owner.
   B. Test shall be witnessed by authority having jurisdiction and Architect.

END OF SECTION
SECTION 15400
PLUMBING

PART 1 - GENERAL

1.1 SUMMARY

A. Work Included: Provide all labor, materials and equipment for all plumbing work indicated on the Contract Drawings or in these Specifications, including but not limited to the major items listed as follows:

1. Service connections to sewer, water, storm drain and gas lines.
2. Installation of pipe, valves, and fittings.
3. Furnish and set all sleeves for pipes thru walls.
4. Flashing of pipe stacks.
5. Pipe coverings, insulation, and waterproofing.
7. Sealing of all penetrations thru fire walls and floors.
8. Final connection to equipment specified in other sections.
10. Grouting and cleanup.

B. Related Documents: Documents affecting work of this Section include, but are not necessarily limited to the GENERAL CONDITIONS, SUPPLEMENTARY CONDITIONS and Sections in DIVISION 1 of these Specifications.

C. Related Work:

1. Excavation, Backfill and Compaction for Utilities 02318.
2. Grading 02310.
3. Site Sanitary Sewer System 02530.
4. Sprinkler Irrigation System in Section 02810.
5. Site Water Distribution Systems 02510.
6. Cast In Place Concrete Work in Section 03300.
7. Storm Drainage Systems 02630.

10. Fire Protection Systems in Section 15330

11. Electrical Conduit and Wiring, including Motor Starters for Plumbing Equipment in Division 16.

12. Basic Mechanical Requirements in Section 15010.


1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled laborers who are thoroughly trained and experienced in the necessary crafts and who are completely familiar with the specified requirements and the methods needed for proper performance of the work of this Section.

B. Without additional cost to the City, provide such other labor and materials as are required to complete the work of this Section in accordance with the requirements of governmental agencies having jurisdiction, regardless of whether such materials and associated labor are called for elsewhere in these Contract Documents.

C. Conform to applicable Codes and regulations.

D. In addition to the requirements of all governing codes, ordinances and agencies, conform to the requirements of the following codes and standards:


3. City Engineer’s requirements.


6. City of Los Angeles Fire department requirements.


8. All requirements of Federal/OSHA

9. All other regulatory agencies having jurisdiction over this work.

E. Guarantees: Furnish a written guarantee form required under Division 1, against defects in materials and workmanship for one year. Guarantee shall include repair of damage to, or replacement (if so required) of any part of premises caused by water, oil, gas leaks or breaks in pipes, fixtures or equipment provided under this Section.

1.3 SUBMITTALS
A. Comply with pertinent provisions of SUBMITTALS SECTION of DIVISION 1 - GENERAL REQUIREMENTS of these Specifications.

B. **Product Data:** Within 40 calendar days after the Contractor has received the City Engineer’s “Notice to Proceed”, submit:

1. Design drawings, signed by a properly licensed engineer and showing proposed layout of the system;

2. Calculations demonstrating the adequacy of the proposed systems and its compliance with these Specifications;

3. Manufacturers’ catalogs, Samples, and other items needed to fully demonstrate the quality of the proposed materials and equipment.

4. Material list of items proposed to be provided under this Section.

C. **Record Drawings:**

1. Comply with pertinent provisions of GENERAL CONDITIONS of these Specifications.

2. Include a copy of the Record Drawings in each copy of the operation and maintenance manual described below.

D. Upon completion of this portion of the Work, and as a condition of its acceptance, deliver to the City Engineer three copies of an operation and maintenance manual compiled in accordance with the provisions of the GENERAL CONDITIONS of these Specifications.

**1.4 PRODUCT HANDLING**

A. Except as otherwise approved by the City Engineer, determine and comply with manufacturer’s recommendations on product handling, storage and protection.

B. Deliver products to the job-site in their manufacturer’s original container, with labels intact and legible.

1. Maintain packaged materials with seals unbroken and labels intact until time of use.

2. Promptly remove damaged material and unsuitable items from the job-site, and promptly replace with material meeting the specified requirements, at no additional cost to the City.

C. The City Engineer may reject as non-complying such material and products that do not bear identification satisfactory to the City Engineer as to manufacturer, grade, quality and other pertinent information.

**1.5 GENERAL REQUIREMENTS**

A. **Locations Indicated on Drawings:** For purpose of clarity, the Drawings are generally diagrammatic omitting offsets and small details. Certain pipe runs are shown distorted to avoid confusion. Where locations are fixed by dimension notations, follow as closely as possible consistent with proper installation.
B. **Exact Location**: As required for proper installation, avoid interference with architectural and structural features and work of other trades and to preserve head room and to keep openings and passageways clear. Arrange neatly and occupy minimum space; install piping parallel or at right angles to structures at the elevations indicated. Provide flanges and unions where required to permit servicing, removal and re-connection of each item of equipment.

C. **Discrepancies or Errors**: In case discrepancies or errors occur between plans, specifications, structural members, regulating codes, etc. Notify the City Engineer for instructions as directed in the GENERAL CONDITIONS of these Specifications.

D. **Openings**: Provide as necessary for passage of pipes through walls, floors, partitions, and other construction whether indicated on the Contract Drawings or not.

E. **Cutting and Repairing**:
   1. Do no cutting of structural members without written authorization by the City Engineer. Where permitted, provide all reinforcement with repair materials as directed by the City Engineer.
   2. **Repairing**: By appropriate craftpersons to restore construction to a condition as approved by the City Engineer and Contract Administration.

F. **Protection of Work**: Provide as necessary to prevent damage of any kind to materials and installation. Adequately cover fixtures and equipment during construction as required by the City Engineer.

G. **Record Drawings**: Provide accurate dimension locations including depths of underground piping, valves and cleanouts, and all control equipment as installed in strict accordance with provisions in GENERAL CONDITIONS of these Specifications.

H. **Shop Drawings and Lists of All Materials, Fixtures and Equipment**:
   1. **General**: Submit for approval within 30 calendar days after the Contractor has received the City Engineer’s “Notice to Proceed”, in accordance with provisions of the GENERAL CONDITIONS of these Specifications, to assure ample time for checking and processing of the submittals by the City. Delays resulting from improper and untimely submittals shall be the responsibility of the Contractor. Start no construction work before approval of submittals.
   2. **Required Shop Drawings**: Only required when proposing a substitute (different brand) except when specifically specified for an individual item.
   3. **Required List of All Materials, Fixtures, and Equipment**: Provide complete list with names and addresses of manufacturers, catalog numbers, trade numbers, trade names, illustrations, and descriptive literature for each article. Underline all pertinent data for each item in each copy of catalog or brochure in which it is described. Note in letter of transmittal all variations in performance, design and installation. Identify each article in submittals with reference to Section Number and Subsection Number of this Section and the specified item.
   4. Procure specified items after the 40 days from the Contract date.
   5. **Disapprovals**: Delete articles disapproved by the City Engineer as not conforming to the Specifications or grade, and provide suitable articles in lieu
thereof in conformity with Specifications. Start no purchasing or no work related to the submittals prior to approval of submittals.

6. Approval of Shop Drawings or other submittals will be general and will not relieve the Contractor of the responsibility for the proper fitting and construction of the specified work, nor from furnishing and performing work required by the Contract which may not be indicated on the shop drawings when approved as required by provisions of Section 11 in the GENERAL CONDITIONS of these Specifications.

7. Use Approved List for procurement without deviations, unless otherwise authorized by the City Engineer.

8. Modification of Contract Drawings: Furnish appropriate proposed revisions drawings prepared by a licensed Architect or Engineer for approval by the City Engineer. Required, in each case where proposed substitute material or equipment for proper installation will require changes to the design of the project on the Contract Drawings and make such drawings sufficiently complete for proper installation of substitute material or equipment and for construction by interested trades for the proposed revisions. Contractor shall bear the cost of the drawings and of the proposed revised construction.

I. Materials and Workmanship:

1. General: In conformity with Los Angeles City Plumbing, Industrial Waste, Pressure Vessel and Mechanical Codes, Underwriters' Laboratories, Los Angeles County, and California State Requirements.

2. Materials: To be recently manufactured and in perfect condition; materials for similar uses to be same type and manufacture unless otherwise approved.

3. Workmanship: In accordance with best trade practices.

J. Permits and Inspections:

1. Permits: Obtain and pay for permits as required by Uniform Plumbing and Mechanical Codes, 1997 Editions, with the City of Los Angeles 1996 Amendments.

2. Inspections Required: For all installations prior to concealment of the work, by the Los Angeles City Department of Building and Safety, and by the City Engineer. "Final Certificate of Approval" for the entire plumbing system required.

K. Maintenance and Operating Manuals: Provide the City with three (3) copies of neatly bound and indexed maintenance and operating manuals for all equipment as per provisions in the GENERAL PROVISIONS of these Specifications.

L. Closing in of Work: Do not conceal or close-in work until it has been inspected and approved by the City Engineer and authorities having jurisdiction. Contractor shall uncover prematurely covered or closed-in work before testing and inspection and shall re-conceal or re-close-in the work after testing and inspection, at no added cost to the City.

1.6 ACCEPTANCE OF WORK

A. Plumbing systems will not be considered for acceptance until the Contractor has completed disinfection of domestic water systems and all other work as hereinafter
specified, including all testing work and has demonstrated to the City Engineer that all such systems operate properly in accordance with these Specifications and the standards herein referenced.

1.7 SERVICE CONNECTIONS

A. **Sewer**: To 5'-0" from buildings as shown on drawings; Contractor to determine exact location of required connection and to be responsible for proper location of building drain and building sewer lines from buildings to street sewer main for most direct and suitable connection. Sewer permit and connection fees shall be arranged and paid by the Contractor. Sewer facility fee to be paid for by the City.

B. **Water**: To 5'-0" from buildings as shown on Drawings; Contractor to arrange for installation of water service meter and vault by Department of Water and Power and to pay all fees, charges and assessments. Water for construction shall be separately arranged for and paid for by the Contractor.

C. **Gas**: To gas meter at location shown on the Drawing; Contractor to arrange for installation of gas service meter and earthquake shut-off valve downstream of gas meter by Southern California Gas Company and to pay all fees, charges and assessments. Gas required for testing to be paid for by the Contractor.

D. **Storm Drain**: To 5'-0" from buildings as shown on drawing. Contractor shall determine exact location of required connection and shall be responsible for proper location of on-site storm drains. Storm drain permit and connection fees to be arranged and paid for by site work Contractor.

PART 2 - PRODUCTS AND EXECUTION OR INSTALLATION

2.1 GENERAL

A. Isolate all bare copper piping from hangers, supports, or structures with prefabricated isolator consisting of steel shell with corrosion resistant coating and chemically treated hair-felt pad.

B. Wherever work penetrates any waterproofing, do so with care and make opening through such waterproofing absolutely watertight in a manner approved by the City Engineer.

C. Do not conceal or cover work until inspected, tested, and approved by the City Engineer. Should any work be enclosed or covered up prior to inspection and testing, the Contractor, at his expense, shall uncover the work, make necessary tests and corrections to proper conditions as approved by the City Engineer.

D. Replace defective pipes, fittings, or joints with new materials. Repairing with dope, tar, cement, or other materials not permitted.

E. All piping and equipment shall operate without objectionable noises or vibration, as determined by the City Engineer. Provide positive type isolators as hereinafter specified.

2.2 MISCELLANEOUS EQUIPMENT & MATERIALS

A. **Couplings**: Same material as pipe on which couplings are used.

B. **Unions**: 
1. **For Solder-Joint Piping**: Wrought copper or cast bronze, close grained and nonporous, extra heavy type, 150-lb. working pressure, ground joint, individually tested by manufacturer.

2. **For Screwed-Joint Piping**: Galvanized malleable iron, brass to iron seat, 250-lb. working pressure female pattern, ground joint.

C. **Hose Bibb Controls**: Chicago Faucet No. 1771, ½-inch concealed control stops with lock-shield caps on concealed piping; gate valves on exposed piping.

D. **Pressure Regulating Assembly**:
   1. **Pressure Reducing Valve**: Wilkins No. 500 YSBR or approved equal by Watts Regulator Co., with built-in bypass to reduce thermal expansion; assembled sized and piped as detailed on drawings; brass bolts and nuts used for assembly; to be Los Angeles approved type.
   2. **Pressure Gauge**: Bourdon tube type, non-corrodible movement, 3-½-inch dial, recalibrator design, 0 to 200-lb. range, ¼-inch IPS male bottom connection.
   3. **Relief Valve**: McDonnell and Miller No. 240-1 in. - 125, set as 125 psi, conforming to ASME Code requirements.

2.3 **SLEEVES**

A. **Required**:
   1. **In Concrete Slabs**: Standard weight galvanized steel pipe in forms before concrete is placed.
   2. **In Masonry and Concrete Walls and Footings**: Set treated fiber rigid concrete sleeves or standard weight galvanized steel pipe, in forms before concrete is placed or built into masonry. See Structural Plans.
   3. **In Stud Walls**: 24 gage galvanized iron or steel.

B. **Clearance**: Provide ½-inch between sleeve and pipe or covered pipe, extend sleeve in floor slabs 2-inches above finished floor and 4-inches above rough floor.

2.4 **PIPE COVERING**

A. **Waterproofing Protection on Pipe**:
   1. **Required Covering**: Cover all copper and steel pipe and fitting embedded in ground, in concrete masonry, or solid plaster.
   2. **Material**: Plastic tape approved by City of Los Angeles, Department of Building and Safety.
   3. **Hand Application**:
      a. Clean all materials thoroughly to the bare metal base, remove all grease and oil with a nonoily solvent; file or grind burrs, sharp edges, and rough spots smooth. Make all surfaces dry and dust free.
b. Spiral wrap pipes with uniform laps of plastic tape by hand, completing one layer with prescribed laps; reverse direction of wrapping and apply a second layer in the same manner, again maintaining prescribed laps. All widths of tape, length of rolls, and dimensions of laps shall be as recommended by manufacturer in the manufacturer's material requirements table. Take care to insure a uniformly applied, tightly bonded tape, free of air pockets, voids and wrinkles.

4. **Machine Application:**
   a. Clean as outlined above for hand application.
   b. Spiral wrap uniformly by an approved manual or power driven machine with 50 percent laps and one over-wrap of 50/50/50# asphalt laminated kraft, either wet strength one side, or reinforced. All width of tape, length of rolls, and application as recommended by manufacturer in manufacturer's material requirements table. Exercise care to insure a uniformly applied, tightly bonded tape, free of air pockets, voids, and wrinkles.

5. **Testing:** Holiday detection testing prior to installation underground shall be required at the discretion of the City Engineer. Use a holiday detector set at 5,000 and 6,000 volts. Patch all holidays detected with a double "cigarette wrap" of No. 665 (15 mil) tape.

2.5 **FLASHING OF PIPE STACKS**
   A. **Required:** For all pipes, passing through roof, comply with Specification Section 07620.

2.6 **ACCESS PANELS**
   A. **For Valves or Equipment Located Behind Ceramic Tile Walls:** Provide 8-inch x 8-inch opening; stainless steel, beveled edge frame; stainless steel cover secured with flush-head screws; polished finish; vandal-proof screws where indicated or required.
   B. **For Valves, Clean-outs or Equipment Located Behind Finish Plaster Walls or Ceilings:** Provide 8-inch x 8-inch minimum opening, 16-gage steel frame; 14-gage steel door with concealed hinges arranged to open 180 degrees or to be removable and with Allen head locking device; with bonderized and prime coated finish.
   C. **Installation:** Required for ready accessibility to all valves and water hammer arrestor unless installed, in pipe spaces or in readily accessible ceiling space.
   D. **Manufacturer's Reference Data:** Required as noted in 1.3 of this Section.

2.7 **STORAGE TYPE WATER HEATER/ EXPANSION TANK**
   A. **Water heater tank:** Glass lined with anode rods, AGA approved and listed, and State Energy Standard listed item.
   B. **Expansion tank:** Steel shell, ASME designed, Pre-charged air chamber, Butyl diaphragm, rigid polypropylene liner.
   C. **Capacity:** As indicated on the Drawings.
   D. **Installation:** Anchor to floor and with earthquake restraint (2-18 gage sheet metal bolt to wall as indicated on the drawings). Connect to gas, water and vent lines.
E. **Vent:**

1. Carried vertically through roof as detailed on the Drawings.

2. In accordance with Los Angeles City Plumbing Code.

3. Type B, air insulated, double wall construction from flue collar or draft hood on water heater appliance through roof, size as indicated on the drawings; constructed of noncombustible corrosion-resistant materials; pipe and fitting as listed and approved by the Los Angeles City Heating Code and Underwriter's Laboratories, Inc. Where water heater manufacturer specifies pressurized double wall flue that includes combustion air, provide manufacturers recommended product.

4. Provide bird-proof vent cap, storm collar and 12-inch adjustable cone roof flashing constructed of galvanized steel outer casing and aluminum inner pipe.

F. **Combination Temperature and Pressure Relief Valve:** Resetting type constructed and listed to meet AGA and American National Standards Requirements. Install with temperature sensing element immersed in water within the top 6-inches of the tank with a 1-inch relief line to floor sink.

G. **Manufacturer's Reference Data:** Required as noted in 1.3 of this Section.

2.8 **INSTANTANEOUS TYPE WATER HEATER**

A. Electrical, wall mounted, UL approved, with flow restrictor.

2.9 **FIRE SEAL**

A. **Required:** Seal around pipe passing through fire-rated wall or floor to maintain fire rating.

B. **Material:** Fire-Seal, U.L. classified for fire rating three hours.

C. **Manufacturer's Reference Data:** Required as noted in 1.3 of this Section.

PART 3 - EXECUTION

3.1 **GENERAL**

A. Make all equipment and piping systems to operate without objectionable noise and vibration, as determined by the City Engineer. Do not interfere with other trades (electrical, mechanical, structural, etc.) to avoid noise and vibration transmission. Provide positive type isolators as herein after specified.

B. **Surface Conditions:** Examine all areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed until detrimental conditions are corrected.

3.2 **INSTALLATION OF PIPE**

A. **Pipe Inside Building:** Conceal with in building walls, partitions, furred spaces or ceilings except in mechanical equipment room, where indicated or possible and work into position without springing or forcing.
B. **Underground Pipe Outside Building:** Locate top of all pipes not less than 2-feet below finish grade, except where otherwise indicated on the drawings. Lay sewer pipe in a separate trench. Space all pipe lines at a minimum of 12-inches center to center with a minimum of 2-feet horizontal distance from footing or wall, and above 45 degree downward line from the footing. Install all pipes in a straight line with neat appearance when completed. Take precautions to prevent damage to wrapped pipe. Trench bottom to be free of rocks and gravel. Lay pipe parallel or at right angles to building or property lines. Set drain lines on a firm foundation or sub-grade, true to line and grade. When entering building, water and gas pipes to rise above footing (with shut-off valve on riser) and go through the wall.

C. **Soil and Waste Lines in Building:** Provide a removable coupling at floor level where lines go underground; bring cast iron pipe up to waste connection of each fixture.

D. **Gas Piping:**
   1. Install so that branch lines are tapped off tops of pipe valve end of main lines, valved to bleed off condensate that my form in pipe. Plug or cap valves.
   2. Run main fuel line from meter to gas appliances. Provide gas service stop at all appliances.

E. **Pipe Openings:** Keep closed to prevent obstructions and damage during construction.

F. **Grade or Slope:**
   1. **Sanitary Piping and Other Drain Lines:** Horizontal runs to have uniform fall of not less than 1/4-inch per foot; 1/8- inch in yard areas, and in ceiling spaces when approved by City Engineer.
   2. **Vent Piping:** Grade to positively prevent accumulation of water or condensation.
   3. **Gas Piping:** All lines to slope downward to meter, fixture, gas drip, or dirt leg.

G. **Bends:** Run drainage pipe as straight as possible, with long radius turns and offsets at angle of 45 degrees or less. Make changes in direction of all piping with fittings.

H. **Clean-outs:** To be located:
   1. Where indicated on drawings. Exact locations as directed by the City Engineer.
   2. At all horizontal offsets, or changes in direction of piping greater than 45-degrees.
   3. At ends of all waste and sewer lines more than 5-feet in length.
   4. At intervals of 50-feet for piping of 4-inches and smaller, and 100-feet for larger piping.
   5. At base of each vertical stack (waste, soil and storm drains).
   6. After testing remove C.O. plug; apply water pump grease to male threads and replace hand tight.

I. **Noises:** Piping to be free from unusual noises due to flow of water under normal conditions.
J. Full-Length Sections of Pipe: Required for all pipe lines wherever practical; short sections with unnecessary couplings will not be allowed.

K. Floor and Ceiling Plates: Required where exposed pipes pass through walls, floors or ceilings; polished chromium-plated split-flange or one piece.

L. Hot and Cold Water Separation: Separate hot and cold water lines by at least 6-inches on parallel runs.

M. Expansion of Piping: Provide as required in all piping and for prevention of damage to pipe or insulation where expansion or contraction occurs.

N. Seismic Bracing: Provide lateral and longitudinal sway bracing required for all suspended piping in compliance with Drawing Details or as specified in Section 15240 – HVAC Equipment Seismic Restraints and Vibration Isolation.

O. Inspection:
   1. By Contractor: All installations to determine that pipes are free from defective workmanship and that pipes and fittings are free from obstructions and are in their proper locations.
   2. By Inspector and All Duly Constituted Authorities: All installations prior to concealment.

3.3 INSTALLATION OF VALVES AND FITTINGS

A. Care in Fitting and Installing Fixtures: Install all exposed plated or enameled connections to fixtures with special care to avoid tool marks or threads showing at fittings.

B. Unions: Required at each valve, at gas pressure regulator, and on connections to all equipment; to be of the same materials as fittings.

C. Water Hammer Arrestors:
   1. Install water hammer arrestors indicated on the Drawings and in the following locations: (only non-ferrous arrestors may be used in copper water systems).
      a. On water lines to service sinks, kitchen sinks, water closets and urinals.
      b. Between the last two fixtures when three or more fixtures, other than those listed in (a) above, areas served by a common server.
   2. When possible, arrestor shall be installed in the wall or furring. When arrestor is installed in wall or furring, furnish an access plate large enough to permit removal of the arrestor. The access plate shall be a minimum of 2” larger in each direction than the arrestor. See equipment list for sizes, makes and models or arrestors. Where not specifically offered in the Contract Documents installation shall be in accordance with the Plumbing and Drainage Institute Standard PDI-WH201.
   3. Each fixture water line shall be provided with a dampening device. When such service is not provided by water hammer arrestors, provide an air chamber at each fixture supply. This shall be an 18” long vertical piece of capped pipe one size larger than the branch to a fixture. In lieu of individual air chambers, header
air chamber may be used where header serves two fixtures. This shall be located at each end of the header and shall be a 36" length of vertical pipe, capped, not less than one pipe size larger than the header.

D. Reducing Fittings: Required only where changes in pipe sizes occur.

E. Prohibited Fittings: Screw or sand bushings; 90 degrees or 45 degrees street elbows, close nipples, long screws, bullhead tees, and special fittings, unless approved by the City Engineer.

F. Valves: Use gate, ball and butterfly valves for shut-off duty; globe, ball and butterfly for throttling bypass or manual flow control duty. Install on each branch line to one or more fixtures and on every underground branch line for complete control of the system. Place valves with stems horizontal wherever possible. Adjust, regulate, and pack glands before final acceptance.

G. Separate Control: Install valves at each fixture on hot and cold water to permit repairs without interference with any other fixture. Provide hose bibbs with individual control valves, except where otherwise indicated adjacent to and either concealed or exposed as indicated by location of hose bibb.

H. Dielectric Couplings or Flanges:
   1. Required where copper pipe is joined to steel or iron pipe or equipment. Unions will not be allowed. Not required for bronze valves in steel lines or for caulked joints between copper and cast iron drainage lines.
   2. Use couplings only on cold water installations.
   3. Use flanges on all installations above 140 degrees Fahrenheit and made of material suitable for temperatures involved.

I. Exposed Toilet Flush Valves: Locate rough and finish 4-3/4 inches to right of center of valve to center of wheel handle angle stop, and 12-inches above top rim of bowl to center line of flush valve, locate oscillating handle to left facing bowl. Install sensor operated valves per manufacturer’s recommendations.

J. All Flushometer Valves: Disassemble and lubricate with water pump grease and graphite before installation.

3.4 EQUIPMENT AND FIXTURE CONNECTIONS

A. General: Stub all piping out to the exact location and set symmetrical with the fixtures.

B. Water Headers Serving Water Closets: Shall be as indicated on drawings.

C. Water Headers Serving Urinals: Shall be as indicated on drawings.

3.5 ATTACHMENT OF FIXTURES

A. Required: Support and attach all fixtures hereinbefore specified properly and adequately to walls, ceilings, or floors in true right angles with floor and wall using adjustable fixture carrier as indicated on the Drawings or as specified.

B. To Concrete Backing: Machine bolts through concrete with nut and washer on space side, or with heavy expansion bolts of required length.
C. **To Steel Stud Backing**: Bolt to 4-inch x 1/4-inch steel plate; plate to be welded or clamped by U-bolts to steel studs.

D. **Anchor Bolts, Sleeves, and Templates**: Required: Anchor bolts for fixture attachment, steel pipe sleeves for bolt adjustment and templates for holding anchor bolts.

E. **Toilets and Urinals**: Set finish with approved type graphite ring and stainless plumber's putty.

F. Disassemble all flushometer valves and lubricate with water pump grease and graphite before installation.

G. **Fixture Height for Handicapped Persons**: As indicated on the Architectural and Plumbing Drawings.

H. **Grouting and Cleaning**:
   1. Required between base of toilet bowl and floor and between back of all plumbing and wall areas.
   2. Use hard, white, durable plaster materials filling all voids and cracks and provide adequate bearing surface mounting.
   3. Before plaster materials have hardened, scrape a reasonable amount of plaster from void or crack allowing sufficient depression to receive caulking. Completely fill cracks or voids to a finished surface between all plumbing fixtures and walls or floors with "Tub-Caulk" manufactured by Miracle Adhesive Co., New York, New York or equal. Apply as recommended by the manufacturer.
   4. **Floor Sinks**: Except in kitchen areas, install one-inch above finish floor and neatly grout all four sides.

I. **Cleaning**: Thoroughly clean all equipment, fixtures, trim, and exposed piping of cement, plaster, grease, and oil spots. Carefully wipe surfaces and scrape cracks and corners clean.

J. **Polishing**: Polish all exposed chromium-plated or nickel-plated surfaces, with clean cloths.

K. **Completed Work**: Leave in a neat, clean condition, ready for use.

L. **Inspection**:
   1. **By Contractor**: Inspect all installations to determine that pipes are free from defective workmanship and that pipes and fittings are free from obstructions and are in their proper locations.
   2. **By City Engineer and All Duly Constituted Authorities**: All installations prior to concealment.

3.6 **PLUMBING CONNECTIONS TO EQUIPMENT SPECIFIED IN OTHER DIVISIONS**

A. **Fuel Gas**: To gas roof-top package units with appliance gas service stops adjacent to equipment.
B. **Drain**: From air conditioning coils to sink tailpieces, material as specified in Water Supply Materials Subsection.

C. **Final Connections**: Required by the Plumbing Contractor to all appliances.

### 3.7 DISINFECTING OF WATER SYSTEMS

A. **Required**: For each hot water, cold water, and drinking water system, after all fixtures have been completely connected and are ready for operation.

B. **Disinfecting Agent**: Gas or liquid chlorine, as normally used for the chlorination of water systems. Calcium or sodium hypochlorite as approved by Federal and American Water Works Association procedures may be used.

C. **Disinfecting Connection**: Locate service cock or riser, 3/4-inch to 1-1/4-inch size, near water service entrance.

D. **Procedure**:

1. Remove all screens on faucets.
2. Flush all lines and fixtures thoroughly with clear water.
3. Adjust all faucets and outlets so that a trickle of water flows from each; water service supply valve to remain open.
4. Connect a hand-operated pump or other injection device to the disinfecting connection, the pump or device to provide a pressure greater than that of the water supply to the system.
5. Inject the disinfectant slowly and continuously at an even rate (not in slugs).
6. Check the effluent at each faucet and outlet with an orthotolidin solution while injection is continuing until the chlorine residual concentration indicates not less than 50 parts per million at all outlets.
7. Close all outlets including water service supply valve and disinfecting connection and hold for 24 hours.
8. After retention the chlorine residual concentration at most outlets when checked with an orthotolidin solution to be not less than ten parts per million. If less, disinfecting procedure to be repeated.
9. If check is satisfactory, flush all disinfected systems with clear water until chlorine residual concentration when checked with an orthotolidin solution to be not greater than that of the incoming water supply.

E. **Bacteriological Analysis**:

1. Upon completion of final flushing after retention period, obtain and test a water sample by a recognized laboratory acceptance to the City Engineer.
2. A written report to be submitted by the laboratory to the City Engineer showing:
   a. Name and location of job and date sample was obtained.
b. That the coliform aerogenes are negative.
c. That the total plate count is less than 100 bacteria per cubic centimeter.
d. That the water is safe to use.

F. **Costs:** All cost of the materials, equipment, and application, including water charges and laboratory fees, shall be borne by the Contractor.

### 3.8 BACK SIPHONAGE PROTECTION

A. **Protect water supplies** of all plumbing fixtures against back siphonage in the event of a vacuum in the piping system.

B. **Locate discharge outlets** of all supply faucets for lavatories and sinks so as to clear the top of overflow rim at least 1-inch.

C. **Install approved hose bibb vacuum breaker** at each hose bibb, recessed and exposed.

D. **Equip toilet flush valves** with approved vacuum breakers. Install at the height required by the Los Angeles City Plumbing Code.

E. **Atmospheric type backflow preventers** required for lawn sprinkler systems and are shown on the Landscaping Drawings.

F. **Reduced Pressure Type Backflow Preventer:** Los Angeles City approved type.

G. **Vacuum Breaker Assembly:** Required for interceptor connection.

H. **All backflow prevention devices** shall be approved by the City of Los Angeles, Department of Building and Safety and Los Angeles County Health Department and other official agencies having jurisdiction. Use test devices designed for testing, so tested by a certified tester, paid for by the Contractor. Submit certification to the "General Maintenance Superintendent", General Services Department, prior to acceptance of the project. Such certification shall in no way nullify the warranty of such device or equipment. Perform all tests in the presence of the City Engineer or his duly appointed representative.

### 3.12 TESTS

A. **Sanitary Systems:** In accordance with Uniform Plumbing Code, 1999 Edition with the City of Los Angeles 2001 Amendments.

B. **Roof Drain System:** Similar to tests on sanitary system.

C. **Water Systems:** Minimum hydrostatic pressure of 250 psi for a period of four hours.

D. **Gas Piping:** In accordance with Uniform Plumbing Code, 1999 Edition with the City of Los Angeles 2001 Amendments.

E. **Supervision:** Make all tests in the presence of the City Engineer and demonstrate all fixtures and equipment to function satisfactorily and to the approval of the City Engineer. Provide and pay for all equipment, materials, and labor necessary for tests.

### 3.13 EMERGENCY REPAIRS
A. The City reserves the right to make emergency repairs as required to keep equipment in operation, without voiding the Contractor's guarantee bond, nor relieving the Contractor of his responsibilities during the bonding period.

END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes plumbing piping systems to a point 5 feet outside the building. Systems include the following:

1. Potable water distribution, including cold- and hot-water supply and hot-water circulation.
2. Drainage and vent systems, including sanitary and storm.
3. Engineered drainage systems, including the following:
   a. Storm drainage systems.

B. Related Sections: The following sections contain requirements that relate to this Section:

1. Division 15050 Section "Basic Mechanical Materials and Methods" for piping joining materials, joint construction, and installation requirements not specified in this Section.
2. Division 15135 Section "Meters and Gages" for thermometers, pressure gages, and fittings.
3. Division 15490 Section "Special Systems" for plumbing system components.
4. Division 15100 Section "Valves".
5. Division 07920 Section "Joint Sealants for Material & Methods" for sealing pipe penetrations through floor, walls and fire rated.
6. Division 15060 Section "Hangers & Supports".
7. Division 15190 Section "Mechanical Identification".
8. Division 15250 Section "Mechanical Insulation".

1.3 SYSTEM PERFORMANCE REQUIREMENTS

A. Provide components and installation capable of producing piping systems with the following minimum working pressure ratings, except where indicated otherwise:


1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

1. Water samples, test results, and reports specified in "Field Quality Control" and "Cleaning" Articles.
2. Coordination drawings, drawn accurately to scale and coordinating penetrations.
1.5 QUALITY ASSURANCE

A. Comply with the provisions of ASME B31.9 "Building Services Piping" for materials, products, and installation.

B. Provide listing/approval stamp, label, or other marking on piping made to specified standards.

C. Comply with the provisions of ASME Boiler and Pressure Vessel Code. Section IX, Weldings and Brazing Qualification for Welding Processes and Operators.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Couplings for Grooved-End Steel Pipe and Grooved-End Ferrous Fittings:
   a. Grinnell Supply Sales Co., Grinnell Corp.
   d. Stockham Valves & Fittings, Inc.
   e. Victaulic Co. of America.

2. Couplings for AWWA-Size, Grooved-End, Ductile-Iron Pipe and Fittings:
   b. Victaulic Co. of America.

2.2 PIPES AND TUBES

A. General: The application of the following pipe, tube, and fitting materials and joining methods required for plumbing piping systems are indicated in Part 3 Article "Pipe and Fittings Applications."

B. Hard Copper Tube: ASTM B 88, Types K and L, water tube, drawn temper.


D. Steel Pipe: ASTM A 53, Type S, Grade A, Schedule 40, seamless, black, plain ends.


E. Hub and Spigot, Cast-Iron Soil Pipe: ASTM A 74, Service Class.

F. Hubless, Cast-Iron Soil Pipe: CISPI 301.

2.3 PIPE FITTINGS AND TUBE FITTINGS

A. Wrought-Copper, Solder-Joint Pressure Fittings: ASME B16.22.

C. Bronze Flanges: ASME B16.24, Classes 150 and 300.

D. Copper Unions: ASME B16.18, cast-copper-alloy body, hexagonal stock, with ball-and-socket joint, metal-to-metal seating surfaces, and solder-joint, threaded, or solder-joint and threaded ends.


H. Steel Pipe, Grooved-End Fittings: ASTM A47 malleable-iron, ASTM A106 steel, or ASTM A536 ductile-iron, galvanized, grooved-end fittings designed to accept couplings for grooved or shouldered joints.

I. Cast-Iron Threaded Flanges: ASME B16.1, Classes 125 and 300.

J. Ductile-Iron, Flexible Expansion Joints: Compound fitting with combination of flanged and mechanical-joint ends conforming to AWWA C110 or AWWA C153. Units have 2 gasketed ball-joint sections and 1 or more gasketed sleeve sections, rated for 250 psig minimum working pressure and with FDA-approved epoxy interior coating, for offset and expansion indicated.

K. Hub and Spigot, Cast-Iron Soil Pipe Fittings: ASTM A74, Service Class.

L. Hubless, Cast-Iron Soil Pipe Fittings: CISPI 301.


2.4 JOINING MATERIALS

A. Solder, brazing, and welding filler metals are specified in Division 15 Section "Basic Mechanical Materials and Methods."

B. Cast-Iron Soil Pipe and Fittings: ASTM C564 neoprene rubber gaskets and lubricant.


D. Stainless Steel, Heavy-Duty Couplings for Hubless Cast-Iron Soil Pipe and Fittings: ASTM C564 neoprene sealing gasket, with Type 304 stainless-steel housing or shield and stainless-steel clamps. Coupling shall be 3 inches wide in sizes 1-1/2 to 4 inches and 4 inches wide in sizes 5 to 10 inches.

E. Cast-Iron, Heavy-Duty Couplings for Hubless Cast-Iron Soil Pipe and Fittings: ASTM C564 neoprene sealing gasket, with cast-iron housing and stainless steel bolts.

F. FM-Type, Heavy-Duty Couplings for Hubless Cast-Iron Soil Pipe and Fittings: FM-approved, ASTM C564 elastomeric sleeve, with stainless steel band and strips or cast-iron housing and corrosion-resistant bolts.
G. Sleeve-Type Couplings for Plain-End, Nonpressure System Pipe: Rubber or elastomeric sleeve and stainless steel band assembly, fabricated to match outside diameters of pipes to be joined.

1. Sleeves: ASTM C 564, rubber for cast-iron soil pipe and ASTM F 477, elastomeric seal for plastic pipe. Sleeves for dissimilar or other pipe materials shall be compatible with pipe materials being joined.
2. Bands: Stainless steel, one at each pipe insert.

H. Gasket-Type Couplings for Plain-End, Nonpressure System Pipe: Rubber or elastomeric compression gasket, made to match pipe inside diameter or hub and adjoining pipe outside diameter.

1. Gaskets: ASTM C 564, rubber for cast-iron soil pipe and ASTM F 477, elastomeric seal for plastic pipe. Gaskets for dissimilar or other pipe materials shall be compatible with pipe materials being joined.

2.5 VALVES

A. Refer to Section 15100 "Valves" for gate, globe, ball, butterfly, and check valves.
B. Refer to Section 15400 "Plumbing" for special-duty valves.

PART 3 - EXECUTION

3.1 EXCAVATION

A. Excavation, trenching, and backfilling are specified in Section 02318 "Excavation, Backfilling and Compaction for Utilities."

3.2 PREPARATION OF FOUNDATION FOR BURIED PIPING

A. Grade trench bottom to provide smooth, firm, stable, and rock-free foundation throughout length of piping.
B. Remove unstable, soft, and unsuitable materials at surface on which piping is to be laid and backfill with clean sand or pea gravel to indicated level.
C. Shape bottom of trench to fit bottom of piping. Fill unevenness with tamped-sand backfill. Dig bell holes at each pipe joint to relieve bells of loads and to ensure continuous bearing of pipe barrel on foundation.

3.3 PIPE AND FITTINGS APPLICATIONS

A. General: Use pipe, tube, fittings, and joining methods for piping systems according to the following applications.
B. Water Distribution Piping Below Ground: Use the following:
   1. 3/4" Inches and larger: Soft copper tube, Type K, cast-copper-alloy solder-joint pressure fittings, and soldered joints with Alloy no lead solder City of L.A. approved.
C. Water Distribution Piping Above Ground: Use the following:
1. 4 to 6 Inches: Hard copper tube, Type L; wrought-copper and bronze grooved-end fittings; couplings for grooved-end copper tube and grooved-end copper fittings; and grooved copper tube and grooved tube fitting joints.

2. 3 Inches and Smaller: Hard copper tube, Type L; wrought-copper or cast-copper-alloy pressure fittings; copper unions; bronze flanges; and solder joints with Alloy no lead City of L.A. approved.

D. Soil, Waste, and Vent Piping Below Ground: Use the following:

1. 2 to 6 Inches: Hub-and-spigot cast-iron soil pipe, hub-and-spigot cast-iron soil pipe fittings, neoprene rubber gaskets, and compression joints.

E. Soil, Waste, and Vent Piping Above Ground: Use the following:

1. 6 Inches: Hubless cast-iron soil pipe, hubless cast-iron soil pipe fittings, stainless-steel, cast-iron, or FM-type heavy-duty couplings for hubless cast-iron soil pipe and fittings; and hubless joints.

2. 2 to 4 Inches: Hubless cast-iron soil pipe, hubless cast-iron soil pipe fittings, CISPI-type couplings for hubless cast-iron soil pipe and fittings, and hubless joints.

F. Storm Drainage Piping Below Ground: Use the following:

1. 3 to 8 Inches: Hub-and-spigot cast-iron soil pipe, hub-and-spigot cast-iron soil pipe fittings, neoprene rubber gaskets, and compression joints.

G. Storm Drainage Piping Above Ground: Use the following:

1. 3 to 6 Inches: Hubless cast-iron soil pipe; hubless cast-iron soil pipe fittings; stainless-steel, cast-iron, or FM-type heavy-duty couplings for hubless cast-iron soil pipe and fittings; and hubless joints.

H. Gas Piping Above Ground:

1. ½ to 2 Inches: Schedule 40 black steel with threaded malleable iron fittings.

2. 2-1/2 to 6 Inches: Schedule 40 black steel with butt welded fittings.

I. Gas Piping Below Ground:

1. Polyethylene plastic pipe, ASTM D1248 and D2513, standard dimension ratio 11, rated at 80 psi working pressure at 73 degrees F. for 3 inches and smaller, SDR 11.5 rated at 76 psi at 73 degrees F., joined by heat fusion, color orange or yellow, Plexco PE 2406, Phillips, or equal. Transition to anodeless steel riser at meter, regulator, or building wall.

2. Polyethylene plastic fittings shall be ASTM D 3261 and D 2683, standard dimension ratio 11, rated at 80 psi working pressure at 73 degrees F. for 3 inches and smaller, butt or socket type fittings, joined by heat fusion, color orange or yellow, Plexco, Phillips, or equal. (Provide with P-8)

J. Condensate & Equipment Drain Piping:

1. ½ to 2 Inches: Type ‘L’ copper with wrought copper alloy drainage fittings with solder joints.

3.4 VALVE APPLICATIONS
A. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:

1. Shutoff Duty: Use gate, ball, or butterfly valves.
2. Throttling Duty: Use globe, ball, or butterfly valves.

3.5 PIPING INSTALLATION, GENERAL

A. Basic piping installation requirements are specified in Division 15 Section "Basic Mechanical Materials and Methods."

3.6 WATER DISTRIBUTION PIPING INSTALLATION

A. Install piping level without pitch.

3.7 DRAINAGE AND VENT PIPING INSTALLATION


B. Make changes in direction for drainage and vent piping using appropriate Y branches, Y branches with 1/8 bends, and long-sweep 1/4, 1/5, 1/6, 1/8, and 1/16 bends. Sanitary tees and short-sweep quarter bends may be used on vertical stacks of drainage lines where change in direction of flow is from horizontal to vertical. Use long-turn double-Y-branch and 1/8-bend fittings where 2 fixtures are installed back to back or side by side and have a common drain. Straight tees, elbows, and crosses may be used on vent lines. Make no change in direction of flow greater than 90 degrees. Where different sizes of drainage pipes and fittings are connected, use proper size standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.

C. Lay buried building drains beginning at low point of each system, true to grades and alignment indicated, with unbroken continuity of invert. Place hub or bell ends of piping facing upstream. Install required gaskets according to manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Maintain swab or drag in piping and pull past each joint as completed.

D. Install drainage and vent piping at the following minimum slopes, except where another slope is indicated:

1. Horizontal Sanitary Drainage Piping: 1/8 inch per foot (1 percent) to 5ft. within the bldg.
2. Storm Building Drain: 1/8 inch per foot (1 percent) to 5ft. within the bldg.
3. Vent Piping: 1/8 inch per foot (1 percent).

E. Sleeves are not required for cast-iron soil pipes passing through concrete slab, without membrane waterproofing, on grade.

3.8 JOINT CONSTRUCTION

A. Basic piping joint construction is specified in Division 15 Section "Basic Mechanical Materials and Methods."

1. Compression Joint: Make with neoprene gasket matching class of pipe and fittings.
2. Hubless Joint: Make with neoprene gasket and sleeve or clamp.

C. PE Heat-Fusion and Compression Joints: Conform to ASTM D 3309.

3.9 INSTALLATION OF VALVES

A. Sectional Valves: Install sectional valves close to main on each branch and riser serving 2 or more plumbing fixtures or equipment connections and where indicated. Use gate or ball valves for sectional valves 2 inches and smaller. Use gate or butterfly valves for sectional valves 2-1/2 inches and larger.

B. Shutoff Valves: Install shutoff valves on inlet to each plumbing equipment item, on each supply to each plumbing fixture not having stops on supplies, and elsewhere as indicated. For shutoff valves 2 inches and smaller, use gate or ball valves; for shutoff valves 2-1/2 inches and larger, use gate or butterfly valves.

C. Drain Valves: Install drain valves specified in Division 15 Section "Special Systems" on each plumbing equipment item located to drain equipment for service and repair. Install drain valve at base of each riser, at low points of horizontal runs, and where required to drain water distribution piping system.

1. Install hose-end drain valves at low points in water mains, risers, and branches.

D. Check Valves: Install swing check valve on discharge side of each pump and elsewhere as indicated. Use MSS SP-80, Class 125, cast-bronze body for 2-inch and smaller piping and MSS SP-71, Class 125, cast-iron body for 2-1/2-inch and larger piping.

E. Balance Valves: Install valve in each hot-water circulating loop, discharge side of each pump, and elsewhere as indicated. Use ball valve for 2-inch and smaller piping and butterfly valve for 2-1/2-inch and larger piping.

3.10 HANGERS AND SUPPORTS INSTALLATION

A. Hanger and support devices are specified in Division 15 Section "Hangers and Supports."

B. Install hangers for horizontal piping with following maximum spacing and minimum rod sizes:

<table>
<thead>
<tr>
<th>Nom. Pipe Size (Inches)</th>
<th>Steel Pipe Max. Span (Feet)</th>
<th>Copper Tube Max. Span (Feet)</th>
<th>Min. Rod Diameter (Inches)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 3/4</td>
<td>7</td>
<td>5</td>
<td>3/8</td>
</tr>
<tr>
<td>1</td>
<td>7</td>
<td>6</td>
<td>3/8</td>
</tr>
<tr>
<td>1-1/4</td>
<td>7</td>
<td>7</td>
<td>3/8</td>
</tr>
<tr>
<td>1-1/2</td>
<td>9</td>
<td>8</td>
<td>3/8</td>
</tr>
<tr>
<td>2</td>
<td>10</td>
<td>8</td>
<td>3/8</td>
</tr>
<tr>
<td>2-1/2</td>
<td>11</td>
<td>9</td>
<td>1/2</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>10</td>
<td>1/2</td>
</tr>
<tr>
<td>3-1/2</td>
<td>13</td>
<td>11</td>
<td>1/2</td>
</tr>
<tr>
<td>4</td>
<td>14</td>
<td>12</td>
<td>5/8, 1/2 for</td>
</tr>
<tr>
<td>5</td>
<td>16</td>
<td>13</td>
<td>5/8, 1/2 for</td>
</tr>
<tr>
<td>6</td>
<td>17</td>
<td>14</td>
<td>3/4, 5/8 for</td>
</tr>
<tr>
<td>8</td>
<td>19</td>
<td>16</td>
<td>7/8, 3/4 for</td>
</tr>
</tbody>
</table>

1. Support vertical steel pipe and copper tube at each floor.
C. Conform to table below for maximum spacing of supports:

<table>
<thead>
<tr>
<th>Pipe Material</th>
<th>Horizontal</th>
<th>Vertical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cast-Iron Soil Pipe</td>
<td>5</td>
<td>15</td>
</tr>
<tr>
<td>Copper Tubing - 1-1/4 Inches</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>and Smaller</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper Tubing - 1-1/2 Inches</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>and Larger</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Steel Pipe</td>
<td>12</td>
<td>15</td>
</tr>
</tbody>
</table>

D. Pipe Attachments: Install the following:

1. Riser Clamps: MSS Type 8 or Type 42 for vertical runs.
2. Adjustable Steel Clevis Hangers: MSS Type 1 for individual straight horizontal runs 100 feet and less.
3. Adjustable Roller Hangers: MSS Type 43 for individual straight horizontal runs longer than 100 feet.
4. Spring Cushion Rolls: MSS Type 49, where indicated, for individual straight horizontal runs longer than 100 feet.
5. Pipe Rolls: MSS Type 44 for multiple straight horizontal runs 100 feet or longer. Support pipe rolls on trapeze.
6. Spring Hangers: MSS Type 52 for support of base of vertical runs.

E. Support cast-iron soil pipe and fittings not included in table, at maximum horizontal spacing of 5 feet, except 10-foot sections of pipe may be supported at 10-foot spacing and at maximum vertical spacing of 15 feet.

F. Support pipe and tubing not included in table according to manufacturer's recommendations.

### 3.11 CONNECTIONS

A. Supply Runouts to Fixtures: Install hot- and cold-water supply piping runouts of sizes indicated, but not smaller than required by plumbing code to fixtures.

B. Drainage Runouts to Fixtures: Provide drainage and vent piping runouts, with approved trap, of sizes indicated, but not smaller than required by plumbing code, to plumbing fixtures and drains.

C. Locate drainage piping runouts as close as possible to bottom of floor slab supporting fixtures or drains.

D. Mechanical equipment connections: Connect hot and cold water supply piping system to mechanical equipment as indicated. Provide shutoff valve and union for each connections. Use flanges instead of unions for 2 1/2 inches and larger.

### 3.12 FIELD QUALITY CONTROL

A. Inspect water distribution piping as follows:

1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction.
2. During progress of the installation, notify the plumbing official having jurisdiction at least 24 hours prior to time inspection must be made. Perform tests specified below in presence of the plumbing official.
a. Roughing-In Inspection: Arrange for inspection of piping system before concealed or closed-in after system roughing-in and prior to setting fixtures.

b. Final Inspection: Arrange for final inspection by plumbing official to observe tests specified below and to ensure compliance with requirements of plumbing code.

3. Reinspections: When a plumbing official finds that piping system will not pass test or inspection, make required corrections and arrange for reinspection by the plumbing official.

4. Reports: Prepare inspection reports signed by plumbing official.

B. Test water distribution piping as follows:

1. Test for leaks and defects in new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of system tested.

2. Leave uncovered and unconcealed in new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved for testing.

3. Cap and subject the piping system and test per U.P.S. (Uniform Plumbing Code) & City of L.A. Code requirements.

4. Repair leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.

5. Prepare reports for tests and required corrective action.

C. Inspect drainage piping as follows:

1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.

2. During progress of installation, notify the plumbing official having jurisdiction at least 24 hours prior to time such inspection must be made. Perform tests specified below in presence of the plumbing official.

a. Roughing-In Inspection: Arrange for inspection of piping system after system roughing-in, before concealing, and prior to setting fixtures.

b. Final Inspection: Arrange for final inspection by plumbing official to observe tests specified below and to ensure compliance with requirements of plumbing code.

3. Reinspections: Make required corrections and arrange for reinspection by plumbing official when piping system fails to pass test or inspection.

4. Reports: Prepare inspection reports signed by the plumbing official.

D. Drainage and Vent Piping System Tests: Test drainage and vent systems according to procedures of authority having jurisdiction or, in absence of published procedure, as follows:

1. Test for leaks and defects in new drainage and vent piping systems and parts of existing systems that have been altered, extended, or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.

2. Leave uncovered and unconcealed in new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose for testing work that has been covered or concealed before it has been tested and approved.

3. Rough Plumbing Test Procedure: Except for outside leaders and perforated or open-jointed drain tile, test piping of plumbing drainage and venting systems on completion of roughing-in piping installation. Tightly close all openings in piping system and fill with water to point of overflow, but not less than 10 feet head of water. Water level shall not
drop during the period from 15 minutes before inspection starts through completion of inspection. Inspect joints for leaks.

4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and their traps filled with water, test connections and prove gastight and watertight. Plug stack openings on roof and building drain where it leaves the building and introduce air into the system equal to pressure of 1-inch water column. Use a U tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.

5. Repair leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.

6. Prepare reports for tests and required corrective action.

3.13 CLEANING

A. Clean and disinfect water distribution piping as follows:

1. Purge new potable water distribution piping systems and parts of existing potable water systems that have been altered, extended, or repaired prior to use.
2. Use purging and disinfecting procedure prescribed by authority having jurisdiction or, if a method is not prescribed by that authority, the procedure described in either AWWA C651 or AWWA C652 or per IAPMO Code (Uniform Plumbing Code).

3.14 COMMISSIONING

A. Fill water systems.

B. Before operating systems, perform these steps:

1. Close drain valves, hydrants, and hose bibbs.
2. Open shutoff valves to full open position.
3. Open throttling valves to proper setting.
4. Remove plugs used during testing of piping systems and plugs used for temporary sealing of piping during installation.
5. Remove and clean strainer screens. Close drain valves and replace drain plugs.
6. Remove filter cartridges from housings and verify that cartridges are as specified for application where used, clean, and ready for use.

C. Check plumbing equipment and verify proper settings, adjustments, and operation. Do not operate water heaters before filling with water.

D. Check plumbing specialties and verify proper settings, adjustments, and operation.

E. Energize pumps and verify proper operation.

3.15 PROTECTION

A. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day or when work stops.

END OF SECTION
SECTION 15440
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements of the following Division 15 Sections apply to this Section:
   1. Division 15010, Section "Basic Mechanical Requirements."
   2. Division 15030, Section "Electrical Requirements for Mechanical Equipment."
   3. Division 15050, Section "Basic Mechanical Materials and Methods."

C. Code Standards:
   1. Comply with all pertinent recommendations contained in last edition of Los Angeles Plumbing Code, California Water Conservation Standards and all other applicable codes.

1.2 SUMMARY

A. This Section includes plumbing fixtures and trim, fittings, and accessories, appliances, appurtenances, equipment, and supports associated with plumbing fixtures.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 15100, Section "Valves" for valves used as supply stops.
   2. Division 15400, Section Plumbing.

C. Products furnished but not installed under this Section include:
   1. Plumbing fittings (including faucets) and piping indicated, for fixtures, appliances, appurtenances, and equipment specified in other sections.

D. Products installed but not furnished under this Section include:
   1. Accessories, appliances, appurtenances, and equipment specified in other sections, requiring plumbing services or fixture-related devices, as indicated.

1.3 DEFINITIONS

A. Accessible: Describes a plumbing fixture, building, facility, or portion thereof that can be approached, entered, and used by physically handicapped people.

B. Accessory: Device that adds effectiveness, convenience, or improved appearance to a fixture but is not essential to its operation.

C. Appliance: Device or machine designed and intended to perform a specific function.

D. Appurtenance: Device or assembly designed to perform some useful function when attached to or used with a fixture.
E. Equipment: Device used with plumbing fixtures or plumbing systems to perform a certain function for plumbing fixtures but that is not part of the fixture.

F. Fitting: Fitting installed on or attached to a fixture to control the flow of water into or out of the fixture.

G. Fixture: Installed receptor connected to the water distribution system that receives and makes available potable water and discharges the used liquid or liquid-borne wastes directly or indirectly into the drainage system. The term "Fixture" means the actual receptor, except when used in a general application where terms "Fixture" and "Plumbing Fixture" include associated trim, fittings, accessories, appliances, appurtenances, support, and equipment.

H. Roughing-In: Installation of piping and support for the fixture prior to the actual installation of the fixture.

I. Support: Device normally concealed in building construction, for supporting and securing plumbing fixtures to walls and structural members. Supports for urinals, lavatories, and sinks are made in types suitable for fixture construction and the mounting required. Categories of supports are:
   1. Carrier: Floor-mounted support for wall-mounted water closet, and support fixed to wall construction for wall-hung fixture.
   2. Chair Carrier: Support for wall-hung fixture, having steel pipe uprights that transfer weight to the floor.
   3. Chair Carrier, Heavy Duty: Support for wall-hung fixture, having rectangular steel uprights that transfer weight to the floor.
   4. Reinforcement: Wood blocking or steel plate built into wall construction, for securing fixture to wall.

J. Trim: Hardware and miscellaneous parts, specific to a fixture and normally supplied with it required to complete fixture assembly and installation.

1.4 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data for each type of plumbing fixture specified, including fixture and trim, fittings, accessories, appliances, appurtenances, equipment, supports, construction details, dimensions of components, and finishes.

C. Wiring diagrams for field-installed wiring of electrically operated units.

D. Manufacturer's descriptive data and installation instructions shall be submitted for approval.

1.5 QUALITY ASSURANCE


B. Listing and Labeling: Provide electrically operated fixtures specified in this Section that are listed and labeled.
1. The terms "listed" and "labeled" shall be as defined in the National Electrical Code, Article 100.

C. Design Concept: The drawings indicate types of plumbing fixtures and are based on the specific descriptions, manufacturers, models, and numbers indicated. Plumbing fixtures having equal performance characteristics by other manufacturers may be considered provided that deviations in dimensions, operation, color or finish, or other characteristics are minor and do not change the design concept or intended performance as judged by the Architect. Burden of proof for equality of plumbing fixtures is on the proposer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver plumbing fixtures in manufacturer's protective packing, crating, and covering.

B. Store plumbing fixtures on elevated platforms in a dry location.

PART 2 - PRODUCTS

2.1 PLUMBING FIXTURES

A. Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:

1. Water Closets:
   a. American Standard, Inc.
   b. Acorn Engineering
   c. Bradley Corp.
   d. Crane Plumbing/Fiat Products.
   e. Kohler Co.

2. Urinals:
   a. American Standard, Inc.
   b. Acorn Engineering
   c. Bradley Corp.
   d. Crane Plumbing/Fiat Products.
   e. Kohler Co.

3. Lavatories:
   a. Acorn Engineering Co.
   b. American Standard, Inc.
   c. Bradley Corp.
   d. Crane Plumbing/Fiat Products.
   e. Eljer; A Household International Co.
   f. Just Manufacturing Co.
   g. Kohler Co.

4. Sinks:
   a. American Standard, Inc.
   b. Crane Plumbing/Fiat Products.
   c. Eljer; A Household International Co.
   d. Elkay Manufacturing Co.
5. Service Sinks:
   a. American Standard, Inc.
   b. Crane Plumbing/Fiat Products.
   c. Eljer; A Household International Co.
   d. Kohler Co.

6. Showers:
   a. Acorn Engineering Co.
   b. American Standard, Inc.
   c. Bradley Corp.
   d. Crane Plumbing/Fiat Products.
   e. Eljer; A Household International Co.
   f. Kohler Co.

7. Electric Water Coolers:
   a. Eljer; A Household International Co.
   b. Filtrine Manufacturing Co.
   c. Halsey Taylor; A Household International Co.
   d. Haws Drinking Faucet Co.
   e. Kohler Co.

8. Toilet Seats:
   b. Church Seat Co.
   c. Kohler Co.
   d. Olsonite Corp.

9. Flushometers:
   a. Sloan Valve Co.

10. Commercial/Industrial Cast-Brass Faucets:
    a. American Standard, Inc.
    b. Chicago Faucet Co.
    c. Crane Plumbing/Fiat Products.
    d. Eljer; A Household International Co.
    e. Kohler Co.
    g. Speakman Co.
    h. T & S Brass and Bronze Works, Inc.

11. Pressure Balance Shower Faucets:
    a. American Standard, Inc.
    b. Bradley Corp.
    c. Chicago Faucet Co.
    d. Crane Plumbing/Fiat Products.
e. Eljer; A Household International Co.  
f. Kohler Co.  
g. Leonard Valve Co.  
h. Powers Process Controls; A Unit of Mark Controls Corp.  
i. Symmons Industries, Inc.

14. Thermostatic Mixing Valve:
   a. Bradley Corp.  
b. Leonard Valve Co.  
c. Powers Process Controls; A Unit of Mark Controls Corp.  
d. Symmons Industries, Inc.

15. Miscellaneous Fittings (Except Faucets):
   a. Aquaflo Corp.  
b. Brass Craft Subsidiary; Masco Co.  
c. Central Brass Manufacturing Co.  
d. Chicago Faucet Co.  
e. Crane Plumbing/Fiat Products.  
f. Eljer; A Household International Co.  
g. Kohler Co.  
h. T & S Brass and Bronze Works, Inc.

16. Supports:
   a. Josam Co.  
c. Wade Div.; Tyler Pipe.  
d. Zurn Industries, Inc.; Hydromechanics Div.

17. Disposers:
   a. In-Sink-Erator Div.; Emerson Electric Co.  
b. Thermador/Waste King; A Masco Co.

18. Water Filters:
   a. EBCO Manufacturing Co.  
b. Filtrine Manufacturing Co.  
c. Halsey Taylor; A Household International Co.  
d. Haws Drinking Faucet Co.  
e. Sunroc Corp.

19. Sensor - Operated Faucets:
   a. Acorn Engineering Co.  
b. Sloan Valve Co.  
c. Powers Process Control  
d. Speakman Co.  
e. Bradley Corp.  
f. Symmons Industries Inc.

2.2 PLUMBING FIXTURES, GENERAL
A. Provide plumbing fixtures and trim, fittings, other components, and supports as specified herein and as required to completely install each fixture.

2.3 WATER CLOSET

A. Unless otherwise specified, all water closets are vitreous china water saver type, white.

B. All flush valves, stops and supplies are to be chrome plated brass. Flush valves to be non-hold open type.

C. Water Closet (WC-1): Wall hung, flush valve, low water consumption.

1. Fixture: Vitreous china, siphon jet action, elongated bowl, wall hung, 1-1/2" top spud. American Standard Afwall EL 1.6. #2257.103

2. Seat: Heavy duty white molded plastic with stainless steel hinge with stop, open front and less cover. Olsonite #95.

3. Support: Adjustable cast iron wall closet fixture support fitting and carrier with stub type foot support. J.R. Smith No. 0400 Series for vertical or 0200 Series for horizontal.

4. Flush valve: Quiet operating exposed 1.6 gallon per flush, sensor operated valve, vacuum breaker, IPS screwdriver angle stop, cast brass wall flange with set screw, coupling for 1-1/2" top spud and water saving device, vandal-proof metal cover. Sloan Royal 111-ES-S

D. Water Closet (WC-2A): Wall hung, flush valve, low water consumption. ADA accessible. (Mount at 17" to top of seat.)

1. Fixture: Vitreous china, siphon jet action, elongated bowl, wall hung, 1-112" top spud. American Standard Afwall EL 1.6. # 2257.103

2. Seat: Heavy duty, white molded plastic with stainless steel hinge with stop, open front and less cover. Olsonite #95.

3. Support. Adjustable cast iron wall closet, fixture support fitting and carrier with stub type foot support. J.R. Smith No. 0400 Series for vertical or 0200 Series for horizontal.

4. Flush valve: Quiet operating exposed 1.6 gallon per flush, sensor operated valve, ADA equipped, vacuum breaker, IPS screwdriver angle stop, cast brass wall flange with set screw, coupling for 1-1/2" top spud and water saving device, vandal-proof metal cover. Sloan Royal 111-ES-S.

E. Water Closet (WC-3): Holding Cells

1. Fixture: Fixture shall be fabricated from 14 gauge, Type 304 stainless steel. Construction shall be seamless welded and exposed surfaces shall have a satin finish. Countertop shall have an air-circulating, self-draining soap dish, paper holder on left side. Toilet shall be concealed blowout jet type with an elongated bowl, a self-draining flushing rim, and an integral contoured seat with a sanitary high polish finish, and shall meet ANSI 112.19.2M requirements, 1.6 gpf, shall withstand loadings of 5,000 pounds without permanent damage and shall be furnished with necessary fasteners for proper installation. Off floor Lav-Toilet Drinking Spout Comby, Willoughby Industries EC-1546-R/L-OF-BPH-PS-2-PBH-EB-OV-LW2-TWE-TW3-LF-T4-TB2-HPS-WS-TFE-FVT-FV-SK-TG. Provide angled right or left as applicable.
2. Flush Valve: Provide Sloan Hydraulic Royal Prison Flush Valve Model 9603-1.6 with remote flush button and rough brass finish for installation in wall behind fixture. Provide 18” x 24” security type access panel in wall above fixture.


1. Fixture: Fixture shall be fabricated from 14 gauge, Type 304 stainless steel, seamless welded and exposed surfaces shall have a satin finish and conform to ANSI, UFAS, and ADA requirements. Toilet shall be concealed blowout jet type with an elongated bowl, a self-draining flushing rim, and an integral contoured seat with a sanitary high polish finish, and shall meet ANSI 112.19.2M requirements, 1.6 gpf, shall withstand loadings of 5,000 pounds without permanent damage and shall be furnished with necessary fasteners for proper installation. Off floor Lav-Toilet Drinking Spout Comby. Willoughby Industries ECW-1545-L/R-OF-HC-BP-PS2-PBH-EB-OV-LW2-TWE-TW3-LF-T4-TB2-HPS-WS-TFE

2. Flush Valve: Provide Sloan Hydraulic Royal Prison Flush Valve Model 9603-1.6 with remote flush button and rough brass finish for installation in wall behind fixture. Provide 18” x 24” security type access panel in wall above fixture.

G. Water Closet (WC-4A): ADA accessible/DUI Hype.

1. Fixture: Fixture shall be fabricated from 14 gauge, Type 304 stainless steel, seamless welded and exposed surfaces shall have a satin finish. Toilet shall be concealed siphon jet type with an elongated bowl, a self-draining flushing rim, and an integral contoured seat with a sanitary high polish finish, and shall meet ANSI 112.19.2M requirements, 1.6 gpf, with gasketed waste outlet, shall withstand loadings of 5,000 pounds without permanent damage and shall be furnished with necessary fasteners for proper installation. Provide thru wall flush valve connector. Willoughby Industries ETW-1490-FM-BS-HC-TWE-TW3-PC-FVT-HPS-LF-MT-RTH2-T4-WS.

2. Flush Valve: Provide Sloan Hydraulic Royal Prison Flush Valve Model 9603-1.6 with remote flush button and rough brass finish for installation in wall behind fixture. Provide 18” x 24” security type access panel in wall above fixture. Locate push button in per drawings.

2.4 URINALS

A. Unless otherwise specified, all urinals are vitreous china water saver type, white.

B. All flush valves are to be chrome plated brass, non hold open.

C. Urinal (UR-1): Wall hung, flush valve, low water consumption.

1. Fixture: Vitreous china, siphon jet action urinal with flushing rim, 3/4” top spud, outlet threaded 2” IPS inside, 1.0 gallon flush. American Standard Allbrook # 6541.132.

2. Support: Floor mounted support with hanger brackets, bottom bearing plates and rigid rectangular upright supports. J. R. Smith No. 0637.

3. Flush Valve: Exposed sensor operated flush valve, equipped with non-hold open button, vacuum breaker, 1” screwdriver angle stop and coupling for 3/4” top spud, vandal-proof. Sloan Royal 186-1 ES-S.

D. Urinal (UR-2A): Wall hung, flush valve, low water consumption. ADA accessible. (Mount at 17” to top of rim.)
1. **Fixture:** Vitreous china, siphon jet action urinal with flushing rim, 3/4" top spud, outlet threaded 2" IPS inside, 1.0 gallon flush. American Standard Allbrook 1.0 #6541.132.

2. **Support:** Floor mounted support with hanger brackets, bottom bearing plates and rigid rectangular upright supports. J. R. Smith No. 0637.

3. **Flush valve:** Exposed sensor operated flush valve, equipped with non-hold open button, vacuum breaker, 1" screwdriver angle stop and coupling for 3/4" top spud, vandal-proof. Sloan Royal 166-1 ES-S.

### 2.5 LAVATORIES

A. Unless otherwise specified, all lavatories are white.

B. Provide chrome plated brass angle stops, supplies, tail piece, P trap and strainer for all lavatories.

C. **Lavatory (L-1):** Oval countertop, deck faucet.

   1. **Fixture:** Vitreous china, 19-1/4" x 17", undercounter, 4" center hole faucet holes, rear overflow. Oaklyn N # 496.011.
   
   2. **Faucet:** Symmons Model #S-6080 w/4" hole center, sensor operated, hardwired. Provide OMNS model L-400 Faucet Flow Control with .5 gpm flow rate.
   
   3. **Supply:** 1/2" H&CW with angle stops.
   
   4. **Drain:** Integral drain and 1-1/4" tailpiece. Chicago Faucet No. 327A.
   
   5. **Stops:** Loose-key angle valves, lock shield, flexible risers. Chicago Faucet No. 1006.
   
   6. **Trap:** Cast brass adjustable L.A. Pattern Type P-trap.

D. **Lavatory (L-2A):** Oval countertop, deck faucet. ADA accessible.

   1. **Fixture:** Same as L-1 except insulate supplies, trap & trap arm.
   
   2. **Faucet:** Same as L-1.
   
   3. **Supply:** Same as L-1.
   
   4. **Drain:** Integral drain and 1-1/4" tailpiece. Chicago #327A.
   
   5. **Stops:** Loose-key angle halves, lock shield, flexible riser. Chicago Faucet No. 1006.
   
   6. **Trap:** 1-1/4" x 1-1/2" cast brass adjustable L.A. Pattern Type P-trap with 90° elbow extended tailpiece and IPS brass waste to wall per ADA requirements.
   
   7. Insulate supplies, trap and trap arm.

E. **Lavatory (L-3A):** ADA accessible

   1. **Fixture:** Fixture shall be fabricated from 14 gauge, Type 304 stainless steel. Construction shall be seamless welded and exposed surfaces shall have a satin finish, and conform to ANSI, UFAS, and ADA requirements for accessibility. Countertop shall have an air-
circuiting, self-draining soap dish. ADA compliant Lavatory with Oval Bowl, Front Access Willoughby Industries HS-1310-96-HC-BP-PM2-LWE-LW1-MT-TB2-WS.

2. Valve: Pneumatically operated pushbutton valve to conform with NSF 61, Section 9-1997 lead-free requirements. Fixture shall have an ADA compliant control valve. Air Control.

F. Lavatory (L-4), (L-4A): Wall hung, deck faucet

1. Fixture: Vitreous china, 20" x 18", lavatory with front overflow and antis splash rim, less soap depressions, 4" center faucet holes, backsplash punched for concealed arm carriers. Lucerne. # 0355.012

2. Faucet: Same as L-1.

3. Supply: Same as L-1.

4. Drain: Integral drain and 1-1/4" tailpiece. Chicago #327A.

5. Stops: Loose-key angle valves, lock shield, flexible riser. Chicago Faucet No. 1006.

6. Trap: 1-1/4" x 1-1/2" cast brass adjustable L.A. Pattern Type P-trap with IPS brass waste to wall.


8. Insulate supplies, trap and trap arm.

G. Lavatory L-4A same as L-4 except insulate supplies, trap & trap arm.

2.6 STAINLESS STEEL SINKS

A. Manufacturers:

1. Design Basis: Just

2. Other Acceptable Manufacturers:
   a. Elkay.
   b. Just.

B. Sink (S-1A): Countertop, double compartment, deck faucet, disposer. ADA accessible.


2. Faucet: 8" spread, 1.6 gpm flow, deck mounted, chromeplated, gooseneck spout, 4" color indexed wrist blade handles, ceramic disk cartridges. Chicago 786-GN2FCXK.


4. Trap: Cast brass adjustable L.A. Pattern Type P-trap with IPS brass waste to wall.

C. Sink (S-2A): Countertop, single compartment, deck faucet. ADA accessible.
   1. Fixture: Stainless steel Type 304, 18 gauge, self-rimming, 19" x 21: x 6-1/2" deep undercoated, Just SL-ADA-1921-A-GR.
   2. Faucet: 8" spread, 1.6 gpm flow, deck mounted, chromeplated, gooseneck spout, 4" color indexed wrist blade handles, ceramic disk cartridges. Chicago 786-GN2FCXK.
   4. Drain: Stainless steel grid, Type 316, with tailpiece, Just J-ADA-35.

D. Sink (S-3A): wall hung, three faucets.
   1. Fixture: Enameled cast iron, 60" x 18" x 7-3/4" deep, Kohler K-3203.
   4. Drain: Stainless steel grids, Type 316, with tailpiece, Just J-ADA-35.

E. Service Sinks, Type SS-1 – See plumbing plans, Fiat Products Model #TSB-3000 with stainless steel rim guards.
   1. Material: Terrazzo Composition.
   2. Dimensions: 24" x 24"
   4. Fittings and Accessories: Provide the following compatible components:

2.7 SHOWERS:

A. Shower (SH-1):
   1. Faucet: Symmons Model #96-1-295 Pressure Balancing Mixing Valve.
   2. Shower head, Arm, and Flange: Provide adjustable showerhead “OMNI” model series #A-749 with 1.5 gpm flow restrictor.
   3. Floor drain shall be same as FD-1 without A.T.P.
   4. Shower Enclosure assembly and shower pan, see Architectural drawings.

B. Shower (SH-2A):
   1. Faucet: Symmons Model #96-1-295 Pressure Balancing Mixing Valve.
   2. Shower head, Arm, and Flange: Provide adjustable showerhead “OMNI” model series #A-749 with 1.5 gpm flow restrictor. (Typical for two.)
   3. Floor drain shall be same as FD-1 without A.T.P.
   4. Shower Enclosure assembly and shower pan, see Architectural drawings.
   5. Diverter Valve: Symmons Model #4-458.
2.8 THERMOSTATIC MIXING VALVES

A. Manufacturers:
   1. Design Basis:
      a. Bradley.
      b. Lawler.
      c. Leonard.
      d. Symmons.

B. Provide recessed behind access panel adjacent to emergency shower and/or eyewash to provide tempered water.


2.9 EMERGENCY SHOWER AND EYEWASH

A. Manufacturers:
   1. Haws.
   2. Guardian.

B. ADA and California Accessible Installation. Green ABC plastic shower eye wash heads, galvanized steel schedule 40 piping, chrome plated pull-down bar, stainless steel pull rod with in 4 inches of wall.

C. Emergency Shower and Eye Wash (EEWS-1A): Haws Model 8155HWC.

D. Emergency Eye Wash (EEW-1A): ABS Eye/Face Wash heat with dust cover, stream control, ABS wall bracket, vacuum breaker, stainless steel jacketed hose and squeeze handle stay open chrome plated brass valve. Haws Model 8904, Encon, Guardian, Equipment or equivalent.

E. Water Cooler, Type EWC-1A - See plumbing plans - Elkay Wheelchair access Model # EHFS-A8. Provide two units, 6" apart.
   2. Water Cooler Type: Wall Mounted.
   3. Capacity: 7.6 GPH @ 50 F.
   5. Color or Finish: Stainless steel finish.
   7. Fittings and Accessories: Provide the following compatible components:
      b. Trap: P. Trap.
c. Power: FLA= 2.5 EA, Watts-325 EA, Hp=1/5, 115V, 1O, 60 EA.

F. Water Cooler, Type EWC-2A – See plumbing plans – Elkay Wheelchair access Model #LPTEA8C.
   2. Water Cooler Type: Recessed.
   3. Capacity: 7.5 GPH @ 50°F.
   5. Color or Finish: Stainless steel finish.
   7. Fittings and Accessories: Provide the following compatible components:
      b. Trap: P. Trap.

G. Drinking Fountain, Type DF-1A – See plumbing plans – Elkay Wheelchair access Model #EHFS-AD. Provide two units, 6" apart.
   2. Color or Finish: Stainless steel finish.
   4. Fittings and Accessories: Provide the following compatible components:
      b. Trap: P. Trap.

2.10 DRAINS

A. Floor Drain FD-1, see plumbing plans J.R. Smith Model No. 2005-A-Y-AP. Cast-Iron body, inside caulked with seepage pan flat, round nickel bronze strainers not less that 5" diameter for 2" outlet bodies, 7" for 3" outlet bodies and 8" for 4" outlet bodies.

B. Floor drain FD-2: See plumbing plans J.R. Smith # 2500 with vandal resistant screws, integral grate, threaded outlet. Provide Sloan #186.1 urinal manual flush valve in nearest cell toilet equipment area and run 1" pipe down to floor drain flushing connection.

C. Floor Drain (FD-3): Cast iron body, flashing collar, 8" round ductile iron tractor grate, sediment bucket, trap primer connection. J.R. Smith #2110-Y-BM.

D. Area Drain (AD-1): Cast iron body, flashing collar, tractor grate. J. R. Smith 2140-B-Y-U.

E. Roof Drain: (RD-1): Cast iron body, combined flashing clamp and gravel stop, cast iron dome strainer, underdeck clamp, extension and sump receiver. J.R. Smith #1310-ERC-Y.

F. Roof Drain (RD-2): Cast iron body, combined flashing clamp and gravel stop, cast iron flat strainer, underdeck clamp, extension and sump receiver. J. R. Smith 1416C-U-R-C.

G. Overflow Roof Drain (OD-1): Cast iron body, flashing clamp, gravel stop, cast iron dome strainer, 2" water dam underdeck clamp, extension and sump receiver. J.R. Smith #1310-ERC-Y-WD.


I. Trench Drain (TD-1): Concrete trench, cast iron traffic grate with frame by Architect and J.R. Smith #2210-Y-D drain.
2.11 FLOOR SINK
   A. Floor Sink FS-1: See plumbing plan. Jr. Smith Model No. 3140Y 6" x 8" deep, square cast-iron acid resistant enameled, bottom aluminum dome strainer with nickel bronze rim and ½ grate top.

2.12 P" TRAPS
   A. P" Traps: PT-1 see plumbing plan American Standard, Kohler, or Crane Cast Brass complete, Chrome Plated.

2.13 CLEANOUTS
   A. Cleanout assemblies (cleanout plug shall be line size) CO & WCO, see plumbing plan P-2 Jr Smith # 4532, Zurn # 2-1445-1, Josam # 58790-22, Wade # 8460R. Iron Body cleanout tee full line size up to 4" and round access plate. Plugs shall be brass, countersunk with tapped boss for 5/16" - #18 or 1/4" - #20 screw.

   B. Floor cleanout (FCO), see plumbing plans Jr Smith #4043, Josam # 56030-22, Wade # W-6000 & Zurn # 2-1400-3 (square). Jr Smith # 4023, Josam # 56010-22, Wade $ W-6000 & Zurn # 2-H00-2 (rounds.)

2.14 BACKFLOW PREVENTION ASSEMBLIES
   A. RPBFP-1 (Reduced Pressure Backflow Preventor) See plumbing plans, Watts 909 or Febco 805,

2.15 HOSEBIBS
   A. HB-1 (Recessed Hose Bibs), See plumbing plans Acorn Model # 8151 with stainless steel box, key lock, vacuum breaker and integral shut-off-valve.

   B. HB-2 (Free standing Hose Bibs), See plumbing plans Acorn #8126 brass body, hose threaded outlet with non-removable vandal proof feature, vacuum breaker and separate shut-off-valve.

2.16 ROOF RECEPTOR
   A. Roof Receptor (RR-1): J.R. Smith 2960-Y with 2" solid dam.

2.17 WATER HAMMER ARRESTERS
   A. Description: Stainless steel compression shell and bellows, pre-charged, permanently sealed, tested and certified by PDI. J.R. Smith Hydrotol or equivalent by Josam or Zurn.

2.18 AUTOMATIC TRAP PRIMERS (ATP)
   A. In wall behind access panel: Watts or equivalent by Precision Plumbing Products.

PART 3 - EXECUTION

3.1 EXAMINATION
   A. Examine roughing-in for potable cold water and hot water supplies and soil, waste, and vent piping systems to verify actual locations of piping connections prior to installing fixtures.

   B. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.
C. Do not proceed until unsatisfactory conditions have been corrected.

3.2 APPLICATION

A. Install plumbing fixtures and specified components, in accordance with designations and locations indicated on Drawings.

B. Install supports for plumbing fixtures in accordance with categories indicated, and of type required:
   1. Carriers for following fixtures:
      a. Wall-hanging water closets.
      b. Wall-hanging fixtures supported from wall construction.
   2. Chair carriers for the following fixtures:
      a. Wall-hanging urinals.
      b. Wall-hanging lavatories and sinks.
      c. Wall-hanging and electric water coolers.
   3. Heavy-duty chair carriers for the following fixtures:
      a. Accessible lavatories.
      b. Fixtures where specified.
   4. Reinforcement for the following fixtures:
      a. Floor-mounted sinks required to be secured to wall.
      b. Recessed, box-mounted electric water coolers.

3.3 INSTALLATION OF PLUMBING FIXTURES

A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturers' written installation instructions, roughing-in drawings, and referenced standards.

B. Install wall mounted lavatories, urinals and water closets with wall carriers mounted to the floor.

C. Install wall-hanging, flush valve water closets with support manufacturer's tiling frame or setting gage.

D. Install wall-hanging, flush valve urinals with gasket seals.

E. Fasten wall-hanging plumbing fixtures securely to supports attached to building substrate when supports are specified, and to building wall construction where no support is indicated. Backing for wall hung fixtures other than for those with supports or carriers shall be as follows:
   1. Stud walls: Install ¼" x 6" wide steel flat backing plate to the inside web of the studs and secured to at least three studs by welding or bolting.
   2. Concrete walls: Securely fasten steel brackets with heavy expansion shields and bolts of proper length.

F. Fasten floor-mounted fixtures and special fixtures having holes for securing fixture to wall construction, to reinforcement built into walls.
G. Fasten wall-mounted fittings to reinforcement built into walls.

H. Fasten counter-mounting-type plumbing fixtures to casework.

I. Secure supplies behind wall or within wall pipe space, providing rigid installation.

J. Set shower receptor drains and service sink in leveling bed of cement grout.

K. Install stop valve in an accessible location in each water supply to each fixture.

L. Install trap on fixture outlet except for fixtures having integral trap.

M. Securely anchor flush valves behind or within walls to be rigid and not subject to movement due to push or pull action on the valve.

N. Install escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and within cabinets and millwork. Use deep pattern escutcheons where required to conceal protruding pipe fittings.

O. Seal fixtures to walls, floors, and counters using a sanitary-type, one-part, mildew-resistant, silicone sealant in accordance with sealing requirements specified in Division 7 Section "Joint Sealers." Match sealant color to fixture color.

P. Provide chrome plated, rigid or flexible supplies to fixtures with stops, reducers and escutcheons.

3.4 INSTALLATION OF PIPING, VALVES AND EQUIPMENT

A. General: Refer to Section 15010, BASIC MECHANICAL REQUIREMENTS

B. Pitch: Run all horizontal sanitary and drain piping smaller than 4" at a uniform grade of not less than 1/4" per foot. Run all horizontal sanitary and drain piping 4" and larger at a uniform grade of not less than 1/8" per foot unless otherwise noted on the drawings.

C. Water piping within walls and rough-ins for fixtures and equipment: Provide copper plated steel support system soldered to piping and secured to building construction so that pipes cannot be displaced. Provide trisoiator or fire retardant closed cell elastomeric material between support system and building construction or other piping. Holdrite or equivalent.

D. Waste and vent piping within walls and rough-ins for fixtures and equipment: Provide copper plated steel support system for copper DWV piping or galvanized steel support system for cast iron or galvanized piping. Secure supports to piping and building construction so that pipes cannot be displaced. Provide felt strip isolation between dissimilar metals. Provide trisoiator for fire retardant closed cell elastomeric material between support system and building construction or other piping. Holdrite or equivalent.

E. Piping through walls serving fixtures, equipment and outlets. Provide temporary plastic sleeve installed around piping serving plumbing fixtures, equipment and outlets to provide clearance between the pipe and drywall or plaster construction at the point of pipe penetration. After the plumbing rough-in and drywall installation is completed, the plastic sleeve shall be removed and Type GR fire retardant sponge material installed to seal the pipe penetration. Specialty Products Acousto-sleeve or equivalent.

F. Underground piping: No-hub soil pipe not permitted.

G. Unions and flanges: Provide on piping to inlet and outlet of all apparatus and equipment to facilitate removal of equipment, and downstream of all shutoff valves.
H. Water hammer arresters: Install water hammer arresters at all quick closing valves such as flush valves, float valves, solenoid valves, etc. Size and locate all water hammer arresters as recommended by PDI Manual WH 201.

I. Non-potable water outlets: Identify each non-potable water outlet with a permanent engraved beveled edge bakelite name plate reading "DANGER - UNSAFE WATER - DO NOT DRINK'.

3.5 CONNECTIONS

A. Piping installation requirements are specified in other sections of Division 15. The Drawings indicate general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

1. Install piping connections between plumbing fixtures and piping systems and plumbing equipment specified in other sections of Division 15.

2. Install piping connections indicated between appliances and equipment specified in other sections, direct connected to plumbing piping systems.

3.6 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning fixtures and components, then retest. Repeat procedure until all units operate properly.

3.7 ADJUSTING AND CLEANING

A. Operate and adjust faucets and controls. Replace damaged and malfunctioning fixtures, fittings, and controls.

B. Operate and adjust disposers, hot water dispensers, and controls. Replace damaged and malfunctioning units and controls.

C. Adjust water pressure at drinking electric water coolers, and faucets, shower valves, flush valve and mixing valve having controls, to provide proper flow and stream.

D. Replace washers of leaking and dripping faucets and stops.

E. Clean fixtures, fittings, and spout and drain strainers with manufacturers’ recommended cleaning methods and materials.

F. Review the data in Operating and Maintenance Manuals. Refer to Division 1 Section "Project Closeout."

3.8 PROTECTION

A. Provide protective covering for installed fixtures and fittings.

B. Do not allow use of fixtures for temporary facilities, except when approved in writing by the Government Agency.

3.9 FIXTURE SCHEDULE
A. Provide plumbing fixtures as scheduled or approved equal on the following "Data Sheets." Each
Data Sheet begins with a new page.

3.10 SERVICE CONNECTIONS

A. Determine exact location of required water, drain, and sewer connections and make proper
connections to 5'-0" outside building.

B. All potable water lines shall be purged completely prior to use before connecting to the source(s)
of water for the project. The Contractor and the Plumbing Inspector shall visually ascertain the
quality of the water supply. The connections shall not be made unless the supplied water quality
is agreeable to both parties. Disagreement shall be referred to the City Engineer and for
resolution before proceeding.

3.11 WATER HAMMER ARRESTORS

A. Install water hammer arrestors indicated on the Drawings and in the following locations (only non-
ferrous arrestors may be used in copper water system).

1. Only water lines to service sinks, kitchen sinks, water closets and urinals.

2. Between the last two fixtures when three or more fixtures, other than those listed in 1
above, are served by a common header.

B. When possible, arrestor shall be installed in the wall or furring. When arrestor is installed in wall
or furring, furnish and access plate large enough to permit removal of the arrestor. The access
plate shall be a minimum of 2" larger in each direction than the arrestor. See equipment list for
sizes, makes, and models of arrestors. Where not specifically offered in the contract documents
installation shall be in accordance with the Plumbing and Drainage Institute Standard PDI-
WH201.

C. Each fixture water line shall be provided with a dampening device. When such service is not
provide by water hammer arrestors, provide an air chamber at each fixture supply. This shall be
an 18" long vertical piece of capped pipe one size larger than the branch to a fixture. In lieu of
individual air chambers, header air chamber may be used where header serves two fixtures.
These shall be located at each end of the header and shall be a 36" length of vertical pipe,
capped, not less than one pipe size larger than the header.

3.12 CLEANOUTS

A. Size: Cleanouts of same nominal size as pipe they serve except where they occur in piping
4" and larger, in which case they shall be 4" in size.

B. Accessibility: Make all cleanouts accessible. Use graphite on all cleanouts with all threads
being thoroughly greased after acceptable pressure test.

C. Locations:

1. At all horizontal offsets.

2. At ends of all lines more than 5' in length.

3. At 100’ maximum intervals in all horizontal runs within the buildings lines, unless
otherwise shown on the drawings.

4. At base of all stacks.
5. For cleanouts in finished portions of building, locations subject to Owner's representative's approval before installation.

3.13 DISINFECTION OF WATER SYSTEMS

A. General: Disinfect all hot and cold water systems per AWWA Standard C651-92 and the following.

B. Qualification, performance requirement, supervision and testing: Work performed and certified by an independent contractor, selected by this Contractor and approved by the Owner's representative. Work will not be acceptable if performed by the installing contractor of the plumbing and piping system or any subcontractor of the installing contractor. Perform disinfection under supervision of the Owner's representative. Give two days notice. Disinfection shall be subject to written approval upon receipt of satisfactory laboratory test results.

C. Certification: Submit four certificates stating (1) system capacity, (2) disinfectant used, (3) time and rate applied, and (4) resultant residuals in parts per million at completion of work.

D. Disinfecting agent: Use chlorine solution of type approved for water system disinfection.

E. Preparation:

1. Service cock: Provide service cock or valve within 3' of supply main for introducing disinfecting agent into lines.

2. Flushing: Leave each fixture for outlet wide open after final pressure tests until flow shows only clear water.

3. Domestic hot water temperature: Reduce to that of cold water system during disinfecting procedure.

F. Procedure:

1. Flushing: With system full of water and under main pressure, open all outlets.

2. Inject disinfectant through service cock at slow, even, continuous rate until orthotolidine test at each outlet shows chlorine residual concentration of more than 50 parts per million (ppm).

3. Close all outlets and valves including service valve at main and injection cock. Maintain for 24 hours.

4. Test: Orthotolidine test, after 24 hour period, shall indicate minimum chlorine residual concentration of 50 ppm. If not, repeat disinfection procedure until this standard is attained.

5. Final flushing: After satisfactory completion of above test, flush out system until orthotolidine tests show maximum chlorine residual of 0.6 ppm.

G. Bacteriological analysis of water: After final flushing, analyze water samples to test negative for coil-aerogene organisms. Analysis to indicate total plate count less than 100 bacteria per cc or equal to control sample.
H. Final approval: If analysis results are not satisfactory, repeat disinfection procedure until specified standards are met.

3.14 TESTING AND ADJUSTING

A. General: Adjust each piece of equipment and all systems to insure proper functioning of controls, elimination of noise and vibration, and left in first-class operating condition.

B. Defective work: Remove and replace any piece of apparatus, work, or material failing any tests. Retest portion of work replaced by Contractor at his own expense.

C. Notice: Provide 48 hour notice that piping is ready for testing. Test in accordance with all local and state ordinances.

D. Protection: Isolate all equipment subject to damage from test pressure. Make no test against a service valve or meter.

E. Tests:

1. Domestic and industrial water systems: Test with water at a hydrostatic pressure of 200 psi.
2. Sanitary, sewer, waste, vent, drain and storm water systems: Fill piping with water, to top of highest point, at not less than 5 psi.
3. Fuel gas and compressed air systems: Test with air at 150 psi. Test each joint with soap suds.
4. Duration: Maintain all tests, unless otherwise noted, without leaks or pressure loss for a minimum period of 8 hours.

F. Flow Test: Conduct flow test on all fixture drains, roof drains, floor drains, area drains, floor sinks, etc., prior to building occupancy. Allow full flow of water into each drain for 15 minutes and check for leaks, stoppage or sluggish flow. Clean drains where necessary. Test must be witnessed by the Owner's Representative.

G. Perform operational tests on all machinery and devices to determine compliance with specifications. Equipment to function quietly and efficiently. Repair or correct undue noise or vibration caused by malfunctioning of piping and equipment before acceptance.

3.15 LABELS AND IDENTIFICATION

A. Provide valve tags, piping systems and equipment identifications as specified in Section 15010, BASIC REQUIREMENTS AND MATERIALS.

3.16 VALVES ON PLUMBING SYSTEM

A. Furnish and install gate, globe, angle and check valves on all plumbing work at the following locations whether indicated or not:

1. A gate valve to control water lines to each group of fixtures. A group of fixtures shall be considered to be three or more fixtures all of which are in the same room. These valves shall be accessible from the room in which the fixtures are installed and shall be located at approximately 3 feet, but not more than 7 feet, form the floor. These valves shall control only the fixtures in the room in which they are installed.
2. A gate on each building branch line, which two or more fixtures when these fixtures do not have a group control valve as specified in the paragraph immediately above.

3. A partition stop on the supply to a drinking fountain and on each concealed fixture supply. This partition stop shall be located below the fixture, one foot above the floor, unless otherwise specified.

4. A loose key partition stop adjacent to an controlling the water to each sill cock and hose bib except that

   (1) Stops will not be required for individual hose bibs when these hose bibs are on a branch line serving only the hose bibs and the branch line is equipped with a shut-off valve.

5. A gate valve at each location where a water line is connected to a piece of equipment other than mentioned above.

6. A check valve on each hot water return line where it connects to a hot water storage tank or water heater.

7. All exposed stops on plumbing fixture supplies all exposed shower valves and the exposed part of concealed valves or stops shall be chromium plated and polished, unless otherwise specified.

8. All handles, hand wheels and operating nuts shall be of steel, brass or cast iron and shall be removable. Unless specified to be loose key type, handles shall be securely fastened to their stems. On exposed outdoor valves, omit operating handles and provide operating nuts.

9. Furnish a handle or key for each five, or fraction thereof, loose key valves, bibs, or stops and deliver same to the Government Agency representative.

   END OF SECTION
PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

B. Requirements of the following Division 15 Sections apply to this section:
   1. "Basic Mechanical Requirements."
   2. "Basic Mechanical Materials and Methods."
   3. "Basic Piping Materials and Methods."

1.2 SUMMARY

A. This Section includes the following types of plumbing pumps:
   1. Inline circulators.
   2. Vertical, inline pumps.
   4. Submersible sump pumps. (Duplex)

B. Related Sections: The following sections contain requirements that relate to this section:
   1. Division 3 Section "Concrete Work" for specifications on concrete and reinforcing materials and concrete placing requirements for equipment pads.
   2. Division 15 Section "Vibration Control" for inertia pads, isolation pads, spring supports, and spring hangers.
   3. Division 15 Section "Special Systems" for horizontal and vertical, engine-driven pumps for.
   4. Division 15 Section "HVAC Pumps" for hydronic system centrifugal pumps.
   5. Division 16 Section "Electrical Connections for Equipment" for power-supply wiring including field-installed disconnects and required electrical devices.
   6. Division 16 Section "Motor Controllers" for field-installed, a.c. motor controllers.

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data including certified performance curves, weights (shipping, installed, and operating), furnished specialties, and accessories, plus installation and start-up instructions.

C. Shop drawings showing layout and connections for plumbing pumps. Include setting drawings with templates, and directions for installation of foundation bolts, anchor bolts, and other anchorages.

D. Wiring diagrams detailing wiring for power, signal, and control systems; differentiating between manufacturer-installed wiring and field-installed wiring.

E. Maintenance data for plumbing pumps, for inclusion in Operating and Maintenance Manuals specified in Division 1 and Division 15 Section "Basic Mechanical Requirements."
1.4 QUALITY ASSURANCE

A. Hydraulic Institute Compliance: Design, manufacture, and install plumbing pumps in accordance with "Hydraulic Institute Standards."

B. National Electrical Code Compliance: Components shall comply with NFPA 70 "National Electrical Code."

C. UL Compliance: Plumbing pumps shall be listed and labeled by UL and comply UL Standard 778 "Motor Operated Water Pumps."

D. NEMA Compliance: Electric motors and components shall be listed and labeled NEMA.

E. SSPMA Compliance: Test and rate sump and sewage pumps in accordance with the Sump and Sewage Pump Manufacturers Association (SSPMA) Standards.

F. Single-Source Responsibility: Obtain plumbing pumps of the same type from a single manufacturer.

G. Design Criteria: The Drawings indicate sizes, profiles, connections, and dimensional requirements of plumbing pumps and are based on the specific manufacturer types and models indicated. Pumps having equal performance characteristics by other manufacturers may be considered, provided that deviations in dimensions and profiles do not change the design concept or intended performance as judged by the Architect. The burden of proof for equality of plumbing pumps is on the proposer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store pumps in a dry location.

B. Retain shipping flange protective covers and protective coatings during storage.

C. Protect bearings and couplings against damage from sand, grit, and other foreign matter.

D. For extended storage times (greater than 5 days), dry internal parts with hot air or a vacuum-producing device. After drying, coat internal parts with light oil, kerosene, or antifreeze. Dismantle bearings and couplings, dry and coat with an acid-free, heavy oil, and tag and store in dry location.

E. Comply with manufacturer's rigging instructions for handling.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

1. Inline Circulators:
   c. "Series 60," Bell & Gossett, ITT.
   d. "1600 Series," Taco, Inc.

2. Submersible Sump Pumps:
a. "Type VSS-2-1/2D," Federal Pump Corp.
d. Paco. Model 480-11, 1750 RPM.
e. Sta-Rite – Model EC4 Series

3. Base-Mounted, Separately Coupled, End-Suction Pumps:
   a. "1510 Series, Model 2BC" Bell & Gossett.
   c. "PF2g," Amtrol, Inc.
   e. "360 Series," Aurora Pumps.
   f. "Type CCB, CGB, and CKB," Federal Pump Corp.
   h. "FM Series," Taco, Inc.
   i. "Uni-Pumps, Types GB, GLB, KB, KHB, and KLB," Weinman, Mueller Pump.

2.2 PUMPS, GENERAL

A. Pumps and circulators: factory assembled and factory tested.

B. Preparation for shipping: After assembly and testing, clean flanges and exposed machined metal surfaces and treat with an anticorrosion compound. Protect flanges, pipe openings, and nozzles with wooden flange covers or with screwed-in plugs.

C. Motors: Conform to NEMA standards; single, multiple, or variable speed with type of enclosure and electrical characteristics as indicated; have built-in thermal-overload protection and grease-lubricated ball bearings. Select motors that are nonoverloading within the full range of the pump performance curve.

D. Apply factory finish paint to assembled, tested units prior to shipping.

2.3 INLINE CIRCULATORS

A. General Description: Circulators shall be horizontal inline, centrifugal, separately coupled, single-stage, all-bronze, radially split case design, with mechanical seals, and rated for 125 psig working pressure and 225 deg F continuous water temperature.

B. Casings: Bronze, with threaded companion flanges for piping connections smaller than 2-1/2 inches, and threaded gage tappings at inlet and outlet connections.

C. Impeller: Statically and dynamically balanced, closed, overhung, single suction, fabricated from Rolled Temper brass conforming to ASTM B 36, and keyed to shaft.

D. Pump Shaft and Sleeve: Steel shaft with oil-lubricated copper sleeve.

E. Mechanical Seals: Carbon steel rotating ring, stainless-steel spring, ceramic seat, and Buna-N bellows and gasket.

F. Pump Bearings: Oil-lubricated, bronze journal and thrust bearings.

G. Motor Bearings: Oil-lubricated sleeve bearings.

H. Shaft Couplings: Flexible; capable of absorbing torsional vibration and shaft misalignment.
I. Motors: Resiliently mounted to the pump casing.

2.4 SUBMERSIBLE SUMP PUMPS

A. General Description: Pumps shall be duplex, non-clog, vertical, centrifugal, direct connected, end suction, bronze fitted, complete with integral inlet strainer, operating controls, and sump cover.

B. Casing: Cast iron with integral cast-iron inlet strainer and legs to elevate the pump to permit flow into the impeller. Discharge companion flange shall be arranged for vertical discharge and suitable for plain-end pipe connection.

C. Impeller: Statically and dynamically balanced, semiopen, overhung, single suction, fabricated from cast bronze conforming to ASTM B 584, keyed to shaft and secured by a locking capscrew.

D. Pump and Motor Shaft: Stainless steel, with factory-sealed, grease-lubricated ball bearings.

E. Seals: Double mechanical seals.

F. Motor: Hermetically sealed, capacitor start, with built-in overload protection, with 10-foot, 3-conductor, waterproof cable and grounding plug and explosion proof.

G. Basin: Fiber glass with inlet connections.

H. Basin: Cast-iron with inlet connections.

I. Basin: Welded steel with inlet connections.

J. Cover: Cast iron, round cover, access opening and openings for pump shaft, control rod, and discharge piping.

K. Controls: NEMA 1, float switch complete with float, float rod, and rod buttons.

L. Controls:
   1. Pump controller shall be of the mercury float switch type capable of ON-OFF pump control, alternating and high water alarming.
   2. Alternating pumps: An electric alternator shall alternate the pump operation and shall operate both pumps in the event one pump cannot handle the load.

M. Control panel: Intrinsically safe, NEMA 1 enclosure, prewired for one point feeder supply connection and shall be as specified, and shall include the following:
   1. Across-the-line magnetic type starter with overload protection and HOA switch for pump.
   2. Circuit breaker switch.
   3. Control transformer with fused primary and fused secondary protection.
   4. For high level alarm circuit, provide a two pole relay with N/O and N/C contacts for monitoring by the Building Automation System.
   5. Pilot lights: Green lights indicating pumps operation, red lights indicating alarm, amber lights indicating moisture.
   6. Alarm bell mounted on panel door with silencing button.

N. Mounting: Pumps shall be mounted within concrete sump and discharge piping extending through the side of concrete sump.

O. Coverplate and frame: Standard cast iron grade with mounting frame.
P. Sumps: Concrete sumps shall be provided under the work if another Division. This Contractor shall furnish coverplate mounting frame for installation by the concrete trades and be responsible for the proper drilling and fitting.

2.5 BASE-MOUNTED, SEPARATELY COUPLED, END-SUCTION PUMPS

A. General Description: Pumps shall be base-mounted, centrifugal, separately coupled, end-suction, single-stage, all-bronze, radially split case design, and rated for 175 psig working pressure and 225 deg F continuous water temperature.

B. Casings: Bronze, with flanged piping connections, and threaded gage tappings at inlet and outlet flange connections.

C. Impeller: Statically and dynamically balanced, closed, overhung, single suction, fabricated from cast bronze conforming to ASTM B 584, keyed to shaft and secured by a locking capscrew.

D. Wear Rings: Replaceable, bronze.

E. Pump Shaft and Sleeve Bearings: Steel shaft with bronze sleeve.

F. Seals: Stuffing box consisting of a minimum of 4 rings of graphite-impregnated braided yarn with a bronze lantern ring between center 2 graphite rings and a bronze packing gland.

G. Seals: Mechanical seals consisting of carbon steel rotating ring, stainless-steel spring, ceramic seat, and flexible bellows and gasket.

H. Pump Couplings: Flexible; capable of absorbing torsional vibration and shaft misalignment; complete with metal coupling guard.

I. Mounting Frame: Factory-welded frame and cross members, fabricated of steel channels and angles conforming to ASTM B 36. Fabricate for mounting pump casing, coupler guard, and motor. Grind welds smooth prior to application of factory finish. Motor mounting holes for field-installed motors shall be field drilled.

J. Motor: Secured to mounting frame with adjustable alignment on mounting frame.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas, equipment foundations, and conditions with Installer present, for compliance with requirements for installation and other conditions affecting performance of plumbing pumps. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Examine rough-in for plumbing piping systems to verify actual locations of piping connections prior to installation.

3.2 EQUIPMENT BASES

A. Construct concrete equipment pads as follows:
   1. Form concrete pads by using framing lumber with form release compounds. Chamfer top edge and corners of pad.
2. Install reinforcing bars, tied to frame, and place anchor bolts and sleeves using manufacturer's installation template.

3. Place concrete and allow to cure before installation of pumps. Use Portland Cement conforming to ASTM C 150, 4,000 psi compressive strength, and normal weight aggregate.

3.3 INSTALLATION

A. General: Comply with the manufacturer's written installation and alignment instructions.

B. Install pumps in locations and arrange to provide access for periodic maintenance, including removal of motors, impellers, couplings, and accessories.

C. Support pumps and piping separately so that the weight of the piping system does not rest on the pump.

D. Suspend inline pumps with althread hanger rod and vibration isolation hangers of sufficient size to support the weight of the pump independent from the piping system.

E. Basins: Install sump pump basins in indicated locations and connect to drainage lines. Brace interior of basin in accordance with manufacturer's instructions to prevent distortion or collapse during concrete placement. Refer to Division 3 for concrete work. Set cover over basin and fasten to top flange of basin. Install so cover is flush with finished floor.

3.4 ALIGNMENT

A. Align pump and motor shafts and piping connections after setting on foundations, after grout has been set and foundations bolts have been tightened, and after piping connections have been made.
   1. Adjust alignment of pump and motor shafts for angular and parallel alignment by one of the two methods specified in the Hydraulic Institute "Centrifugal Pumps - Instructions for Installation, Operation and Maintenance."

B. After alignment is correct, tighten the foundation bolts evenly but not too firmly. Fill the base plate completely with nonshrink, nonmetallic grout, with metal blocks and shims or wedges in place. After grout has cured, fully tighten foundation bolts.
   1. Alignment tolerances shall meet manufacturer's recommendations.

3.5 CONNECTIONS

A. General: Install valves that are same size as the piping connecting the pump.

B. Install suction and discharge pipe sizes equal to or greater than the diameter of the pump nozzles.

C. Install a nonslam check valve and globe valve on the discharge side of pumps.

D. Install a gate valve and strainer on the suction side of inline pumps.

E. Install a pump suction diffuser and gate valve on the suction side of base-mounted, end-suction pumps.

F. Install flexible connectors on the suction and discharge side of each base-mounted pump. Install flexible connectors between the pump casing and the discharge valves and upstream from the pump suction diffuser.
G. Install pressure gages on the suction and discharge of each pump at the integral pressure gage tappings provided.

H. Install pressure gage connector plugs in suction and discharge piping around pump. Pressure gage connector plugs are specified in Division 15 Section "Meters and Gages."

I. Electrical wiring and connections are specified in Division 16 sections.

J. Control wiring and connections are specified in other Division 15 sections.

3.6 FIELD QUALITY CONTROL

A. Check suction lines connections for tightness to avoid drawing air into the pump.

3.7 COMMISSIONING

A. Final Checks Before Start-Up: Perform the following preventative maintenance operations and checks before start-up:
   1. Lubricate oil-lubricated bearings.
   2. Remove grease-lubricated bearing covers and flush the bearings with kerosene and thoroughly clean. Fill with new lubricant in accordance with the manufacturer's recommendations.
   3. Disconnect coupling and check motor for proper rotation. Rotation shall match direction of rotation marked on pump casing.
   4. Check that pump is free to rotate by hand. For pumps handling hot liquids, pump shall be free to rotate with the pump hot and cold. If the pump is bound or even drags slightly, do not operate the pump until the cause of the trouble is determined and corrected.

B. Starting procedure for pumps with shutoff power not exceeding the safe motor power:
   1. Prime the pump, opening the suction valve, closing the drains, and prepare the pump for operation.
   2. Open the valve in the cooling water supply to the bearings where applicable.
   3. Open the cooling water supply valve if the stuffing boxes are water cooled.
   4. Open the sealing liquid supply valve if the pump is so fitted.
   5. Open the warm-up valve of a pump handling hot liquids if the pump is not normally kept at operating temperature.
   6. Open the recirculating line valve if the pump should not be operated against dead shutoff.
   7. Start motor.
   8. Open the discharge valve slowly.
   9. Observe the leakage from the stuffing boxes and adjust the sealing liquid valve for proper flow to ensure the lubrication of the packing. Do not tighten the gland immediately, but let the packing run in before reducing the leakage through the stuffing boxes.
   10. Check the general mechanical operation of the pump and motor.
   11. Close the recirculating line valve once there is sufficient flow through the pump to prevent overheating.

C. If the pump is to be started against a closed check valve with the discharge gate valve open, the steps are the same except that the discharge gate valve is opened some time before the motor is started.

END OF SECTION
SECTION 15480
WATER TREATMENT EQUIPMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish and install water treatment equipment for water systems as indicated and as specified.

B. Contractor will furnish and install all equipment, chemicals and service necessary to provide a complete water treatment program. A single water treatment company shall provide all products and services for sole responsibility for the first year from initial start-up. The water treatment company shall have been a recognized specialist in the field of industrial water laboratory, a Ph.D. chemist in its direct employ, and a complete research and development facility. Technical service representation shall be fully trained in all respects of industries water treatment and be geographically local (within 60 miles of site location) and have a minimum of 3 years direct experience in the treatment of industrial water systems.

1.2 DESIGN REQUIREMENTS

A. Water treatment equipment shall feed and control chemicals to protect the following systems:

1. **Hot Water Systems**: Corrosion control.

B. Water softener includes commercial water softening equipment for the following equipment:

1. **Steam cleaner (SR-1)**: Soft water

1.3 SUBMITTALS

A. Submit in accordance with Division 01: Submittals.

B. Submit shop drawings indicating flow diagrams and operation instruction manuals of systems.

1.4 QUALITY ASSURANCE

A. Comply with the provisions of Section 15010 Basic Mechanical Requirements.

B. Water treatment company shall furnish proof of a fully documented and operational quality assurance program. Said QA program shall assure customer of high quality service and be underwritten by an accredited organization.

PART 2 - PRODUCTS

2.1 CHEMICAL FEEDING EQUIPMENT

A. Shot feeder--shall be constructed of ten (10) gauge steel. Working pressure is 200 psi maximum at 200 degree F. Capacity shall be five (5) gallons minimum for closed loop application and 50 gallons minimum for cooling tower application. Installation shall be completes with all piping, valves, and fittings. Full opening shall be 3 1/2”. Fill cap shall
close with a quarter turn. Shall have bottom drain. Shall be capable of accepting filter bag kit for side stream filter operation.

B. Provide a pot feeder in bypass piping around hot water pump to control scales and corrosion in hot water system. Feeder shall be J.L. Wingert Con; or approved equal. Use a #2 up to 200 gallon capacity; a #5 for up to 750 gallon capacity and greater.

2.2 WATER SOFTENER EQUIPMENT

A. Factory-assembled, pressure-type, commercial water softeners having capacities and for electrical characteristics indicated.

2.3 SOFTENER TANKS

A. General: Single or multiple tanks as indicated, to provide total capacity of system.

B. Steel Tanks: Electric-welded, pressure-vessel quality, low carbon steel, ASME labeled for 100 psig, and hydrostatically tested at 150 psig.

1. Tanks Less Than 36 Inches In Diameter: With two 4 inch-diameter or 4 by 6 inch elliptical handholes, one in top head and one in lower side wall.
2. Tanks 36 Inches in Diameter and Larger: With minimum of 11 by 15 inch manhole in top head.
3. Support Legs: Constructed of structural steel, welded to lower tank head.
5. Finish: Spray-painted exterior with rust-resistant prime coat, 2 to 3 mils dry film thickness. Sandblasted tank interior and lined with epoxy polyamide coating, 8 to 10 mils dry film thickness.

C. Freeboard: Provide minimum freeboard of 50 percent for backwash expansion above normal ion exchange mineral bed level.

2.4 SOFTENER TANK DISTRIBUTION SYSTEMS

A. Upper Distribution: Single point-type upper distribution system, fabricated of Schedule 40, galvanized steel pipe and fittings.

2.5 CHEMICALS

A. Exchange Resin: High-capacity exchange resin of sulfonated polystyrene, stable over entire pH range with good resistance to bead fracture from attrition or shock. Provide resin having capacity of removing 30,000 grains of hardness as calcium carbonate, per cubic foot of resin, when regenerated with 15 pounds of salt.

B. Salt: High-purity pellet salt. Rock salt and granulated salt forms are not acceptable.

2.6 BRINE TANKS

A. Description: Single brine measuring and dry salt storage tank of sufficient size for at least 4 regenerations at full salting. Tank shall be fabricated of 3/16-inch-thick fiberglass or 3/8-inch-thick molded polyethylene, with cover; equipped with salt platform and screen, float-operated, plastic-fitted, brine valve for automatic control of brine withdrawn and fresh water refill, and brine tubing and fittings.

2.7 CONTROLS
A. General Description: Provide cycle controls, factory mounted and wired on units that incorporate adjustable duration of various steps of regeneration. Provide push-button start as well as complete manual operation. Provide electric time clock and switch for fully automatic operation and adjustable to initiate regeneration at any hour of day and any day of week or at fixed intervals.

B. Sequence of Operation: Program multiport pilot control valve to automatically pressure actuate main operating valve through steps of regeneration and return to service. Provide pointer on pilot valve to indicate cycle of operation. Provide means of manual operation of pilot control valve in event of power intervals.

C. Main Operating Valve: Industrial, automatic, multiport, diaphragm-type valve with following features:

1. Slow opening and closing (nonslam operation).
2. Diaphragm guiding on full perimeter from full open to full shut.
3. Dissimilar metals isolated within valve.
4. Internal automatic self-adjusting brine injector to draw brine and rinse at constant rate independent of pressure.
5. Single-unit valves with internal automatic bypass of untreated water during regeneration.
7. Requires no special tools for service.

D. Flow Control: Automatic flow controller to control proper backwash and flush rates over wide variations in operating pressure; requires no field adjustments.

E. Meter Controls: Equip each softener tank with automatic reset head water meter that will electrically activate signal-activated cycle controller to initiate regeneration at preset gallonage for next service run.

1. Provide electrical lockouts on multiple units to prevent more than one unit from regenerating simultaneously.

2.8 ACCESSORIES

A. Pressure gages for hard water inlet and soft water outlet.

B. Sampling cocks for hard water inlet and soft water outlet for each tank.

C. Position indicator to indicate position of main operating valve.

2.9 WATER TESTING SETS

A. Provide complete water testing set for each water softener, for hardness tests, in metal container suitable for wall mounting.

2.10 WATER TREATMENT CHEMICALS

A full one-year supply of water treatment chemicals shall be provided by contractor. Formulations will be as prescribed for the various systems specified. Formulations shall not contain any ingredients which may be harmful to system materials of construction and shall not endanger the health or safety of persons coming into contact with the materials. MSDS shall be provided for all chemicals furnished. No system shall be operated without benefit of chemical protection unless specified. Once initial passivation is achieved, any additional chemical necessary to recharge the
system due to water loss (other than recommended blow down/bleed) shall be provided by the Mechanical Contractor.

2.11 TEST EQUIPMENT

Provide all necessary test equipment and reagents to maintain chemicals in the control ranges specified. Test kits shall include carrying cases.

2.12 WATER TREATMENT SERVICE PROGRAM

Selected water treatment company shall provide all consulting services for one year from start-up of water systems. All services shall be provided by a fully trained representative of the water treatment company. Service provided shall include:

-Installation and system start-up recommendations
-Initial water analysis and recommendations.
-Training of operating personnel on proper feeding and control techniques.
-Periodic field service and consulting meetings.
-Any necessary log sheets and record forms.
-Any required laboratory and technical assistance

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation of water treatment equipment and startup shall be under the supervision of a representative of the water treatment equipment supplier.

B. Provide water treatment system as specified in this section and of the type required for the treatment of water in the system for Boiler, etc.

C. On condenser water systems, water meter controller and chemical pump shall be mounted on a polypropylene panel. Mounted on same panel will be piping manifold to include chemical injection fitting and all other valves, piping and fittings required for a complete installation.

3.2 WATER SOFTENER INSTALLATION

A. Install water softening equipment level and plumb, on concrete bases in accordance with manufacturer’s written instructions, layout drawings, the original design, and referenced standards. Maintain manufacturer’s recommended clearances. Orient so controls and devices needing servicing are accessible.

B. Install pressure gages on water inlet and outlet piping of each water softener. Pressure gages are specified in Division 15 Section 15135 “Meters and Gages.”

C. Install water testing sets near water softeners, wall-mounted, where indicated.

3.3 CONNECTIONS

A. Water Distribution Piping: Piping installation requirements are specified in Division 15 Section 15410 “Plumbing Piping.” The Drawings indicated the general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

1. Install piping adjacent to equipment to allow servicing and maintenance.
2. Connect water piping to units with shutoff valves and unions and provide full-size valued bypass around unit.
   a. Where water connections are made with dissimilar metal water distribution piping, make connections with dielectric fittings or dielectric unions specified in Division 15 Section 15050 “Basic Mechanical Materials and Methods.”
3. Install drains as indirect wastes to spill into open drains or over floor drains.

B. Install brine lines and fittings furnished by manufacturer but not specified to be factory mounted.

C. Electrical Connections: Power wiring, including disconnect switches, is specified in Division 16.
   1. Grounding: Connect unit components to ground in accordance with the National Electrical Code.

3.4 PRE-OPERATIONAL CLEANING

A. Contractor shall guarantee that no untreated water shall be circulated through heating and air conditioning system components for operation. All systems shall be flushed clean prior to operation. If Contractor should fail to carry out these requirements, he shall be fully responsible to remove all resulting scale or deposits from lines and equipment, and shall repair any damage without cost to the Owner.

B. The Contractor is responsible for chemically cleaning, flushing and charging with chemicals. Contractor shall notify the Owner when system is ready for operation and filling with water.

C. Prior to operation, hot water shall be cleaned to remove oil, grease, and rust oxides using following procedures:
   1. Flood system with a solution containing cleaning compound.
   2. Circulate system at 150 - 180°F. for a period of not less than 12 hours and not in excess of 24 hours. If heat cannot be provided, dosage should be doubled and circulated for 2 days.
   3. Cleaning solutions shall be drained and flushed with clean water until stable pH is obtained. Refill with treated water to stabilize water in system.

END OF SECTION
PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes piping, equipment, and related accessories, for general building, compressed air systems operating at 200 psig and below.

B. Related Sections: The following Sections contain requirements that relate to this Section:
   1. Division 3 Section "Cast-In-Place Concrete" for formwork, reinforcement, and concrete for concrete bases.
   2. Division 15 Section "Electrical Requirements for Mechanical Equipment" for basic requirements for electrical components that are integral part of packaged system components.
   3. Division 15 Section "Basic Piping Materials and Methods" for pipe joining materials, specialties, and basic installation requirements.
   4. Division 15 Section "Valves" for general duty valves, including gate, globe, ball, butterfly, and check valves.
   5. Division 15 Section "Pipe Expansion Joints" for packless and slip expansion joints and ball joints and grooved piping expansion joints.
   6. Division 15 Section "Meters and Gages" for thermometers, pressure gages, and fittings.
   7. Division 15 Section "Hangers and Supports" for equipment and piping hangers and supports.
   8. Division 15 Section "Vibration Control" for field-installed vibration and sound control devices used for equipment and piping systems.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Provisions and Division 1A General Requirements, apply to work of this section.

B. Requirements of the following Division 15 Sections apply to this Section:
   1. Section 15010 “Basic Mechanical Requirements.”
   2. Section 15050 “Basic Mechanical Materials and Methods.”
   3. Section 15490 “Special Systems.”

1.3 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Product data including rated capacities of selected models, weights (shipping, installed, and operating), furnished specialties, and accessories; indicating dimensions, required clearances, and methods of assembly of components, and piping and wiring connections.

C. Wiring diagrams from manufacturers detailing electrical requirements for electrical power supply wiring to equipment. Include ladder-type wiring diagrams for interlock and control wiring required for final installation. Differentiate between portions of wiring that are factory-installed and portions that are field-installed.

D. Certificates of shop inspection and data report as required by provisions of the ASME Boiler and Pressure Vessel Code.
E. Coordination drawings for compressed air systems in accordance with Division 15 Section "Basic Mechanical Requirements."

F. Maintenance data for inclusion in Operating and Maintenance Manual specified in Division 1 Section "Project Closeout" and Division 15 Section "Basic Mechanical Requirements."

1.4 QUALITY ASSURANCE

A. Electrical Component Standard: NFPA 70 "National Electrical Code."

B. Listing and Labeling: Provide equipment that is listed and labeled.
   1. Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

C. ASME Code Compliance: Provide system components complying with the following:
   1. Receiver Tanks: Comply with ASME Boiler and Pressure Vessel Code, Section VIII, Pressure Vessels, and bear the appropriate code symbols.
   2. Safety Valves: ASME Boiler and Pressure Vessel Code, Section VIII, Pressure Vessels, National Board certified, bear the appropriate labeling, and have been factory-sealed after testing.

D. Design Concepts: The Drawings indicate capacities, sizes, and dimensional requirements of system components and are based on the specific types, manufacturers, and models indicated. Components having equal performance characteristics by other manufacturers may be considered provided that deviations in dimensions, operation, and other characteristics are minor and do not change the design concept or intended performance as judged by the Architect. The burden of proof of equality of products is on the proposer. Refer to Division 1 Section "Product Substitutions."

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
   1. Lubricated, Rotary Air Compressors:
      a. American IMC, Inc.
      c. Bauer Compressed Air, Inc.
      d. Champion Pneumatic Machinery Co., Inc. Cooper Industries.
      e. Ingersoll-Rand Co.
      f. LeROI Div.; Dresser Industries, Inc.
      g. Quincy Compressor Div.; Coltec Industries, Inc.
      h. Bel-Aire

2.2 PIPE AND TUBE MATERIALS

A. Steel Pipe: ASTM A 53, Type E, Electric-Resistance Welded or Type S, Seamless, Grade B, Schedule 40, black or hot-dipped, zinc-coated with prime and epoxy coated.
2.3 PIPE AND TUBE FITTINGS WITH PRIME AND EPOXY COATED

A. Malleable-Iron Pipe Fittings: ASME B16.3, Class 150, threaded, plain or galvanized.
D. Wrought-Steel Pipe Fittings: ASME B16.9, Schedule 40, buttwelding.
E. Forged-Steel Pipe Fittings: ASME B16.11, socket type.
F. Grooved-End, Mechanical Pipe Fittings: ASTM A 47, malleable-iron; ASTM A 106, steel; or ASTM A 536, ductile-iron; galvanized fittings with grooves or shoulders designed to accept grooved-end couplings.
H. Valves: Gate, ball, and check valves are specified in Division 15 Section "Valves."

2.4 JOINING MATERIALS

A. Gasket Material: ASME B16.21, nonmetallic, flat, asbestos-free composition.
B. Mechanical Couplings for Grooved-End Steel Pipe: Ductile-iron or malleable-iron housing, synthetic rubber gasket with central cavity pressure-responsive design; with bolts, nuts, locking pin or toggle, or lugs to secure grooved pipe and fittings.
C. Solder Filler Metal: ASTM B 32, Alloy Sb5 (95 percent tin and 5 percent antimony), with 0.20 percent maximum lead content.

2.5 ROTARY SCREW AIR COMPRESSORS, GENERAL

A. Provide factory-assembled and tested, packaged, air-cooled, continuous duty, rotary-type, motor-driven air compressors as indicated, of capacities and having electrical characteristics indicated, and with the following features:
B. Panels: Freestanding single- or 2-compartment electrical control panels of appropriate NEMA types, and power characteristics indicated. Mount devices on front of panel, or extend devices through panel openings, including circuit breaker operators, selector switches, and gages. Identify each switch, control relay, circuit breaker and other components, inside or outside panel with 2-1/2-inch by 4-inch engraved, plastic-laminate signs as specified in Division 15 Section "Mechanical Identification."
C. Starters: Magnetic, across-the-line type starters for each compressor motor, with 3-coil overload protection, undervoltage releases, and Hand-Off-Automatic selector switch. Protect each starter with air circuit breaker.
D. Air Compressor Controls: Automatic compressor control station with load control and protection functions; provide dual voltage type. Electrically separate lower voltage control and protection circuits from higher voltage motor contactors. Equip with lamps to indicate safe operating conditions and alarm situations. Provide with circuit breakers, ammeters, and hour meters.
1. Provide automatic alternators to switch lead compressor at each start, for duplex air compressor units.
2.6 SMALL CAPACITY ROTARY AIR COMPRESSORS

A. General: Provide units with inlet silencer filters, safety valves, discharge pressure gauges, pressure regulators, tank mounted, air dryer, automatic drains and shutoff valve.

B. Tank-Mounted, Lubricated, Air Compressors.

2.7 AFTERCOOLERS

A. Aftercoolers, Air Cooled: Tubular, rated at 250 psig and leak-tested at 350-psig minimum air pressure, in capacities indicated. Size units to cool compressed air in compressor-rated capacities to 10 deg F above summertime maximum ambient temperature.

2.8 ACCESSORIES

A. General: Provide accessories having working pressure rating not less than system pressure at location where used, and compatible with equipment and piping system used.

B. Intercoolers: Air-cooled, fixed-bundle, tubular intercoolers, rated at 250 psig and leak-tested at 350-psig minimum air pressure, in capacities indicated. Size units to cool compressed air in compressor-rated capacities to 10 deg F above summertime maximum ambient temperature.

C. Separators: Conical shaped, centrifugal air-line separators in sizes and capacities indicated. Equip with water-removal trap and drain. Size units for maximum pressure drop through units of 3 psig from air inlet to outlet.

D. Receivers: ASME stamped, cylindrical, vertical or horizontal installation as indicated, galvanized steel; with safety valves in sizes, working pressures and temperatures indicated, and with drain connection.
   1. Pressure rating: Not less than maximum discharge pressure.

E. Safety Valves: ASME Boiler and Pressure Vessel Code, Section VIII, Pressure Vessels construction, National Board certified, labeled, and factory-sealed; constructed of bronze body with poppet safety valve for compressed air service.
   1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.

F. Air-Line Lubricators: Sizes and capacities indicated; equip with drip chamber and sight dome for observing oil drop entering air stream; with oil feed adjustment screw, and quick-release collar for easy bowl removal.
   1. Provide with automatic feed device for supplying oil to lubricator.

G. Filters: Two-stage, mechanical-separation type, air-line filters in sizes and ratings indicated. Equip with deflector plates; resin-impregnated-ribbon type filters with edge filtration, 40-micron (0.0015-inch) thick; and drain cock.

H. Coalescing Filters: Capacities and types indicated. Equip with activated carbon capable of removing water and oil aerosols, with color change dye to indicate when carbon is saturated, and with warning light to indicate when selected maximum pressure drop has been exceeded.

I. Automatic Drain Valves: Corrosion-resistant metal body and internal parts, rated for 200-psig minimum working pressure, capable of automatic discharge of collected condensate.
J. Hose, Clamps, and Couplings: Provide compatible hose, hose clamps, and hose couplings, suitable for compressed air service, of nominal diameter, and rated for 300-psig minimum working pressure except where otherwise indicated.
   1. Quick Connect/Disconnect Hose Couplings: One-way, automatic shutoff, brass body, with O-ring or gasket seal, and stainless steel or nickel-plated steel operating parts. Select socket end with threaded inlet that is considered the fixed end and has a one-way valve.
      a. Plug End: Flow-sensor bleeder, check-valve type, with serrated outlet for hose.
      b. Plug End: Straight-through type, with serrated outlet for hose.

K. Hose Coupling: Two-piece, threaded, brass or stainless steel, O-ring or gasket seal, swivel coupling, with serrated ends, 300-psig minimum working pressure.

L. Hose Adapter: One-piece, brass or stainless-steel fitting, with serrated ends.

M. Hose: Reinforced, single- or double-braid, neoprene-covered hose, for compressed air service.

N. Hose Clamps: Stainless steel, clamps, bands, or wire.

2.9 CONCRETE BASES

A. Concrete: Portland cement, mix to a 4000-psi, 28-day, compressive strength.
   1. Cement: ASTM C 150, Type I.


C. Reinforcement Bars: ASTM A 615, Grade 60, deformed.

2.10 COMPRESSED AIR SYSTEMS (SEE SECTION 15490 – SPECIAL SYSTEMS)

PART 3 – EXECUTION

3.1 CONCRETE BASES

A. Construct concrete equipment bases of dimensions indicated.

B. Form concrete bases using framing lumber with form release compounds. Chamfer top edges and corners.

C. Install reinforcing bars, and place anchor bolts and sleeves using manufacturer's installation template.

D. Place concrete and allow to cure before installation of equipment.

3.2 EQUIPMENT INSTALLATION

A. Install air compressors, intercoolers, aftercoolers, air receiver tanks, and dryers on concrete bases. Set and connect units in accordance with manufacturers' written installation instructions. Install units plumb and level, firmly anchored, in locations indicated, and maintain manufacturers' recommended clearances. Orient so equipment controls and devices needing servicing are accessible.
B. Install seismic bracing for compressor as required by City of Los Angeles Code.

3.3 PIPING APPLICATIONS

A. Low-Pressure Systems: Use the following pipe and fittings:
   1. 2 Inches: Black steel pipe with threaded, malleable-iron fittings; threaded joints.
   2. 1-1/2 Inches and Smaller: Galvanized steel pipe with galvanized, threaded, malleable-iron fittings; threaded joints.

3.4 JOINT CONSTRUCTION

A. Threaded Joints: Thread pipe with tapered pipe threads in accordance with ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint lubricant or sealant, suitable for the service for which the pipe is intended, on the male threads at each joint. Tighten joint to leave not more than 3 threads exposed.

B. Welded Joints: Weld pipe joints in accordance with ASME Code for Pressure Piping, B31.9 Building Service Piping for low-pressure systems and B31.1 Power Piping for medium-pressure systems.

C. Brazed and Soldered Joints: For copper tube and fittings, braze and solder joints in accordance with ASME B31 - Standard Code for Pressure Piping.
   1. Brazed joints in accordance with ASME B31.1 - Power Piping.
   2. Solder joints in accordance with ASME B31.9 - Building Service Piping.
   3. Thoroughly clean tube surface and inside surface of the cup of the fittings, using very fine emery cloth, prior to making soldered or brazed joints. Wipe tube and fittings clean and apply flux. Flux shall not be used as the sole means for cleaning tube and fitting surfaces.

3.5 PIPING INSTALLATION, GENERAL

A. Install air and drain piping with 1/8-inch-per-foot slope downward in direction of air flow.

B. Install eccentric reducers where pipe is reduced in size in the direction of flow, with bottoms of both pipes and reducer flush.

C. Connect branch air piping to mains from top of main. Provide drain leg and drain trap at end of each main, each branch, and each low point in piping system.

D. Install piping specialties in accordance with Division 15 Section "Basic Piping Materials and Methods."

E. Install valves in accordance with Division 15 Section "Valves."

3.6 CONNECTIONS

A. Install piping adjacent to equipment to allow servicing and maintenance.

B. Connect air piping to equipment with unions, and with shutoff valves and strainers when indicated.
   1. Install pressure gages on compressor discharge piping, on receiver tanks, and where indicated.
C. Connect water piping to intercooler and aftercooler units with union and reduced-pressure-zone-type backflow-preventer assembly having strainer, gate valves, and air gap fitting for indirect waste. Connect cooler unit drains with union and flow control valve, and discharge over closest floor drain.

D. Where water piping connections are dissimilar metals, make connections with dielectric fittings or dielectric unions.

E. Install safety valves in receiver tanks, in quantity and size to relieve capacity not less than that of connected compressor.

F. Install automatic drain valves on intercoolers, aftercoolers, separators, receivers, dryers, and other locations indicated. Discharge condensate over nearest floor drain.

G. Install accessories as indicated.

H. Electrical Connections: Power wiring and disconnect switches are specified in Division 16.

3.7 FIELD QUALITY CONTROL

A. General: Provide the services of a factory-authorized service representative to test and inspect unit installation, provide startup service, and to demonstrate and train City's maintenance personnel as specified below.
   1. Test and adjust operating and safety controls. Replace damaged and malfunctioning controls and equipment.
   2. Piping System Tests: Cap and fill new and parts of existing systems that have been modified, with oil-free, dry air or gaseous nitrogen, to pressure of 50 psig above system operating pressure, but not less than 150 psig. Isolate the test source and let stand for 4 hours to equalize temperature. Refill system, if required, to test pressure and hold pressure for 2 hours with no drop in pressure.
      a. Repair leaks and defects with new materials and retest system until satisfactory results are obtained.

B. Train City's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventative maintenance.
   1. Review data in Operating and Maintenance Manuals. Refer to Division 1 Section "Project Closeout."
   2. Schedule training with at least 7 days advance notice.

3.8 COMMISSIONING

A. Preparation: Perform the following final checks before startup:
   1. Complete tests of piping systems.
   2. Check for piping connection leaks.
   3. Check lubricating oil for lubricated-type equipment.
   4. Check V-belts for proper tension.
   5. Check that compressor inlet filters and piping are clear.
   6. Check equipment vibration-control supports and flexible pipe connectors, and that equipment is properly attached to substrate.

B. Starting Procedures: Follow the manufacturer's written procedures. If no procedures are prescribed by the manufacturer, proceed as follows:
   1. Energize circuits.
   2. Start and run equipment through complete sequence of operations.
4. Check air pressures.
5. Manually operate safety valves.
6. Adjust operating controls including pressure settings.

END OF SECTION
SECTION 15490
SPECIAL SYSTEMS

PART 1 – GENERAL

1.1 DESCRIPTION OF WORK:

A. Definitions, guarantees, submittals, clean-up, as-built and all other applicable requirements of Division 1 apply to the work of this section.

B. Examine all other sections for work related to those sections which is required to be included as work under this section.

C. Motor oil system dispensing.

D. Gear oil system.

E. Automatic transmission fluid system.

F. Chassis grease system.

G. Anti Freeze System

H. Steam cleaner.

I. Clarifier tank.

J. Miscellaneous piping.

K. Testing and initial operation.

L. Excavation, trenching and backfill.

1.2 RELATED DOCUMENTS:

A. Drawings and general provisions of Contract, including General and Supplementary Provisions and Division 1A General Requirements, apply to work of this section.

1. Division 2, Section “Excavation, Trenching, Backfilling” for utilities.

2. Division 3, Section “Concrete Work” for specifications on concrete and reinforcing materials and concrete placing requirement for equipment pads.

3. Division 9, Painting.

4. Division 15, "Basic Mechanical Requirements".

5. Division 15, "Basic Mechanical Material and Methods".

6. Division 15, "Mechanical Identification".

7. Division 15, "Mechanical Insulation".

8. Division 15, "Plumbing Pumps".

9. Division 15, "Piping".

10. Division 15, Supports and Anchors.

11. Division 15 Meter & Gages.

12. Division 15, Pipe Expansion Joints.

13. Division 15, “Compressed Air System”.


15. Division 16, "Electrical".
16. Division 5, "Miscellaneous Metals".

1.3 SUBMITTALS

A. Make submittals in accordance with Division 1, Submittals and Section 15050.

B. General: Comply with provisions of section 15010, Mechanical General Provision.

C. Product Data: Within 35 calendar days after receipt of Notice to Proceed, submit complete materials list and manufacturer's brochures of all items proposed to be furnished and installed. Submittal shall include but not be limited to the following:
1. Pipes and fitting.
2. Hangers and supports.
3. Valves.
4. Specialties, gauges and thermometers.

1.4 QUALITY ASSURANCE

A. Unless otherwise noted, all provisions including amendments thereto, of the State Plumbing Code Part 5, Title 24, C.A.R.; of the Uniform Plumbing Code, latest edition; and of the latest Plumbing Ordinances of the City and County of Los Angeles are hereby made part of this Section.
1. Conform to provisions of Section 15010 "BASIC MECHANICAL REQUIREMENTS".
2. Certify that all products and building materials are Asbestos Free.

1.5 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this section before, during and after installation and to protect the work and materials of all other trades.

B. Replacement in the event of damage immediately make all repairs and replacements necessary and at no additional cost to the owner.

PART 2 – PRODUCTS

2.1 OVERHEAD HOSE REELS

A. Chassis grease hose assembly with reels:
1. Heavy duty high pressure open hose reel which shall be designed to meet the strictest requirements of the most rugged service. The reel shall be heavily reinforced with heavy duty mounting brackets, rolled edge sheaves and extra large rollers. Reel shall have a dual needle bearing supporting hub. The fluid hub shall be rated at a minimum pressure of 10,000 psi. This heavy duty high pressure reel shall have a hose capacity of 50 ft. of 3/8” I.D. hose described below (ARO 614-633-50J). Single reel mounting channel with cabinet enclosure and label.
2. 1/2” male pipe thread inlet and 1/2” female pipe thread outlet at 90o angle high pressure (10,000 psi maximum) shut off valve (ARO 636-043).
3. Hose stop (ARO 5668).
4. 3/8” male pipe thread to 3/8” female pipe thread high pressure “Z” type swivel (ARO 636-088).
5. 50 ft. of 3/8” I.D.; 4,000 psi working pressure chassis grease hose with 3/8” male pipe thread both ends (ARO 624401-50).
6. 3/8" male pipe thread to 3/8" female pipe thread high pressure "Z" type swivel (ARO 636-088).
7. 3/8" female pipe thread shot control handle with 7" hydraulic nozzle with coupler. Trigger action (with half or full stroke) gives single shot or continuous flow of lubricant at line pressure (ARO 636-111, 636-072-F123-6).

B. Gear oil hose assembly with reels:
1. Heavy duty low pressure open hose reel which shall be designed to meet the strictest requirements of the most rugged service. The reel shall be heavily reinforced with heavy duty mounting brackets, rolled edge sheaves and extra large rollers. Reel shall have a dual needle bearing supporting hub. The fluid hub shall be rated at 3,000 psi working pressure. This heavy duty low pressure reel shall have a hose capacity of 50 ft. of 1/2" I.D. hose described below (ARO 614-624-50G). 3 reels ARO #614400-3 enclosure.
2. Hose stop (ARO 5668)
3. 1/2" FPT pipe thread inlet and 1/2" female pipe thread outlet with 1/2" ball valve, 2,000 psi working pressure (ARO 66592).
4. 50 ft. of 3/8" I.D., 4,000 psi working pressure gear oil hose with 1/2" male pipe thread both ends (ARO 624401-50).
5. 3/8" female pipe thread with built-in swivel, non-metered gear oil control handle with trigger type manual control and flexible rubber nozzle with non-drip tip (ARO 635-399).

C. Motor oil hose assembly with reels
1. Heavy duty low pressure open hose reel which shall be designed to meet the strictest requirements of the most rugged service. The reel shall be heavily reinforced with heavy duty mounting brackets, rolled edge sheaves and extra-large rollers. Reel shall have a dual needle bearing supporting hub. The fluid hub shall be rated at a minimum pressure of 3,000 psi. This heavy duty low pressure reel shall have a hose capacity of 50 ft. of 1/2" I.D. hose for motor oil service. (ARO 614-624-50G)
2. 50 ft. of 3/8" I.D., 4,000 psi working pressure motor oil hose with 1/2" male pipe thread both ends. (ARO 624401-50)
3. Hose stop for 1/2" I.D. hose described above (ARO 5668)
4. 3/8" female pipe thread with built-in swivel motor oil digital control nozzle. Nozzle shall indicate amount of oil delivered in quarts. Totalizer shall record amount delivered in gallons. Nozzle shall be manual non-drip, tip assembly (ARO 72682), trigger shall lock open and shut off automatically. (ARO 635389-1B2)
5. Provide 1.2" shut-off valves at inlet of hose reel. (ARO 66592)

D. Automatic Transmission Fluid Hose Assembly with Reels
1. Heavy duty low pressure open hose reel which shall be designed to meet the strictest requirements of the most rugged service. The reel shall be heavily reinforced with heavy duty mounting brackets, rolled edge sheaves and extra-large rollers. Reel shall have a dual needle bearing supporting hub. The fluid hub shall be rated at a minimum pressure of 3,000 psi. This heavy duty low pressure reel shall have a hose capacity of 50 ft. of 1/2" I.D. hose described below. (ARO 614-624-50G)
2. 50 ft. of 3/8" I.D. 2,000 psi working pressure engine or turbine oil hose with 1/2" male pipe through both ends. (ARO 624401-50)
3. Hose stop for 1/2" I.D. hose described above. (ARO 5668)
4. 3/8" female pipe thread with built-in swivel turbine oil control nozzle. Nozzle shall indicate amount of torque oil delivered in quarts. Nozzle shall have a manual non-drip assembly. (ARO 635-389-1B2)

E. Air Hose Assembly with Reels
1. Heavy duty low pressure open hose reel which shall be designed to meet the strictest requirements of the most rugged service. The reel shall be heavily reinforced with heavy duty mounting brackets, rolled edge sheaves and extra-large rollers. Reel shall have a dual
needle bearing supporting hub. The fluid hub shall be rated at a minimum pressure of 300 psi. This heavy duty low pressure reel shall have a hose capacity of 50 ft. of 3/8" I.D. air hose described below. (ARO 614-613A-4, 5)

2. 50 ft. pf 3/8" I.D., 300 psi working pressure air hose with 1/2" male pipe thread on one end and 1/4" male pipe thread on other end. (ARO 622401-50)

3. 1/4" female pipe thread air line coupler. 34 cfm full flow at 100 psi line pressure. (ARO 210)

4. 1/2" shut off valve with reducer at inlet of hose reel. (ARO Y25-2)

5. Air hose assembly of deodorizing system shall be provided with the Bus Interior Cleaning and Deodorizing System.

F. Air Outlets
1. 1/4" female pipe thread air line coupler, 34 cfm full flow at 100 psi line pressure, maximum inlet pressure 250 psi. (ARO 210)

2. 1/4" male pipe thread male to male nipple. (ARO 1950)

3. 1/4" male pipe thread air connector. 34 cfm full flow at 100 psi line pressure. (ARO 2608)

4. 1/4" female pipe thread air line connector. 34 cfm full flow at 100 psi line pressure. (AMPFLO C-2)

G. Industrial Water and Anti-Freeze Assembly with Reels
1. Heavy duty low pressure open hose reel which shall be designed to meet the strictest requirements of the most rugged service. The reel shall be heavily reinforced with heavy duty mounting brackets, rolled edge sheaves and extra-large rollers. Reel shall have a dual needle bearing supporting hub. The fluid hub shall be rated at a minimum pressure of 300 psi. This heavy duty low pressure reel shall have a hose capacity of 50 ft. of 3/8" I.D. air hose described below. (ARO 614-613A-4, 5 & 10)

2. 50 ft. pf 3/8" I.D., 300 psi working pressure water hose with 1/2" male pipe thread on one end and 1/4" male pipe thread on other end. (ARO 622401-50)

3. 1/4" female pipe thread water coupler and union.

4. 1/2" shut off ball valve with reducer at inlet of hose reel. (ARO 61754 All Bronze)

5. Nozzle hose assembly system shall be provided with the AVO #635131

2.2 PIPING FOR GREASE, MOTOR OIL, GEAR OIL AND AUTOMATIC TRANSMISSION FLUID SYSTEM

A. Shop Systems Piping
1. Piping and fittings:
   a. Motor oil - Symbol MO, gear oil, Symbol GO, and automatic transmission fluid - Symbol ATF: Schedule 80 black steel ASTM A106 Grade B seamless with 3000 lbs forged steel socket weld fittings and welded joints.

B. Special fittings, accessories, and valves (ARO).

C. Chassis grease shut-off valves shall be Vogt SW-3991, 6,000 psi forged carbon steel full port glove valve, or equal.

2.3 SHOP SYSTEMS

A. Provide complete automatic shop systems as follows:
1. Motor oil.
2. Gear oil.
3. Chassis grease.
4. Automatic transmission fluid.
5. Anti-Freeze fluid.

The systems shall include storage tanks, supply pumps, piping overhead service hose reels, dispenser valves and other accessories to form complete operating system.

B. Pumps

1. Chassis grease pump - Symbol CG-1 (Mounted on storage tank)
   a. 4-1/4" air motor, 4" stroke and 50:1 ratio, 2.31 cubic inch displacement per cycle, 12.5 cycles per pound, double acting high volume pump with 400 lb. drum cover and outlet union check valve (ARO 612-721).
   b. Follower plate for 400 lb. drum and 1-7/8" O.D. pump tube. Follower plate shall have rubber lips, lifting handle and vacuum breaking screw (ARO 640-015-2).
   c. Super quiet exhaust muffler assembly for 4-1/2" air motor pump. (ARO 91790).
   d. 1/2" standard-duty lubricator. Maximum pressure of 200 psi, with plastic 6.25 oz. bowl, maximum temperature of 125°F, 2.5 cfm to 100 cfm maximum air flow range (ARO 125241.000).
   e. 1/2' heavy duty filter regulator gauge combination. Filter maximum pressure to 200 psi with plastic 10 oz. bowl, maximum temperature of 125°F, 30-40 micron filter, 105 cfm through filter 6 psi pressure drop. The regulator range shall be adjustable from 5 psi to 125 psi and have a 0o to 125o F temperature range. The regulator shall have 0-160 psi air pressure gauge (ARO 28344).
   f. 1/2" male pipe thread nipple (ARO 70749)
   g. 1/2" female pipe thread tee (ARO Y-43-34)
   h. 1/2" male pipe thread to 1/2" male pipe thread nipple (ARO 70749).
   i. 1/2" pipe nipple x 6" long.
   j. 1/2" male pipe thread to 1/2" female pipe threaded street elbow (ARO Y-43-204).
   k. 1/2" heavy duty regulator with gauge. The regulator range shall be adjustable from 5 psi to 125 psi and have a 0o through 180o F temperature range. The regulator shall have 0-160 psi air pressure gauge (ARO-27344-010).
   l. 1/2" male pipe thread to 1/4" female pipe thread reducing bushing (ARO 6788).
   m. 1/4" male pipe thread to 1/4" male pipe thread nipple (ARO 1950).
   n. Air operated pump lift shall be attached to the drum cover to raise the pump and drum cover for drum change over. Mounting of the lift shall be by a base plate with three 9/16" diameter holes. Lift height extended shall be 102" down to 60". Air line connectors shall be furnished for 85 cfm and 35 cfm (ARO 640-067).
   o. 5 ft. of 1/4" I.D., 250 psi working pressure air hose with 1/4" male pipe thread both ends. (ARO 622201-05).
   p. 1/4" female pipe thread air line connector (ARO 2609).
   q. 1/2" male pipe thread to 1/2" female pipe thread hose swivel union (ARO 75366).

   a. 4-1/2" air motor, 4" stroke and 9:1 ratio, 10.4 cubic inch displacement per cycle, 22 cycles per gallon, double acting stub type oil pump with outlet union check valve. (ARO 612-729 with elongated suction tube to bottom of tank) or equal.
   b. Wall mounting bracket for 425 series pump unit. (ARO 66100)
   c. 1/2" standard-duty lubricator. Maximum pressure of 200 psi, with plastic 6.25 oz. bowl, maximum temperature of 125°F, 2.5 cfm to 100 cfm maximum air flow range (ARO 126241.000).
   d. 1/2" heavy duty filter-regulator-gauge combination. Filter maximum pressure to 200 psi with plastic 10 oz. bowl, maximum temperature of 125°F, 30-40 micron filter, 105 cfm through filter with 6 psi pressure drop. The regulator range shall be adjustable from 5 psi to 125 psi and have a 0 through 150°F temperature range. The regulator shall have a 0-160 psi air pressure gauge. (ARO-28344)
3. Gear oil pump - Symbol GO-1 (mounted on storage tank)
   a. 4-1/4" air motor, 4" stroke and 9:1 ratio, 12 cubic inch displacement per cycle, 21 cycles per gallon, double acting stub type oil pump with union check valve. (ARO 612729) or approved equal.
   b. Wall mounting bracket for 425 series pump unit. (ARO 66100)
   c. 2" female pipe thread to 3.4" female pipe thread reducing elbow. (ARO Y129-7Z)
   d. 3/4" male pipe thread to 3/4" female pipe thread hose swivel adapter union (ARO 75367)
   e. 6 ft. of 3/4" I.D., 600 psi working pressure material hose with 3/4" male pipe thread ends. (ARO 622651-06)
      a. Suction tube assembly for 55 gallon barrel with foot valve for positive priming, 2" bung adapter and 3/4" female pipe thread fluid outlet. (ARO 65109)
      b. 1/2" male pipe thread to 1/2" male pipe thread nipple. (ARO 70749)
      c. 1/2" standard-duty lubricator. Maximum pressure of 200 psi, with plastic 6.25 oz. bowl, maximum temperature of 125°F, 2.5 cfm to 100 cfm maximum air flow range. (ARO 126241.000)
      d. 1/2" capacity air line connector with 1/2" male pipe thread. (ARO 23904-410)
      e. 1" capacity air line coupler with 1/2" female pipe thread. (ARO 23104-400)
      f. 6 ft. of 1/2" I.D., 800 psi working pressure air hose with 1/2" male pipe thread both ends. (ARO 622553-06)
      g. 1/2" heavy duty filter-regulator combination. Filter maximum pressure to 200 psi with plastic 10 oz. bowl, maximum temperature of 125°F, 30-40 micron filter, 105 cfm through filter with 6 psi pressure drop. The regulator range shall be adjustable for 5 psi to 125 psi and have a 0 through 125°F temperature range. The regulator shall have a 0-160 psi air pressure gauge. (ARO 28344)
      h. 3/4" male pipe thread to 3/4" female pipe thread nipple. (ARO Y27-155-C)
      i. 3/4" female pipe thread outlet union check valve assembly. (ARO 2486)
      j. 6 ft. of 3/4" I.D., 2,250 psi working pressure material hose with 3/4" male pipe thread both ends. (ARO 624601-06)
      k. 3/4" male pipe thread to 3/4" female pipe thread hose swivel adapter union. (ARO 75367)

4. Motor oil pump-Symbol MO-1 (installed on wall).
   a. 4-1/4" air motor, 4" stroke and 9:1 ratio, 11 cubic inch displacement per cycle, 21 cycles per gallon, double acting stub oil pump with outlet union check valve. (ARO 612-729) with elongated suction tube to bottom of tank) with 3-1/2" 1.D air hose, 4-3/4" 1.D two fabric discharge hose, air coupler and connector. Balcrank 786 or equal.
   b. 1/2" heavy duty filter-regulator-gauge combination. Filter maximum pressure to 200 psi with plastic 10 oz. bowl, maximum temperature 125°F, 30-40 micron filter, 105 cfm through filter with 6 psi pressure drop. The regulator range shall be adjustable for 5 psi to 125 psi and have a 0 through 125°F temperature range. The regulator shall have a 0-160 psi air pressure gauge. (ARO 28344)
   c. 3/4" male pipe thread to 1/2" female pipe thread reducing bushing. (ARO Y45-9xc)
   d. 900 psi relief valve with 1/2" male pipe thread inlet, 3/4" female pipe thread outlet and 1/8" female pipe thread bleed. (APR 61117)
   e. 3/4" male pipe thread to 3/4" female pipe thread hose swivel union. (ARO 75367)
   f. 1/8" male pipe thread to 5/16" seamless steel tube flareless connector. (ARO Y38-5)
   g. 3 ft. of 5/16" plastic tubing. (ARO 76726)
   h. 5/16" rubber drum gromet. (ARO 76908)
   i. Wall mounting bracket. (ARO 66100)

5. Anti-Freeze pump – Symbol ANTI/F-1 (mounted on storage tank)
a. 4-1/4" air motor, 4" stroke and 10:1 ratio, 12.1 cubic inch displacement per cycle, 22
cycle per gallon, double acting stub type pump, with outlet union check valve (ARO
61139-1) stainless steel or approved equal.
b. 3/4" male pipe thread to 3/4" female pipe thread hose swivel adapter union (ARO 75367)
c. 6 ft. of 3/4" I.D., 600 psi working pressure material hose with 3/4" male pipe thread ends.
(ARO 622651-06)
d. Suction tube assembly for 55 gallon barrel anti-freeze only with foot valve for positive
priming, 2" bung adapter and 3/4" female pipe thread fluid outlet. (ARO 65109)
e. 1/2" male pipe thread to 1/2" male pipe thread nipple. (ARO 70749)
f. 1/2" standard-duty lubricator. Maximum pressure of 200 psi, with plastic 6.25 oz. bowl,
maximum temperature of 125° F, 2.5 cfm to 100 cfm maximum air flow range. (ARO
126241.000)
g. 1/2" capacity air line connector with 1/2" male pipe thread. (ARO 23904-410)
h. 1" capacity air line coupler with 1/2" female pipe thread. (ARO 23104-400)
i. 6 ft. of 1/2" I.D., 800 psi working pressure air hose with 1/2" male pipe thread both ends.
(ARO 622553-06)
j. 1/2" heavy duty filter-regulator combination. Filter maximum pressure to 200 psi with
plastic 10 oz. bowl, maximum temperature of 125° F, 30-40 micron filter, 105 cfm through
filter with 6 psi pressure drop. The regulator range shall be adjustable for 5 psi to 125 psi
and have a 0 through 125° F temperature range. The regulator shall have a 0-160 psi
air pressure gauge. (ARO 28344)
k. 3/4" male pipe thread to 3/4" female pipe thread nipple. (ARO Y27-155-C)
l. 3/4" female pipe thread outlet union check valve assembly. (ARO 2486)
m. 6-ft. of 3/4" I.D., 2,250 psi working pressure material hose with 3/4" male pipe thread both
ends. (ARO 624601-06)
n. 3/4" male pipe thread to 3/4" female pipe thread hose swivel adapter union. (ARO
75367)

6. Steam cleaner: manufactured by Hotsy, 1125 N. Kraemer Place, Anaheim, California 92806,
Model 982SS High Pressure Washer or equal. The washer shall have the following
properties:
a. 4.0 GPM @ 200 psi
b. 5 HP Electric Motor, 230 Volt, 60 Cycle, single phase
c. Triplex Ceramic Plunger Pump, belt drive
d. Adjustable temperature control
e. Stainless Steel coil wrap
f. Vertical burner, natural gas fired
g. 50 foot high pressure hose
h. Trigger Gun Control, with wand and adjustable nozzle
i. Power coat finish
j. 8 inch Draft Diverter

2.4 PIPING

A. Underfloor piping supply and return (various services).
   1. Piping installed underground or under slab shall be same material and pressure rating as
   pipe specified above foe various services, except piping and fittings shall be wrapped and
   protected against corrosion as specified herein after on Paragraph 3.02.

2.5 VALVES

A. Gasoline System
   Gate valves: Crane No. 424 or 426
   Globe valves: Crane No. 7
   Check valves: Crane No. 132, lift check
B. Motor Oils, Gear Oil and Chassis Grease Systems
   1. Motor oil, torque oil and gear oil shut-off valves shall be Clayton Mark Pacific valves Petro 790K union end ball valves, 1" valve shall be rated at 3500 psi. Vogt SW-1871 forged steel globe valve may be used as an option.
   2. Chassis grease shut-off valves shall be Vogt SW-3991, 6,000 psi forged carbon steel full port globe valve, or equal.

C. Hydraulic Fluid System (A.T.F.)
   1. Shop lift hydraulic oil shut-off valves - Jamesbury butterfly valves. Valves shall have stainless steel shaft, rate at 350 psi minimum.

D. Miscellaneous Valves and Fittings
   1. Air filter, water separator with gage Graco #203-421.
   2. Air regulator with gage Graco #202-156.
   3. Air control valves Graco #204-886.
   4. High pressure valves Graco #202-3669.

PART 3 – EXECUTION

3.1 PIPING INSTALLATION

A. Installation of piping shall be made substantially as indicated on drawings, installed in accordance with the ANSI Standard Code for Pressure Piping B31.1, latest issue, including anchorage of piping guides and supports for such piping.

B. Horizontal and vertical positions and arrangement of pipelines as shown on drawings shall be confirmed at the site of work prior to fabrication and installation. The drawings are intended for the Contractor's guidance, and Contractor shall verify their accuracy and immediately notify the Engineer of any discrepancies so that such discrepancies may be resolved prior to actual fabrication or installation or work. Minor changes in position of piping, as necessary to meet job conditions, shall be anticipated by the Contractor, and shall not be made the basis for change order. Changes affecting accessibility to or clearance about equipment or accessories shall be promptly communicated to the Engineer.

C. Sizes and arrangement of piping shall be as shown on the drawings; in case of inconsistency of details for final connections, resulting in conflict, such conflict shall be resolved by the Engineer.

D. In the assembly of the piping system, the longest available commercial standard lengths of piping shall be utilized to minimize number of piping joints. Piping shall be accurately cut to field measurement to permit placement without forcing or springing, except where requirements for cold springing are shown.

E. All piping shall be run straight and parallel with adjacent walls and shall present a uniform and neat appearance.

F. Each piece of pipe, fitting and valve shall be carefully inspected on the inside and outside to see that there is no defective workmanship or obstructions in the pipes, fittings or valves.

G. During construction, open ends of piping shall be protected with temporary closures to prevent entry of dirt and debris into lines. Piping size reductions shall be made with eccentric fittings, with flow lines of piping in alignment. No bullhead connections will be permitted, except where specifically shown. Piping shall be plumb and square and arranged for venting or drainage as designated.
H. Provide dielectric insulation at points where copper or brass piping and equipment comes in contact with ferrous piping or equipment. This requirement does not apply to brass valves in ferrous piping where such valves are not externally grounded. Provide on each ferrous pipe connected to underground piping system a flange insulation for complete electrical isolation. Pipeline Seal and Insulator Company, P.S.I., Type "D", full sleeve, double washers, or equal.

3.2 WRAPPING OF PIPE

A. Prior to delivery to the job site wrap buried steel pipe with corrosion protective wrap of pressure sensitive polyvinyl chloride or polyethylene tape applied after pipe has been thoroughly cleaned. Tape shall be nominal thickness of 20 mils consisting of one layer of 20 mil tape or two separate layers of 10 mil tape. Apply with suitable primer adhesive recommended by manufacturer.

B. Tightly apply tapes with 1/2 inch minimum uniform lap, free from wrinkles and voids. Use approved wrapping machines and experienced operators.

C. Tapes: "Chasekote" No. 775, Plicoflex no. 340-25, Polyker 922 and 923, "Scotchwrap" No. 51 or equal. Apply tape after pipe is cleaned as recommended by the tape manufacturer.

D. Cover filled joints and fittings by wrapping polyethylene or polyvinyl tape specified for wrapping pipe, except use two layers of 10 mil thick tape. Wrap joints to provide two full thickness of tape over joint and extend minimum of six-inches over adjacent pipe covering. Where fittings are wrapped, width of tape shall not exceed 2". Apply adequate tension so tape will conform tightly to contours of fittings. Use putty tape insulation compounds such as "Scotchfill", or equal, to fill voids and provide smooth even surface for application of tape wrap.

E. Alternate: In lieu of tape wrap, factory applied plastic coating on steel pipe will be acceptable. Use tapes for field joints, fittings, and valves same as specified above. Pipe Coating: "X-Tru-Coat" (20 mil thick) as manufactured by Standard Pipe Protection, Republic, Pipe Line Service Corp., Scotchkote 202 (12 mil thick) as manufactured by 3M Company, or equal, with "X-Tru-Tape", or equal, for joints, fittings, and valves.

F. Test wrapped or coated pipe, fittings, and field joints on job site, after assembly, with approved high voltage holiday detector Tinker and Rasor equal, with positive signaling device to indicate any flaws, holes, or breaks in wrapping. Set peak voltage to 1,000 volts or per manufacturer's recommendations. Place piping on temporary blocks to allow testing to run along underside of pipe. Repair defects before covering. Conduct testing in presence of engineer.

3.3 CLEANING AND FLUSHING OF PIPING SYSTEM

A. Flush all piping systems with a solution of approximately 10% inhibited HCL solution, or equivalent, to clean the inside of all pipes. Then flush systems with fresh water until no residue of solution is detected.

3.4 TESTS

A. General:
1. Tests must be performed and systems approved prior to maintain, covering, insulating, furring, or concealing piping.
2. Provide all test equipment, instrumentation and labor in conjunction with tests.
3. Prior to test, protect or remove all control devices, air vents, and other items which are not designed to stand pressures used in test.
4. Accomplish testing of piping in sections so as not to leave any pipe or joint untested.
5. Obtain prior approval for test procedures.
6. Responsibility for damages: Contractor shall pay for costs of repair and restoration of work of other trades damaged by tests or cutting done in conjunction with tests.

B. Test each piping system with the service product for at least one hour at 150% of the operating pressure but not less than specified below:

<table>
<thead>
<tr>
<th>System Vented</th>
<th>Gauge Pressure At Start of the test</th>
<th>Test with</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor oil system</td>
<td>1,500</td>
<td>Oil</td>
</tr>
<tr>
<td>Gear oil system</td>
<td>3,000</td>
<td>Oil</td>
</tr>
<tr>
<td>Torque oil system</td>
<td>175</td>
<td>Air</td>
</tr>
<tr>
<td>Chassis grease system</td>
<td>10,000</td>
<td>Oil</td>
</tr>
<tr>
<td>Hydraulic fluid system (AT System)</td>
<td>500</td>
<td></td>
</tr>
<tr>
<td>Industrial/Domestic Water and Antifreeze</td>
<td>200</td>
<td>Water</td>
</tr>
<tr>
<td>All vent pipes</td>
<td>100</td>
<td>Air</td>
</tr>
</tbody>
</table>

C. Test wrapped or coated pipe, fittings, and field joints on job sites, after assembly, with approved high voltage Holiday detector "Tinker and Rasor", or equal, with positive signaling device to indicate any flaws, holes, or breaks in wrapping. Set peak voltage to 10,000 volts. If Scotchkote 202 is used set peak voltage to 1,000 volts. Place piping on temporary blocks to allow testing to run along underside of pipe. Repair defects before covering. Conduct testing in presence of Engineer.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide all labor materials and equipment necessary for the complete installation of the automotive fuel storage and dispensing systems in connection with gasoline, (Motor oil and waste oil may be included per specific project requirements), as shown on the contract drawings and specified herein, including the following:

1. New Underground Storage Tanks:
   a. 15,000 gallon capacity gasoline tank.
   b. 1,000 gallon capacity waste-oil tank.
   c. 1,000 gallon capacity motor-oil tank.

2. Two (2) single product, dual hose dispensing unit for gasoline.

3. New leak detector and tank level monitoring equipment.

4. Piping and accessories as required for a complete facility.

5. Electric submersible pumps with mechanical leak detector as shown on the drawings.

6. One (1) new air/water hose reel mounted above fuel Island as shown on the plans.

7. Card reader tank inventory system for the underground fuel, gasoline tank only, (Fuel Automated Tracking System).

B. Related Work:

1. Work of this Section shall comply with the Contract Documents including, but not necessarily limited to, General Conditions and the General Requirements.

2. Excavation, Backfill and Compaction for Utilities.

3. Cast-in-Place Concrete and setting of anchor bolts for dispensing unit, slabs for fuel tanks and associated equipment in Section 03300.

4. Metal Fabrications in Section 05500.

5. Painting of exposed piping and equipment in Section 09910.


1.2 GENERAL REQUIREMENTS

A. Locations Indicated On Drawings:
1. Approximate only, except where definitely fixed by dimension notations.

2. To be followed as closely as possible; Contractor's responsibility is to notify inspector before installation if any interference with other work exists.

3. Subject to rearrangement for proper installation.

4. Certain runs of piping shown distorted to avoid confusion.

5. Diagrammatic drawings to be understood as schemes of required system and not to be used for accurate locations.

B. Exact Locations:

1. As required for proper installation in available space.

2. Avoid interference with architectural and structural features and work of other trades.

3. Preserve head room and keep openings and passageways clear.

4. Make arrangement neat, occupying minimum space.

5. Subject to approval of the Engineer.


C. Discrepancies or Errors: In case discrepancies or error occurs between specifications, plans, regulating code, etc., notify the Engineer for instructions as directed in GENERAL CONDITIONS.

D. Examine all drawings so as to fully determine the availability of space for the installation of tank and piping system, dispensing equipment and the extent of work required to be performed in order to coordinate this work with the work of other trades. Determine that access to installed equipment will be adequate for maintenance and services.

E. Cutting and Repair of Structures:

1. Cutting: Only as authorized by the Inspector.

2. Repairing: By appropriate mechanics to restore construction to former condition.

3. Cutting of Openings: Provide through walls and other construction as necessary for passage of pipes, conduits, etc. whether or not indicated on the Contract Drawings.

F. Protection of Work: As necessary to prevent damage of any kind to materials and installation. Adequately cover fixtures and equipment during construction as required by Inspector.

G. Record Drawings: Maintain "As-Built" prints indicating accurate layout or locations of underground storage tanks, all piping, valves, cleanouts, and control equipment as installed. Provide in strict accordance with provisions of RECORD DRAWINGS AND RECORD PROJECT MANUAL or GENERAL REQUIREMENTS.

H. Shop Drawings and List of Materials, Fixtures and Equipment:
1. See Division #1 for Requirements.

2. Required List of Materials, Fixtures and Equipment: Submit complete list of materials, fixtures and equipment with names and addresses of manufacturers, catalog numbers and trade names. Submit illustrations and descriptive literature for each article. Underline all pertinent data for each article in each copy of each catalog or brochure in which it is described. Note in letter of transmittal all variations of performance, design and installation.

I. Materials and Workmanship:

1. General: In conformity with the Los Angeles Municipal Codes, Underwriters' Laboratories and California State Air Resources Board and State Fire Marshal Requirements and State Assembly Bills AB 1702 & AB 2481.

2. Materials: New and in perfect condition. Materials for similar uses to be of same type and manufacture unless otherwise approved. Materials for underground tanks, piping, fittings, joining compounds, seals and any other components directly in contact with the products to be dispensed shall be compatible for petroleum products and methanol fuel.

3. Workmanship: Best standard practice of the plumbing and heating trades.

J. Permits and Inspections:

1. As required by the Los Angeles City Municipal Codes, L.A. Fire Department and CAUOSHA and shall be obtained and paid for by the Contractor as noted in Division 1 - GENERAL REQUIREMENTS.

2. The South Coast Air Quality Management District, (SCAQMD) permit shall be obtained and paid for by the Contractor.

3. Applications for a SCAQMD Permit to Construct/Operate shall be completed by the Contractor with the assistance of CITY'S General Services' (DGS) Environmental Compliance Unit. DGS will send the application forms to the Contractor by facsimile or mail. The Contractor shall fill in all blanks as marked and return the forms back to DGS within five (5) working days of the "Contract Execution Date". DGS will then complete the CITY'S portion of the application within five (5) working days from receipt of the package and notify the Contractor of the availability of the completed forms for pickup. The original application forms (along with the necessary fees), the Contractor, with copies shall submit manufacturers' certification that the tank(s) and piping are compatible with petroleum products and methanol fuel, and copies of the site plans and CITY'S project specifications shall be submitted to the SCAQMD by the Contractor, with copies provided to DGS. DGS may be reached at (213) 473-7748.

4. Contractor shall obtain all necessary inspection approvals prior to concealment of the work.

5. Inspections by Los Angeles City Department of Building and Safety, Fire Department and the Bureau of Contract Administration shall be required. Final certificate of approval for the entire system is required.

1.3 EXCAVATING, TRENCHING AND BACKFILLING
A. **Excavating:**

1. All excavating, trenching and backfilling required for installation of piping and any other devices that are part of work of this Section.

2. Make trenches parallel to footings and not closer than 24-inches to the face of the footing and not below a plane having a downward slope of two horizontal to one vertical from a line 9-inches above the bottom of the footing. The depth must anticipate the 6-inches of sand around the pipe.

3. Make trench width to provide ample space for proper installation of any piping.

4. Grade bottom of all excavations to uniform slope as required by the code and to prevent formation of pockets in the pipe.

5. The excavation shall comply with current OSHA regulations, if the tank hole cannot be extended due to limitations by property or structure(s), the contractor shall prepare and obtain approval for a shoring plan for specific installation. The plan must also be approved by the City.

6. Minimum depth of tank, piping and associated system.

7. The excavation for the tank placement shall be lined with a Geo Fabric before any pea gravel is placed in the excavation.

B. **Protection:** Protect all excavations and trenches against caving-in by shoring or otherwise in conformance with "Construction Safety Orders", Division of Industrial Safety, State of California, Title 8, Subchapter 4, Article 6, Sections 1540 and 1541. For more information, refer to Division 2, Section 202, Sub-Section 1.05 - SHORING.

C. **Backfilling:**

1. Remove debris, trash and form materials from the excavation and trenches prior to backfilling.

2. Do not backfill trenches until the Engineer and Fire Department have inspected and approved the finished length of pipe, including all fittings and valves.

3. Backfill Material: Pea gravel of no more than 3/18" maximum size or clean sand shall be used.

4. All Backfill Around Pipe: Pea gravel of no more than 3/8" maximum size shall be used to a thickness of not less than 6-inches around the finished section of pipe.

5. There shall be a minimum of 12" of approved base material on top of the pea gravel compacted to 95% CAB/CMB.

6. Finish backfill to suitable elevation to provide for anticipated settlement and shrinkage.

7. Keep all trenches and excavation free of water until backfilled. Remove all water by pumping or as approved by the Inspector.

8. Remove from the job-site all excess excavated and imported material not used for backfill, and all waste and debris.
9. The tanks shall be set on a 12 inch bed, around and both ends with pea gravel or clean sand.

10. The tanks shall be buried to sufficient depth to allow drainage of all lines down to the tank area. For maximum burial depth allowed by the Tank manufacturer, consult the engineer.

11. Crushed rock base for tank and drive slabs will be 12 inches.

12. New 8 inch thick reinforced concrete slab over tanks with number 4 bars at 12 inches on center each way.

1.4 ACCEPTANCE OF WORK

The complete system will not be considered for acceptance until the Contractor has completed the contracted work, has demonstrated to the representative of the Engineer that the systems operate properly in accordance with these Specifications and the standards herein referenced and final approval has been received from the Fire Department.

1.5 SOILS INFORMATION

A. Information on the drawings or in the Soils Investigation Reports does not constitute a guarantee of uniformity of soils conditions on the construction site.

B. Copies of Soil Report prepared by the Bureau of Engineering, Department of Public Works will be part of “Important Notice” to be sent to prospective bidders.

PART 2 – PRODUCTS, EQUIPMENT AND INSTALLATION

2.1 PIPING

A. Materials for Gasoline Supply:

1. Pipe and Fittings: All supply piping, Primary piping and Secondary containment piping shall be a 2” Environ Geoflex-D doublewall piping system, installed within the Geoduct Flexible Conduit with the manufacturers recommended fittings only or U.L. approved equal. Material described shall be compatible with petroleum products and methanol fuel.

B. Materials for Vapor Recovery System and Vent:

1. Underground Piping: All vapor recovery and vent piping shall be double-walled Fiberglass-Dualoy 3000L by Ameron or AA. Smith or equal as approved by the authorized city representative.

   a. The vapor recovery phase 2 connection from dispensers to the VR-2 header shall be fiberglass 2 inch diameter single wail.

2. Above-ground Vent Pipe shall be Carbon Steel Schedule 40 and shall have a protective corrosion resistive coating of approved type.

3. Vapor Recovery Piping
4. All fittings and devices for the vapor recovery system shall be compatible with Environ Leak Detection System.

5. Secondary containment for all underground pipe, sump, under dispenser containment etc. must be constructed to prevent any water intrusion into the system by precipitation, infiltration or surface run off.

6. Piping, sump, under dispenser containment (UDC) shall be UL approved for petroleum products, and all blends of fuel, and also approved for product tightness as mandated by AB 1702 & AB 2481.

7. Penetration fitting for sump and under dispenser containment (UDC) must be liquid and vapor tight and must be listed by UL or other independent testing organization (accepted by L.A. Fire Department) for product tightness.

C. Material for Leak Detection Sensor Conduit: Steel Schedule 40 corrosion protected.

D. Pipe Sizes:

1. Fill Stand Pipe: 4-inch inside diameter, corrosion protected.

2. Vent/Vapor Recovery Stand Pipe: 4-inch inside diameter, corrosion protected.

3. Fuel Vapor Return Pipes: 2-inch diameter primary piping and 4-inch diameter secondary piping.

4. Fuel Supply: 2-inch diameter primary pipe and 3-Inch diameter secondary pipe.

5. Vapor Recovery Pipe Risers at Dispenser Island/Pad: 2-inch inside diameter to required pipe size for installation of vapor recovery system.

6. Vent Pipes:
   a. Underground: 2-inch diameter primary and 3-inch diameter secondary.
   b. Aboveground: 2-inch diameter.


8. Motor Oil: 1-inch diameter primary pipe and 3-Inch diameter secondary pipe.

E. Steel Pipe Waterproofing and Protection:

1. Required Covering: All steel pipe and fittings embedded in ground or in concrete.

2. Materials: Plastic tape approved by Los Angeles City, Department of Building and Safety.

3. Hand Application: Clean all material thoroughly to the bare metal base. Remove all grease and oil with a non-oily solvent. File or grind smooth burrs, sharp edges and rough spots. Make all surfaces dry and dust free. Spiral wrap pipes with uniform laps by hand, completing one layer with prescribed laps; then reverse direction of wrapping and apply a second layer in the same manner, again maintaining prescribed laps, all widths of tape, lengths of rolls and dimensions of laps shall be as recommended by manufacturer in the manufacturer's material
requirements table. Exercise care to ensure a uniformly applied, tightly bonded tape, free of air pockets, voids and wrinkles.

4. Machine Application: Clean all materials thoroughly to the bare metal base for machine application. Spiral wrap pipe uniformly by an approved manual or power driven machine with 50% laps and one over wrap of 50150 lb. asphalt laminated draft, either wet strength one side, or reinforced. All widths of tape, lengths of rolls and application shall be as recommended by manufacturer in manufacturer's material requirements table. Exercise care to ensure a uniformly applied, tightly bonded tape, free of air pockets, voids and wrinkles.
1. 1 ea. #4805OH, EZ-Lift 48" Manhole with 2 each 5 gallon containments and 2 snap-tight access lids.

2. 1 ea. #4885, threaded PV vent.

3. 1 ea. #OOCL12, 12" Cam-lock Observation Port.

4. 2 ea. #120-FIM, Extractor fittings, 4x4x2x2.

5. 2 ea. #12312B, 2" Ball Floats with 118" bleeder holes.

6. 1 ea. #A0030-124, Swivel Fill Adaptor.

7. 1 ea. 464, Top Seal Cap.

8. 1 ea. #A0076-124, Swivel Vapor Adaptor.

9. 1 ea. #611VR3, Toggle Type, Vapor Return Adaptor Cap.

10. 1 ea. #61T, OPW 4" Drop Tube with Overfill Prevention Valve or equal.

11. 117F/M Union Extractor.

12. Other components (if required) to complete the assembly.

H. Fill Assembly System (Motor Oil): This system including the containment boxes shall consist of the following equipment manufactured by CNI Manufacturing or approved equivalent per tank:

1. 1 ea. #4805OH, EZ-Lift 48" Manhole with 2 each 5 gallon containments and 2 snap-tight access lids.

2. 1 ea. #4885, threaded PV vent.

3. 1 ea. #OOCL12, 12" Cam-lock Observation Port.

4. 2 ea. #120-FIM, Extractor fittings, 4x4x2x2.

5. 2 ea. #12312B, 2" Ball Floats with 118" bleeder holes.

6. 1 ea. #A0030-124, Swivel Fill Adaptor.

7. 1 ea. 464, Top Seal Cap.

8. 117F/M Union Extractor.

9. Other components (if required) to complete the assembly.

I. Turbine and Check Valve Side of Tank: Use CNI Easy-Lift or approved equal.

1. 1 ea. #7047 48" diameter EZ-Lift Manhole.

2. 1 ea. #OOCL12, 12" Observation Port with Camlok Cover.
J. Stand Alone Containment Boxes: Where required shall consist of the following CNI Boxes or Equivalent:

1. #205OCL, All Ductile Iron 5 gallon containment box with snap-tight cover.
2. #7031, Ground Wire Continuity Box for connection to a rod away from the tank.
3. #112MWCL-1, 12”x12” Monitor Well Box.

K. Maintenance Holes: Round maintenance hole with cover, gasket and screws. Maintenance hole assembly shall be traffic-rated (Fire Department vehicles) and watertight and heavy coated with epoxy resin paint for corrosion protection. It shall have the following features:

1. For Pump and Float Check Valve Combination: 48” diameter with one (1) 12” Dia. access hole, lift covers and 5 gallon containment box at the Float Check Valve side.
2. For Fill and Gage Combination: 48” Dia. with two (2) 12” Dia. access holes and individual lift covers and 5 gallon containment box each.

L. Shop Drawings and Manufacturer's Reference Data: Required as specified in Subsection 1.2 (H) of this Section.

2.2 TANKS

A. Capacity: Tanks shall be installed as part of the fuel site. Tank(s) must be double walled, fiberglass coated steel tank(s) of size and weight indicated in the "Tank Schedule" on the Contract Drawings. Tanks shall be UL and LAFD approved. The approval shall cover the entire steel assembly and exterior fiberglass reinforced polyester resin. Tank shall have a 30-year replacement warranty against corrosion failure. Tanks shall include necessary piping sumps. Tanks shall be manufactured to the Steel Tank Institute's (STI) ACT-100 Specification and shall carry the STI ACT-100 label.

B. Manufacturer: Shall have the following certificate/license:

1. STI ACT-100 License
2. Los Angeles Fire Department General Approval Certification.

C. Material:

1. In accordance with the City of Los Angeles Code, Chapter 5, Article 7, "Fire Protection and Prevention".
2. The tank shall be constructed of carbon steel material as specified in Article 7 of the Underwriters Laboratories’, Inc (UL)-58. All tank thicknesses shall be built in strict accordance with Article 5 of UL-58.
3. Primary Shell: Carbon steel plate.
4. Weld all joints in accordance with UL-58. If butt welds are to be utilized, butt welds shall be full penetration welds. In addition, all welds shall meet the criteria in Appendix G of the STI's ACT-100 Specification.
5. Secondary Shell: Composite steel and fiberglass reinforced plastic (FRP). For external corrosion protection, the steel secondary shell shall be clad with FRP with a minimum laminate thickness of 100 mils in accordance with UL-1746. Fiberglass reinforced plastic shall compose of a precise mixture of resin, catalyst and chopped roving of fiberglass applied by spraying.


7. All joints shall be welded in accordance with UL-58. If butt welds are to be utilized, butt welds shall be full penetration welds. In addition, all welds shall meet the criteria in Appendix G of the STI's ACT-100 Specification.

8. Submit a written certification stating that the outer shell has passed the holiday test detector operating at 35,000 volts, performed immediately after tank construction completion.

9. Make lifting lugs at ends of tanks capable of withstanding weight of tank with a safety factor of 3 to 1 as specified in Article 6 and 19 of the UL-58 standard.

10. Openings Required: Refer to drawings for fitting locations and sizes. Provide bushing or cap at tank as required.

11. Each primary inner tank shall be built with steel striker plates, with a minimum thickness of a 1/4 inch, as specified in Article 12 of the UL-58 standard, installed on the interior bottom below each tank opening.

12. Each tank shall be furnished with a 2 inch diameter bung at each end of the tank for the installation of the annulus probe.

13. Gauging (strapping) tables for each shall be furnished to the CITY.

14. Upon delivery of the tanks, the tanks will be subjected to an acceptance test. The CITY will conduct another holiday test, at a voltage between 10,000 and 15,000 volts performed immediately before placing the tanks in the excavation.

15. 30-year warranty for interior and exterior corrosion.

16. Tank's primary and secondary walls shall be compatible with petroleum products and methanol fuel.

C. Labeling and Certificates:

1. As required by City and State Ordinances and suitably attached to tank(s) prior to shipment to the job-site(s).

2. Appropriate label of the Underwriters' Laboratories, Inc., or an equivalent label of another testing agency approved by the City Fire Commission.

3. A label of non-ferrous metal, bearing the name of the tank manufacturer, the letters "L.A.F.D.", the approval number, the gauge of metal of the tank and the capacity of the tank in gallons.

4. Name of the tank manufacturer.

5. The STI serial number.
D. Inside of Tanks: Keep clean and free from dirt, water, or other foreign matter by closing openings with pipe plugs.

E. Excavation and Backfill:
   1. All excavation as necessary in accordance with the requirements of the Los Angeles Municipal Code.
   3. Backfill: Backfill with pea gravel of 318" maximum size from undersides of the tank to subgrade balance of backfill as specified in Section 02318 – Excavation, Backfilling and Compacting for Utilities.
   4. Inspection: Tank excavation not to be backfilled until underground fuel tank and all piping have been installed and the Fire Department and the Engineer have completed their inspection of the installation.

F. Installation of Tanks: If a high water table is present at the site, the tanks shall have an 18" slab of concrete poured above the tank and extending 12" beyond the tank on all sides with 2 mats of '/2 " inch rebar, 12" on-center each way laid in the concrete.

Conform to the details on drawings and manufacturer's recommendations and in accordance with Section 57.31.42 of the Municipal Code of the City of Los Angeles, the requirements of the National Board of Fire Underwriters, applicable State of California Codes and as approved by the Los Angeles Fire Department and the Engineer.

G. All new underground tank installation shall be provided with approved overfill prevention equipment.

H. Shop Drawings: Required; for approval prior to fabrication of the tanks as specified in Subsection 1.4H. of this Section.

2.3 FUEL DISPENSING SYSTEM

A. Dispenser: Gasboy 9153-AXTWLCX or approved equivalent, single product dual hose remote dispenser with internal dial light, electric reset, and 10.1 pulsar (methanol compatible). Dispensers shall be California Air Resources Board certified. Where required by the project requirements and approved by the Engineer, a dual product, dual hose Gasboy dispenser may be used.

B. Pump: Submersible Pump Assembly: 4" submersible pump. Red Jacket AGP150S1 or approved equivalent. Pump assembly shall include 1-1/2 HP submersible pump with piston type pressure leak detector (PLD) Part No. 116.030, riser and manifold. It shall fit a standard 4" N.P.T. tank opening (Use 2 Pumps). Pump shall be U.L. listed for use with petroleum products and methanol fuel and shall be capable of delivering 20 GPM at 98 Ft. head. Electrical requirements: 208 to 230V-60 HZ-10.5AMP-FL. The assembly shall be U.L. listed. Bottom of pump to bottom of tank clearance shall be 5". Each tank shall be equipped with two submersible pumps for redundancy or uninterruptible fueling. Circuitry shall be installed to automatically alternate the starting of the pumps to allow uninterrupted fueling if one pump fails and allow both pumps to evenly wear to minimize maintenance. A tank selector switch shall be provided in order to selectively isolate tanks for maintenance and repair and to provide control of fuel inventories. Complete as-built electrical drawings shall be provided to the City.

C. Accessories (Gasoline):
1. Gasoline Hose: Co-axial Premier, Goodyear No. 1-114 x 4'-0", #GN53236544000400.

2. Gasoline Hose. Co-axial Premier, Goodyear No. 1-1/4 x 8'-0", #G/Y53236544000800.


4. Hose Clamp: Goodyear No. 537-005.

5. Hose Breakaway Coupling: "Husky #3360VR" or equal.

6. OPW-38CS Splitter Valve.

7. 2" impact shut-off valve with stabilizer kit by Morrison Bros. Co. Model 4636M or equal and spill containment box by "OPW Pices" or Environ or approved equal. Containment box shall be compatible with SB989 test procedures.

8. High Hose Retractor: Pomeco No. 6100-AGBR or equal.

D. Signage:

1. Text: PUMP EMERGENCY SHUT-OFF SWITCH
   Size: 10" High x 14" Long
   Material: 118" Thick melamine plastic surface laminate with a tough phenolic core, squared corners w/ grommeted holes, scratch resistant, non-static, fire retardant, colorfast and weatherproof
   Lettering: 2" high engraved in material
   Colors: White graphics on red background
   Location: Adjacent to pump emergency shut-off switch mechanically fastened to wall.

2. Text: NO SMOKING
   Size: 14" High x 14" Long
   Material: 1/4" Thick melamine plastic surface laminate with a tough phenolic core, squared corners w/metal bracket, scratch resistant, non-static, fire retardant, colorfast and weatherproof
   Lettering: 3" high engraved (both sides)
   Colors: White graphics on red background
   Location: On top of each fuel dispenser

3. Text: IMPORTANT NOTIFY:
   Size: 10" High x 14" Long
   Material: 118" Thick melamine plastic surface laminate with a tough phenolic core, squared corners w/grommeted holes, scratch resistant, non-static, fire retardant, colorfast and weatherproof
   Lettering: Top line 2" high, and remainder 1 112" high engraved in material
E. Light standard: Model #CTM-FT-400-SMH-F-MT-BLK-NO shall be provided on all islands.


G. Manufacturer’s Reference Data: Required in accordance with provisions of Section 1330 of GENERAL REQUIREMENTS.

H. Fuel Islands: Install 1 ea. 4’x5’ with 6’ Radius Steel Fuel Island form for each Dispenser and card reader. Install 2 steel schedule 40, 12-inch bollards at each end of fuel Island. The bollards will be installed 6’ above and 5’ below finished grade. Bollards to be solid grouted with 36” diameter footing.

2.4 FUEL LEAK DETECTION AND INVENTORY MONITOR SYSTEM:

Leak Detection and Monitoring (LDM) Panel: Veeder-Root TLS-350, or approved equal, shall be as follows:

A. General: System shall be a computer based device, designed specifically for continuous storage tank leak detection applications with enough channels for all the leak sensors and probes of intrinsically safe terminals. System shall be compatible with the Fuel Automated Tracking System Equipment or the Card Reader System. System shall provide an audible buzz with silencer, a backlit 2 x 24 character LCD to display real-time monitoring status such as sensor address, sensor type, signal magnitude, alarm status and setpoint level. System shall also have future expansion capability for telecommunication option. System shall have fuel inventory management capability and information transmission Ma telecommunication facility. System shall operate primarily on 115 volt, single phase, 60 Hz power supply with battery backup with automatic transfer and charger.

B. Console

1. The console shall be wall mounted using external mounting tabs. Locate inside fire station in location shown on drawings.

2. The console shall be equipped with a two-line, 24-character liquid crystal display for on-site viewing of all inventory, leak detect and alarm information.

3. The system shall have a Four-Relay Output Interface Module that can be programmed to actuate external alarm devices when assigned alarm limits are exceeded or alarm conditions are identified. On a high level alarm in the waste oil tank the output relays shall be utilized to activate the relay control panel controlling the solenoid valves in the waste oil drains. On turbine containment sump or under pump containment sump alarm the turbine shall be shut down.

4. The console shall be equipped with a 24-button front-panel keyboard with control and alphanumeric functions for programming, operating and reporting functions.

5. The console shall be equipped with three front-panel indicators to provide a visual indication of power on, warning and alarm conditions.
6. The console shall be equipped with an integral, 24-character, thermal report printer with built-in take-up spool for hard-copy documentation of inventory, leak detect, alarm information, and facsimile transmission confirmation.

7. The console shall be equipped with a back-up battery to maintain all programming information as well as inventory, leak detect and alarm information in the event of a power outage.

8. The console shall be a modular design to accept additional business management, leak detection and communications features in the future.

9. The console shall be equipped with four 1-3/16" conduit knockouts on the top and the bottom of the monitor for rigid conduit entry into the monitor. Two conduit entries (top and bottom) shall be designated for the intrinsically safe compartment, and two conduit entries (top and bottom) shall be designated for the high-power compartment.

10. The console shall be separated into three compartments for: 1) intrinsically safe wiring and devices; 2) high-power wiring and devices; and 3) communications wiring and devices.

11. The console shall have an internal quick-disconnect connector for 120 Vac wiring to the console for ease of installation, service and troubleshooting.

12. The console shall be equipped with Fuel Automated Tracking System, (FATS) and the ability to communicate directly with an external POS terminal, printing device or PC. The system shall also have the ability to communicate with a remote device via the telephone lines.

13. The console shall be capable of selectively communicating in English.

14. The console shall be equipped with internal audible and visual warning and alarm indicators.

15. The console shall be intrinsically safe, with Underwriters Laboratories (UL), Canadian Standards Association (CSA) approval, and Canadian Underwriters Laboratories (CUL).

16. The console shall comply with Federal Communications Commission (FCC) testing, FCC Part 68, Subpart 15.

17. The console shall be mounted and wired according to the manufacturer-supplied installation manuals, with all underground intrinsically safe field wiring enclosed in dedicated conduit and separate from all other wiring. The system's high-voltage wiring may share existing conduit with other high-voltage devices in accordance with the applicable guidelines published in the National Electrical Code (NEC).

18. The console shall continuously monitor all probes and sensors, reporting not only normal operating conditions, but also system malfunctions or failures.

19. The manufacturer shall maintain an ISO-9001 rating ensuring quality management of design, manufacturing, training, and technical documentation.
C. Interstitial Monitoring

1. The system shall be able to perform automatic, continuous leak sensing in the dry interstitial space (annulus) of a double-wall tank, to detect a breach in the inner or outer shell.

2. The system shall differentiate between hydrocarbons and water and provide an indication of a fuel alarm or a liquid alarm.

3. The system shall have the ability to sense the presence of hydrocarbons and/or fluid and provide an alarm for worst-case condition (fuel).

4. The form factor of the sensor must provide for easy field installation/removal.

5. The system shall have the ability to continuously monitor the integrity of the sensor for an open condition, alarm condition, or normal operating condition.

6. Provide 18" diameter by 12" skirt watertight cast iron Monitoring Well with Cam-loks. CNI No. 118MWCL-1 or equivalent. Maintenance hole and cover shall be watertight and traffic-rated to the H2O Standard.

7. The interstitial sensor for a double-wall steel tank shall be 2.5" high and 1.25" in diameter to fit into a riser pipe for a double-wall steel tank of 1.5" I.D. or greater.

8. The steel interstitial sensor shall be equipped with a 25-foot leader cable to connect the sensor to field wiring in the sensor junction box.

9. The interstitial sensor shall utilize a float and reed switch technology to sense and alarm for the presence of fluid.

D. Under pump and Containment Sump Monitoring

1. The system shall be able to perform automatic, continuous leak sensing in the containment-piping sump.

2. The system shall have the ability to detect the presence of fluid (hydrocarbons and/or water) in the piping containment area and provide an alarm condition.

3. The system shall have the ability to differentiate between hydrocarbons and water and provide an alarm condition for the respective alarm. The system shall also have the ability to indicate when the sensing device has failed and is no longer providing environmental compliance.

4. The system shall have the ability to continuously monitor the integrity of the sensor for an open condition, alarm condition, or normal operating condition.

5. The dispenser pan and containment sump sensors shall utilize float switch technology to sense and alarm for the presence of fluids and shall differentiate between hydrocarbons and water.

   a. The design of the sensor shall provide for a distributed sensing capability over the full length of the dispenser pan and containment sump sensor.

   b. The dispenser pan and containment sump sensor shall be reusable after being exposed to hydrocarbon liquids.
c. The dispenser pan and containment sump sensor shall not put the system into an alarm condition due to high concentrations of hydrocarbon vapors.

d. The dispenser pan and containment sump sensor shall provide an indication of fluid when liquid reaches 1” in height.

E. **Alarms**: The gasoline tank system shall be configured such that in the case of an interstitial or containment sump alarm the turbine pump shall be shut down. The motor and waste oil systems shall be configured such that in the case of an interstitial or containment sump alarm, audible and visual alarms shall be activated. A silencer switch shall be provided. A Veeder-Root or equivalent "Overfill Alarm" both audible and visual with an Alarm Acknowledgment switch to provide early warning of potential overfills via an alarm relay in the TLS-350 console shall be provided.

F. **Installation**: Contractor shall mount panel on unistrut stand bolted to wall at location as indicated in building Drawings.

2.5 **FUEL LEVEL GAGE PROBE**

Use the electronic type of level probe for the gasoline tank for its multi-function capabilities in conjunction with the leak monitoring and fuel management system. The electronic type of level probe shall also be used in the motor and waste oil tanks, should those tanks be a project requirement.

A. The probe shall be capable of utilizing standard non-shielded gas and oil-resistant wire between 14 AWG and 18 AWG for field connections.

B. There shall be no more than two conductors between each probe and control console.

C. The probe shall be capable of performing a leak detection test to 0.1 GPH or higher.

2.6 **VAPOR**

2.6 **VAPOR RECOVERY SYSTEM**

Vapor Recovery System along with all equipment must be California Air Resources Board certified and compliant with all State and local regulatory Agency requirements at the time of installation.

2.7 **FIRE PROTECTION SYSTEM**

In compliance with the L.A. Fire Code, Section 57.100.41, Contractor shall supply and install two portable, surface mounted fire extinguishers as shown in the Contract Drawings. At least one fire extinguisher shall be within seventy-five (75) feet of every fuel dispenser.

A. **Fire Extinguishers**: Type ABC-10, U.L. rating 4A-60 B: C by Standard Fire Equipment, division of Zurn Industries, Inc. or approved equal.

B. **Steel Cabinet (for outdoor installed fire extinguishers)** - Type: Surf ace-mounted, Model 4108AL by Standard Fire Equipment, division of Zurn Industries, Inc. or approved equal.

2.8 **EMERGENCY POWER SYSTEM**:

Connect fueling station to emergency generator on site if applicable. Alternatively, an emergency transfer switch and emergency generator configuration plug (pigtail) shall be installed to provide the means to connect a portable emergency generator, which will allow operation of the fueling
station in an emergency. The receptacle shall be a rain tight Aertite 100 Amp Pin and Sleeve receptacle with AJA mounting Box (Part #ADJA1033-125), and female clamping ring plug (Part #ACP1033CD).

PART 3 - EXECUTION

3.1 GENERAL

A. All parts of this fueling system shall comply with all current State and local regulatory agency requirements at the completion of this project.

B. Install and assemble all items listed in this Specification in accordance with best standard practice of the trade so as to be satisfactory and workable systems as determined by the Engineer.

C. Additional tests maybe required or modification of current tests may occur during construction of the project. As such, the Contractor shall comply at no cost to the City except agreed time extension.

3.2 TESTS

A. **Pressure Tests**: Make an air test of each tank and piping to stubs above ground level after completion of installation with all openings capped. Pressure test tank and piping at a pressure not to exceed 5 pounds per square inch (psi) for a period of 1-hour. Tests shall conform to manufacturer's recommendations. (Secondary containment piping shall be tested under the same method.) (Product piping shall be tested at 75 psi.). Precision test as required by Los Angeles Fire Department.

B. **SCAQMD Test TP-201.4**: The principal of this test procedure is to determine the dynamic pressure of a vapor recovery system at known dispensing flow rates. Some alternative procedures are provided and one procedure shall be chosen for application appropriate to the operational characteristics of the subject vapor recovery system. A novel test procedure may be developed and used which incorporates some aspects of the procedures provided.

C. **SCAQMD Test TP-201.3113**: Nitrogen is introduced via the vent pipe until the entire vapor recovery system is pressurized to two (2.0) inches water column. The pressure is then allowed to decay for five (5) minutes. The acceptability of the final pressure is based upon the vapor system ullage.

D. Perform State Water Regional Quality Board SB989 secondary containment testing at completion of installation. Per State Board requirements repeat SB989 testing 6 months after initial test.

E. **Operating Tests**: Operate each piece of equipment and each system to demonstrate compliance with these Specifications.

F. **Installation**: Make all tests in the presence of the Engineer for approval by him and by authorized representative of the Fire Prevention Bureau of the Los Angeles Fire Department.

G. Provide and pay for all necessary equipment, material and labor for tests, except gasoline fuel required to fill the storage vessels will be supplied by the City.
H. **Enhanced Leak Detection:** Test the UST after installation, and before it is placed into use, using one of the following three test methods: (1) enhanced leak detection (ELD), (2) an inert gas pressure test certified by a third party and approved by the SWRCB, or (3) a test method deemed equivalent to ELD and approved by the SWRCB in regulation.

If the results of post-installation testing indicate that the UST system is leaking liquid or vapor, the contractor shall take appropriate actions to correct the leakage, and retest the system using the same approved test method until the system is no longer leaking liquid or vapor.

I. **SB989 Secondary Containment Testing:** Perform State Water Regional Quality Board SB989 Secondary Containment Testing at completion of installation. Repeat SB989 testing 6 months after completion, per State Board requirement.

### 3.3 OPERATING INSTRUCTIONS AND SERVICE MANUAL

A. Carefully prepare full description Service and Operating Manuals for the entire system. Submit these Manuals for approval at least 10 days before completion of work. Failure to submit will delay final inspection and acceptance of work by the City.

B. Form in which Service Manual is to be presented subject to approval of the Engineer.

C. Include the following items, together with any other necessary pertinent data. This list is not complete and is to be used as a guide only:

1. Part numbers of all replaceable items.
2. Manufacturer’s cut and rating tables.
3. Oiling, lubrication and greasing data.
5. All test data for factory and field tests.
6. Belt sizes, types and length.
7. Serial numbers of all principal pieces of equipment.
8. Installing company’s names, addresses and phone numbers. Name and address of servicing company if different from installer.
9. Control diagram and operating sequence, together with labeling of control piping and instruments to match diagram.
10. Valve list indicating location and function of each.
11. Insurance company approvals (where required in specific sections).
12. Calibration or strapping charts and tables for each tank.

D. After approval by the Engineer, furnish five (5) copies of this Manual in addition to an electronic copy in the PDF format to the Engineer for distribution.

E. Operating instructions and Service Manuals are part of final inspection and shall be submitted for approval at least 10 days in advance of request for final inspection.
F. Neatly bind Operating Instructions and Service Manuals in stiff cover binders. Identify such Manuals.

G. The Contractor shall arrange with the Engineer for an instructional operating period at job-site at which time a competent supervisor shall operate the equipment and instruct the Engineer's designated representative personnel in all phases and details of operation and maintenance. Any required instructions from the manufacturer's representatives shall also be given at this time. This period shall be three consecutive days unless failure or malfunction of equipment is experienced.

3.4 EMERGENCY REPAIRS

The City reserves the right to make emergency repairs as required to keep equipment in operation without voiding the CONTRACTOR'S guarantee bond, or relieving the Contractor of his responsibilities during the bonding period.

END OF SECTION
PART 1 - GENERAL

1.1 DESCRIPTION

A. Work included: Provide clarifier and sand trap as specified herein and as indicated on the drawings.

B. Related Work:
   2. Section 02530: Site Sanitary Sewer System.

1.2 QUALITY ASSURANCE

A. Use adequate numbers of skilled workmen who are thoroughly trained and experienced and who are completely familiar with the specified requirements for proper performance of the work in this section.

B. Certify that ALL products and building materials specified herein are ASBESTOS FREE.

1.3 SUBMITTALS

A. Shop Drawings: Shop Drawings shall be submitted for approval in accordance with the section 01330. Drawings shall show dimensions, details and methods of mounting or anchoring, shape and thickness of materials, and details of construction.

B. Descriptive Data: Manufacturer's descriptive data and installation instructions shall be submitted for approval.

1.4 PRODUCT HANDLING

Clarifier shall be protected from damage.

PART 2 - PRODUCTS

2.1 CLARIFIERS (CL-1, CL-2)

A. Tank shall be pre-cast of concrete which has a minimum compressive strength of 3,000 P.S.I. at 28 days using a Type II Portland Cement.

B. Rebar shall meet ASTM A-615.

C. The control of shrinkage cracks shall be accomplished through the use of either welded wire mesh or "Fibermesh" fibers.

   1. The welded wire mesh shall meet the criteria of ASTM A-185.

   2. "Fibermesh" brand fibers shall be used at a concentration of 1.5 pounds of "Fibermesh" per cubic yard of concrete
D. Heavy Duty clarifier tank shall be capable of supporting (without the addition of a traffic slab):
   1. A H-20 truck loading, in addition to 3-feet of earth cover or;
   2. A load of 8 feet of earth.

E. The minimum protective coating requirements for the concrete clarifier tanks are as follows:
   1. The coating shall meet the criteria specified in ASTM C-309.
   2. The coating shall cover all internal surfaces.

F. Internal piping and fittings shall be made of 4 inch PVC plastic or ABS plastic.

G. Provide for gas proof gaskets.

2.2 SAND TRAP (ST-1)

A. Tank shall be pre-cast of concrete which has a minimum compressive strength of 3,000 P.S.I. at 28 days using a Type II Portland Cement.

B. Rebar shall meet ASTM A-615.

C. The control of shrinkage cracks shall be accomplished through the use of either welded wire mesh or "Fibermesh" fibers.
   1. The welded wire mesh shall meet the criteria of ASTM A-185.
   2. "Fibermesh" brand fibers shall be used at a concentration of 1.5 pounds of "Fibermesh" per cubic yard of concrete

D. Heavy Duty clarifier tank shall be capable of supporting (without the addition of a traffic slab):
   1. A H-20 truck loading, in addition to 3-feet of earth cover or;
   2. A load of 8 feet of earth.

E. The minimum protective coating requirements for the concrete clarifier tanks are as follows:
   1. The coating shall meet the criteria specified in ASTM C-309.
   2. The coating shall cover all internal surfaces.

F. Internal piping and fittings shall be made of 4 inch PVC plastic or ABS plastic.

PART 3 - EXECUTION

3.1 MANHOLE COVERS: Manhole covers shall be cast iron with a neoprene gas tight gasket.

3.2 PLACING: Pre-cast unit shall be placed on level dry and undisturbed soil.
3.3 BACKFILLING: Backfill ends first, then backfill sides in 3 foot lifts, alternating sides. Recompact per SECTION: 02318 EXCAVATION, BACKFILLING AND COMPACTING FOR UTILITIES.

3.4 MORTAR: Mortar joint between cap and tank.

3.5 INSTALLATION: Provide all appurtenances necessary for a complete and proper installation.

3.6 Provide extension rings as required to match finish grade.

END OF SECTION
SECTION 15500
HEATING AND AIR CONDITIONING PIPING SYSTEM

PART 1 – GENERAL

1.1 SUMMARY

A. Section Includes: Providing complete piping systems for heating, ventilating, and air conditioning systems as indicated. Systems include but are not limited to following:
2. Miscellaneous Piping Required for Equipment of this Section.

1.2 QUALITY ASSURANCE

A. Refer to Section 15010.

1.3 SUBMITTALS

A. Make submittals in accordance with Division 01 and Section 15010.

B. Manufacturer's Data.

C. Modification of Contract Drawings: Comply with requirements of Section 15010.

1.4 PRODUCT HANDLING

A. Comply with architectural section requirements.

1.5 COORDINATION

A. Coordinate all activities in accordance with of Section 15010.

PART 2 – PRODUCTS

2.1 MATERIALS, EQUIPMENT AND METHODS

A. Heating Hot Water. (Above ground piping).
1. Pipe:
   a. 2" and Smaller: Standard weight, seamless copper, Type 'L' hard drawn, ASTM B88.
   b. 2-1/2" and Larger: Schedule 40 seamless black steel, ASTM A 53B, type S. Pipes and fittings shall be properly marked with schedule No., ASTM NO., manufacturer, etc. in accordance with ASTM requirements.
2. Fittings:
   a. 2" and Smaller: Wrought solder-type copper, per ANSI B16.22.
   b. 2-1/2" and Larger: Standard weight, seamless steel; welding fittings and flanges ASTM A 234 and ASA B 16.9 for fittings and ASTM A 181 or A 105 for flanges.
3. Joints:
   a. 2" and Smaller: 95% tin and 5% antimony solder with non-acid flux type flux, ASTM B32, Grade 95TA.
b. 2-1/2" and Larger: Refer to Section 15050 for welded pipe joints.

4. Unions:
   a. 2" and Smaller: Wrought solder type, copper to copper; except use dielectric unions where copper connects to steel.

5. Flanges: 2" and larger.
   a. 150 lb. Forge steel, weld neck or slip-on, ASTM A181 and ANSI B 16.5. Furnish flat faced flanges against equipment with flat faced flanges. Flange gaskets: Mineral fiber, 1/16 inch thick, equivalent to Garlock No. 900, or equal.
   b. Bolting materials: Carbon steel heavy hex bolts and nuts, ASTM A 307, type B.

B. Valves: Hot Water Heating System.

1. Gate Valves, 2" and Smaller: Shall be of Class 150 with body and union bonnet of ASTM B62 cast bronze composition, threaded or solder ends, solid disc, copper-silicon stem, brass packing gland, Teflon-impregnated packing, and malleable handwheel.

   Threaded          Solder
   Stockham B-120 (RS) Stockham B-124
   Stockham B-130 (RS) -----
   Hammond IB 629       Hammond IB 648
   Crane 431-UB         -----
   Powell 2714

2. Ball Valves, 2" and Smaller: Shall be 600 psi CWP, have cast brass bodies, replaceable reinforced Teflon seats, conventional port, blowout proof stems, chrome plated brass ball, and threaded or solder ends with extended solder cups.

   Threaded          Solder
   Stockham S-216-BR-RT Stockham S-216-BR-RS
   Crane 9302         Crane 2192 H
   Worcester 4112 RT  ---
   Jamesbury 11 1100TT ---
   Apollo 70-100      Apollo 70-200

3. Gate Valves, 2-1/2" and Larger: Shall be Class 125 iron body, bronze mounted, with body and bonnet conforming to ASTM A126, Class B, cast iron, flanged ends, with Teflon-impregnated packing and 2-piece packing gland assembly.

   OS & Y          NRS
   Stockham        G-623 G- 612
   Hammond         IR 1140 IR 1138
   Crane           465 1/2  461
   Powell          1793  1787


   Teflon Disc:

   Threaded          Solder
   Stockham          B-22    B-24
   Hammond           IB413T IB 423
Composition Disc:

<table>
<thead>
<tr>
<th>Company</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane</td>
<td>7</td>
</tr>
<tr>
<td>Powell</td>
<td>150</td>
</tr>
</tbody>
</table>

S.S. Trim:

<table>
<thead>
<tr>
<th>Company</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crane</td>
<td>14 1/2</td>
</tr>
<tr>
<td>Powell</td>
<td>2600</td>
</tr>
</tbody>
</table>

Class 200 valves meeting the above requirements may be used where pressure requires.

Stockham B-32 (Teflon disc) or equal
Stockham B-62 (stainless trim) or equal
Hammond IB 434

5. **Globe Valves, 2-1/2" and Larger**: Shall be Class 125 body, bronze mounted, with body and bonnet conforming to ASTM A126, Class B, cast iron, flanged ends, with Teflon-impregnated packing and two-piece packing gland assembly.

Stockham G-512 (bronze disc)
Hammond IR 116

Crane 351
Powell 241
Stockham G-514 (Teflon Disc)

6. **Check Valves, 2" and Smaller**: Shall be Class 150 with body and cap of ASTM B62 bronze composition and threaded ends. Class 150 valves shall have lift-type Buna-N disc and union caps, and are to be used in lines with globe valves.

Stockham B-322-B
Crane 27
Powell 158

For backflow prevention in lines with gate valves, Y-pattern valves with swing-type disc are recommended:

For Class 150 Service, threaded ends:

Stockham B-321
Crane 137

For class 200 Service, threaded ends:

Hammond IB 944
Stockham B-345
Crane 36
Powell 560-Y

7. **Check Valves, 2-1/2" and Larger**: Shall be iron body, bronze mounted, with body and cap conforming to ASTM A126, Class B, cast iron, flanged ends, and swing-type disc.

Hammond IR 1124
Stockham G-931
Alternative for above listed check valves shall be Class 125/250 iron body,  
bronze mounted, wafer check valve, with ends designed for flanged type  
connection, aluminum bronze disc, EPDM seats, 316 stainless steel torsion  
spring, and hinge pin.

Hammond IR 9253  
Stockham WG-971  
Mission K12 HMP  
Center Line CLC Series  
Marlin A125 HZDSF

8. Automatic valves controlling steam to a coil in a hot water tank shall be single seated type.  
When these valves are installed on a gravity return system, they shall be 2 position type, i.e.,  
completely open or completely closed.

9. Valves on steam mains in boiler rooms shall be angle globe valves and be set to hold no  
condensate.

C. Electric Motor Operated Valves:  
1. Electric motor operated valves shall have operating motors completely immersed in oil.

D. Valves:  General.  
1. All handles or hand wheels on all valves shall be removable and, unless specified to be of  
loose key type, shall be securely fastened to their stems. All valve handwheels, except those  
on radiator valves, shall be of steel, brass, or cast iron.

2. All boiler shut-off valves installed more than 6'-0" above floor, shall be furnished with chain  
wheels and chains to within 6'-0" of floor. All chains shall be free hanging and in a position to  
permit operation of valve from floor. When pulleys or extensions are required to locate these  
chains in such a position, Contractor shall furnish and install said pulleys or extensions as  
required to make a satisfactory operating installation. Extensions over 1'-0" long shall be  
fitted with a supported outboard bearing.

3. Furnish and install chains or wire rope with required accessories to open safety valves from  
boiler room floor.

4. Radiator or convector valves shall be corner or angle type with composition handles,  
composition renewable discs, packing gland, union nut on tailpiece, unless otherwise  
specified. If exposed, they shall have a finished or plated exterior.

5. Temperature Control Valves:  Submit for review.

6. Flow Control Valves:  Submit for review

E. Flow Measuring Devices:  Submit for review.

F. Strainers:  Refer to Section 15050.

G. Condensate Drain Piping, From Air Handling Units:  
1. Pipe:  Type "M" tempered copper tube.

2. Fittings:  Wrought copper. Refer to Section 15050. Use copper to threaded International  
Pipe Size adapters at all threaded connections.

3. Joints:  

b. Threaded:  Pipe joint compound equivalent to WK&K "Key-Tite".

H. Indirect Drains, Relief Valve Discharge Piping and Air Vent Discharge Piping:  
1. Pipe:  Type "M" tempered copper water tube.
2. Fittings: Wrought copper. Refer to Section 15050. Use copper to threaded International Pipe Size adapters at all threaded connections.

3. Joints:
   a. Soldered: 95-5 solder
   b. Threaded: Pipe joint compound equivalent to WKM "Key-Tite".

I. Insulation: Refer to Section 15250.

J. Pipe Anchors, Pipe Guides, Expansion and Contraction Devices.
   1. Piping subject to expansion or contraction shall be anchored in a manner permitting strains to be evenly distributed and alleviated by swing joints or expansion loops or joints. Seismic restraints shall be installed so as not to interfere with expansion and contraction of piping.
   2. Provide anchors in heating or cooling piping system, to restrain and control direction of movement for expansion or contraction in piping system.
   3. Provide guides at specific locations in heating or cooling piping system in conjunction with slip or bellows type expansion joint.
   4. When coils or unit housings are shock or vibration isolated, provide piping flexible metal connector not less than 10" long whether it is indicated on the drawings or not.

K. Flexible Metal Connectors.
   1. Provide vibration elimination flexible metal connectors on hot water supply and return piping where rigidly supported pipes connect to unit housing coil attachments and units supported by vibration isolators.

L. Refer to Sections 15400 for following:
   1. Pipe hangers and supports.
   2. Pipe sleeves and plates.
   3. Pipe flashings.
   4. Relief valves.
   5. Thermometers.
   6. Pressure gages.
   7. Pressure and temperature test plugs.
   9. Dielectric fittings.
   11. Condensate traps.

2.2 EQUIPMENT

A. Furnish as specified: Centrifugal pumps capable of delivering rated capacity against total dynamic head as indicated on schedule and as specified for following:
   1. Hot Water Pumps: End suction, centrifugal, all bronze with flexible coupling motor, vertical split case, cast iron base mounted. Provide VFD for pump. Bell and Gosset or equal by Paco Type "L" or Weinman.
   2. Pressurized Expansion tanks: Vertical, precharged diaphragm-type pressure vessels. Provide with saddle and leg supports. Bell and Gosset Series D or equal by Wessels.

PART 3 – EXECUTION

3.1 PIPING INSTALLATION

A. Install piping systems for chilled water, condenser water, and hot water heating systems, condensate drains, and miscellaneous piping required for equipment, as indicated on Drawings.
3.2 WATER PUMPS

A. Install water pumps as indicated on Drawings and as specified unless otherwise noted. Provide vibration isolation and flexible pipe connections as specified in Sections 15240.

B. Floor mounted pumps shall be provided with a 4” high concrete base. Refer to Section 03300, Cast-In-Place Concrete, for base.

C. Piping shall be supported from building structure to prevent any strain on pump casing. In-line pumps shall be separately supported from piping using pump manufacturer’s specialized spring support kit, if available; pump shall not be rigidly supported.

D. Flanged connections shall be provided on all pumps with a discharge connection larger than 2”. Smaller sizes may have threaded connections. Except for special guided inlet fittings, all inlets to suction side of pumps shall be a minimum of 10 diameters of straight pipe free from strainers, valves or fittings. On discharge side, minimum length of uninterrupted length of straight pipe shall be 5 diameters.

E. Pumps, one horsepower or larger, shall be installed with approved pump connections for noise and vibration isolation and not to compensate for misalignment.

3.3 AIR ELIMINATION

A. All heating water piping and hot water heating equipment shall be installed in a manner so that air will be eliminated from lines or equipment during operation. Pitch pipe lines per code.

B. Manual air valve shall be installed at each high point of hot water circulating lines, on each hot water heating unit unless unit can vent through outlet connection.

C. Approved air vent valves shall be installed with drains to nearest floor sink or outside building as indicated.

3.4 CHEMICAL POT FEEDER

A. Provide a chemical pot feeder in hot water systems as specified in Section 15480.

END OF SECTION
PART 1 – GENERAL

1.1 SUMMARY

A. Work Included: Heating equipment shall include but not be limited to the following:
2. Unit Heaters.

B. Related Work:
1. Basic Mechanical Materials and Methods: Section 15010.
2. Mechanical Insulation: Section 15250.
3. Plumbing: Section 15400.
5. Air Handling Equipment: Section 15850.

1.2 QUALITY ASSURANCE

A. Standards and Codes: Comply with applicable codes, specifications and standards having jurisdiction: ASME, AGA, CEC, ANSI, ASTM, UL, NEC, UMC and SCAQMD.

B. Manufacturer and Installers Qualifications: Comply with provisions stated in Section 15010: Basic Mechanical Requirements.

1.3 SUBMITTALS

A. Comply with provisions of Section 01300: Submittals.

B. Manufacturers' Data: Submit the following:
1. Complete material list of all items proposed to be furnished and installed under this Section. Material lists which do not require performance data shall include manufacturers' names, types, and model numbers for usages indicated.
2. Manufacturers' specifications and other data required to demonstrate compliance with specified requirements. Literature shall include descriptions of equipment, types, models and sizes proposed, capacity tables or curves marked to indicate performance characteristics, electrical requirements, options selected, space requirements (including allowances for servicing if indicated) and any other data necessary to ensure compliance with requirements of this Specification and performances indicated on Drawings.

C. Shop drawings indicating methods of installation of equipment and materials, and details of supporting structures for items indicated. Check Drawings for coordination with other trades before submittal. Items to be covered shall include but not necessarily be limited to the following:
1. Layout Drawings of Equipment: Include plans, elevations and sections, of proposed equipment drawn to scale, to establish that equipment will fits in allotted spaces with clearance for installation and maintenance. Show proposed details for attachment and anchoring to, and hanging from structural framing of building. Show vibration isolation units, foundations and supports, and openings for passage of pipes and ducts. If departures from Contract Drawings are deemed necessary by Contractor, details of such departures, including changes in related portions of project and reasons thereof, shall be submitted with drawings. Approved departures shall be made at no additional cost to the Owner.
2. Electrical interlock or control diagrams for all electrically controlled components having more than one automatic or manual control devices, which are not indicated on Drawings.

D. Manufacturer's Recommended Installation Procedures: Manufacturer's recommended installation procedures, when approved by the Architect will become basis for inspecting and accepting or rejecting actual installation procedures used on Work.

E. Modification of Contract Drawings: In each case where proposed substitute materials or equipment will require, for proper installation, changes to design of project as indicated on Drawings, appropriate proposed revision drawings in format accepted by the Architect, shall be furnished by Contractor for review by the Architect. Such drawing shall be sufficiently complete for proper installation of proposed substitute materials or equipment and for construction by all interested trades of proposed revisions to project. Cost of drawings, cost of plan check and approval by all legally constituted authorities having jurisdiction, and cost of proposed revised construction shall be borne by Contractor.

1.4 PRODUCT HANDLING

Protection, Replacements, Delivery and Storage: Comply with provisions stated under Section 15010: Basic Mechanical Requirements.

1.5 COORDINATION

Coordinate all activities in accordance with provisions of Section 15010: Basic Mechanical Requirements.

PART 2 – PRODUCTS

2.1 HEATING EQUIPMENT AND MATERIALS

Provide heating equipment and materials as indicated on Drawings and specified herein. Sizes, capacities, and operating conditions shall be as indicated on equipment schedules.

2.2 LOW EMISSION HOT WATER BOILER

A. Boiler Design

1. Boiler shall be an AJAX Model WRFG UL Low Emissions listed, premix gas fired, fully automatic package hot water type for outdoor installation. The boiler shall be guaranteed to produce less than 30 PPM NOx corrected to 3% O2 when firing natural gas only. The boilers shall carry a 20 year non-prorated warranty against damage caused by thermal shock.

2. The boiler shall be of the inclined water tube type built to ASME SECTION IV for a maximum allowable working pressure of 125 psig. The tubes shall be 2” O.D., SA178, 13 gauge steel, easily obtainable from competitive sources. Proprietary tubes which can only be obtained from the boiler manufacturer are not acceptable.

3. Tubes shall be rolled and flared into flat rectangular tube sheets mounted in two rectangular box headers. Boiler head plates shall be removable to provide easy access to the boiler tubes for inspection and cleaning. The head plates and tube sheets shall be SA515 Grade 70 pressure vessel quality steel plate not less than 5/8” thickness. The inclined water tube section is to be bolted to the boiler base and permit the removal of the tube bundle and headers without dismantling the boiler base.

4. All waterside tube surfaces shall be available for visual inspection, mechanical cleaning and for tube maintenance by removing the front and rear head plates. A 4” x 6” handhole plate
shall be provided in the front head plate (as standard on sizes 2000 and up). Front and rear head plates shall be insulated.

5. Each unit shall be constructed in accordance with the requirements of the State of California, and the ASME Boiler Code and shall be stamped with the ASME symbol. Copies of the completed ASME Manufacturer's Data Report shall be available upon request. The burner and boiler shall be the product of a single manufacturer and shall be listed as a complete package under U.L. 2096 for Boilers with Emission Reduction Equipment and shall be U.L. listed for use with type “B” vents with barometric dampers.

6. The firebox is to be lined with high temperature castable refractory rated to withstand not less than 2000 oF backed by 2" minimum thickness mineral wool insulation. Access shall be provided to the firebox and burner assembly through a removable refractory lined door.


B. LOW NOx FORCED DRAFT BURNER

1. A low emission style force draft burner shall be supplied. The burner will be U.L. listed gas fired forced draft flame retention type (G). Burner to be equipped for on-off (up to size 2500), low-high-low or full modulation and have flame safeguard controls to meet or exceed U.L. standards. Gas burner is to be equipped with main and pilot gas cocks, main and pilot gas valves, and gas pressure regulators. Gas valves and controls are to be provided to meet U.L. 795 (FM/IRI optional) code requirements.

C. BOILER CONTROLS

1. Boiler controls shall be factory installed with Fireye Micro M Electronic Primary Safety Control System with interrupted pilot, automatic electric ignition and 100% shut-off mounted in an enclosed NEMA 1A panel.

2. Controls to include operating and manual reset high-limit controls.

3. A main gas pressure regulator shall be furnished factory installed. Regulator will be sized based on the scheduled natural gas delivery pressure.

4. Controls and control panel location shall comply with the California Boiler Safety Orders.

D. BOILER AND BURNER TRIM

Each boiler shall be furnished with the following trim and controls as follows:

1. Water pressure relief valve, full capacity. ASME rated for 125 pound working pressure.

2. Gas pressure regulator shall be furnished factory mounted for maximum supply pressure of 14" WC Regulator size based on stated inlet pressure at the appliance regulator.

3. Temperature / pressure gauge.

4. Warrick #26I probe type primary low water cut-off with auto reset. (water only)

5. Warrick #26IM probe type auxiliary low water safety cut-off with manual reset type.

6. Dual safety gas valves.


8. Provide dry contacts in the boiler panel to announce “Boiler Status” and “Alarm” to Building Automation System.

E. EFFICIENCY CERTIFICATION

1. Boiler manufacturer shall certify that steady state boiler efficiency shall meet or exceed 80% when tested in accordance with ANSI Z21.13 test method.

F. FACTORY FIRE TEST

1. The completed unit shall be factory fire tested prior to shipment. A copy of the manufacturer's test report shall be included in the operating and maintenance manual provided to the owner.

G. BOILER STACK
1. Contractor shall furnish and install AMPCO U. L. listed Type B Model R Vent as shown with rain cap on the drawings.

2. Draft inducer shall be provided as necessary to ensure that boiler flue outlet pressure is always balanced to slightly negative under all operating conditions.

H. ACCEPTABLE MANUFACTURERS
1. Boilers shall be the make and model number shown on the drawings or equivalent by Parker.

2.3 UNIT HEATERS
A. Reznor model UDBS separated combustion high static unit heaters shall be equipped for use with natural gas and 120 volt, single phase power supply. The heat exchanger shall be aluminized steel. Die-formed burners shall be of aluminized steel and include flared ports and a stainless steel insert. The unit shall be designed for 82% thermal efficiency.

B. Model UDBS unit heaters are designed for ceiling suspension with a propeller fan for air delivery. Standard features include a manual match-lit pilot with 100% shutoff and a single-stage, 24-volt gas valve. A terminal strip connector facilitates field connection to a remote 24-volt thermostat for automatic operation. Each unit is provided with a fan control and all required limit safety controls, including an energy cutoff (ECO) device and a blocked vent switch. These units are approved for installation in the United States and Canada by the Canadian Standards Association (CSA).

PART 3 – EXECUTION

3.1 INSTALLATION
A. The boiler shall be installed on a concrete pad. Refer to section 03300, Cast-In-Place Concrete, for base.

B. Provide city water for make-up to the hot water system. Include a water make-up assembly which includes a reduced-pressure-type backflow preventer acceptable to the local authorities.

C. Provide gas regulator to reduce the gas pressure to that required by the boiler.

D. Connect hot water lines and pump to the boiler with adequate drains to flush and drain the system. Install the relief valve and carry full size to a point acceptable for discharge of hot water.

E. Make the proper electrical connections for the boiler and equipment in weatherproof boxes. Provide a disconnect means for the boiler controls to turn off power to the main gas valve from an easily accessible point near the boiler.

F. Fill the boiler with water and pressure-test the boiler and system up to the rating of the relief valve. Clean the system with trisodium phosphate or equal cleaner, flush the system to remove all trash and dirt, and refill the system, including inhibitor.

G. Bleed the gas line in a safe manner and energize the boiler controls.

3.2 INSTALLATION CODES
Installation of boilers and appliances in this Section shall conform with applicable requirements of current issue of National Fire Codes, NEC, ANSI, NFPA 70, UMC, ASME Boiler Code CDS-1, UL 795 and ANSI S21.13.
A. Boiler shall be installed on level non-combustible surfaces.

B. Clearance:
   1. Minimum space allowances and clearances shall be as recommended by manufacturer.

C. Combustion Air: Boiler and equipment shall be provided with sufficient supply air for proper fuel combustion. Conform to CMC requirements.

D. Venting: Boiler and equipment shall be vented to atmosphere to conform to CMC requirements.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnish and install air conditioning and air handling equipment as indicated on Drawings and as specified. Air conditioning and air handling equipment shall include but not be limited to following:

1. Packaged Variable Air Volume or Constant Volume Air Conditioning Units.
2. Split System Air Conditioning Units, Air Cooled.
4. Steam Humidifiers.
5. Exhaust Fans.

1.2 SUBMITTALS

A. Submit in accordance with Division 01: Submittals.

1.3 QUALITY ASSURANCE

A. Make submittals in accordance with Section 15010: Basic Mechanical Requirements.

1.4 INSTRUCTIONS

A. Contractor shall provide instructions on equipment operation and maintenance procedure, as required, before or during completion test, to the Owner’s maintenance personnel:

B. Instructions shall be entrusted to a qualified and experienced person, who has been adequately trained and is able to demonstrate correct operation and maintenance of equipment and related components.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS AND ACCEPTABILITY REQUIREMENTS

Manufacturers: The design shown on the drawing is based upon products of the manufacturer scheduled. Alternate equipment manufacturers will be acceptable if equipment meets the scheduled performance and complies with these specifications. If equipment manufactured by manufacturer other than that scheduled is utilized, then the Mechanical Contractor will be responsible for coordinating with the General Contractor and all affected Subcontractors to insure proper provisions for installation of the furnished unit. This coordination will include, but not limited to the following:

A. Structural supports for units.
B. Roof curb transition.
C. Piping size and connection/header locations.
D. Electrical power requirements and wire/conduit and overcurrent protection sizing.
E. All costs incurred to modify the building provisions to accept the furnished units.

2.2 ROOFTOP PACKAGE AIR CONDITIONING UNIT

A. Custom designed units shall be self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, return fan (where applicable), gas furnace (where applicable), controls, air filters, refrigerant cooling coil and compressors, condenser coil and condenser fans.
B. Include accessories as shown or specified herein or on drawings.
C. Units shall have the capacities, electrical power, and EER requirement as indicated on the drawings.
D. Units shall be manufactured by: McQuay, Mammoth, Governair, Season 4.
E. GENERAL DESCRIPTION

1. Furnish as shown on plans, McQuay Rooftop Singlezone Heating and Cooling Unit(s) model RPS. Unit performance, EERs and electrical characteristics shall be per the job schedule.
2. Configuration: Fabricate as detailed on prints.
3. The complete unit shall be ETL/UL listed.
4. Each unit shall be specifically designed for outdoor rooftop application and include a weatherproof cabinet. Units shall be of a modular design with factory installed access sections available to provide maximum design flexibility. Unit shall be completely factory assembled and shipped in one piece. Units shall be shipped fully charged with R22.
5. The unit shall undergo a complete factory run test prior to shipment and factory test sheets shall be available upon request. The factory test shall include final balancing of all fan assemblies; a refrigeration circuit run test, a unit control system operations checkout, a unit refrigerant leak test and a final unit inspection.
6. All units shall have decals and tags to indicate caution areas and aid unit service. Unit nameplates shall be fixed to the main control panel door. Electrical wiring diagrams shall be attached to the control panels. Installation, operating and maintenance bulletins and start-up forms shall be supplied with each unit.
7. Performance: All scheduled capacities and face areas are the minimum accepted value. All scheduled amps, KW, and HP are maximum accepted values that allow scheduled capacity to be met.

F. CABINET, CASING, AND FRAME

1. For units greater than 40 tons, unit cabinet shall be designed to operate at total static pressures up to 6.5 inches w.g.
2. Unit shall have heavy gauge solid galvanized steel liners provided throughout, allowing no exposed insulation within the air stream. All cabinet insulation, except floor panels, shall be a nominal 2" thick, 1 ½ lb. density, R6.5, glass fiber. Floor panels to be a minimum 1” thick, 3 lb. density, R4.2, glass fiber.

3. Exterior surfaces shall be constructed of pre-painted galvanized steel for aesthetics and long term durability. Paint finish to include a base primer with a high quality, polyester resin topcoat of a neutral beige color. Finished surface to withstand a minimum 750-hour salt spray test in accordance with ASTM B117 standard for salt spray resistance.

4. Service doors shall be provided on both sides of each section in order to provide user access to all unit components. Service doors shall be constructed of heavy gauge galvanized steel with galvanized steel interior liners. All service doors shall be mounted on multiple, stainless steel hinges and shall be secured by a stainless steel latch system that is operated by a single, flush mounted handle. The latch system shall feature a staggered engagement for ease of operation and a safety catch shall protect the user from injury in case a positive pressure door is opened while the fan is operating. Removable panels, or doors secured by multiple, mechanical fasteners are not acceptable.

5. For unit sizes greater than 40 tons, the unit base frame shall be constructed of 13 gauge pre-painted galvanized steel.

6. The unit base shall overhang the roof curb for positive water runoff and shall have a formed recess that seats on the roof curb gasket to provide a positive, weathertight seal. Lifting brackets shall be provided on the unit base with lifting holes to accept cable or chain hooks.

G. INDOOR AIR FANS

1. All fan assemblies shall be statically and dynamically balanced at the factory, including a final trim balance, prior to shipment. All fan assemblies shall employ solid steel fan shafts. Heavy-duty pillow block type, self-aligning, grease lubricated ball bearings shall be used. Bearings shall be sized to provide an L-50 life at 200,000 hours. The entire fan assembly shall be isolated from the fan bulkhead and rigidly mounted to the unit’s floor. Fixed pitch V-belt drives with matching belts shall be provided. V-belt drives shall be selected at the manufacturer’s standard service factor.

2. Fan motors shall be heavy-duty 1800 rpm open drip-proof (ODP), premium efficiency. Fan motors to have grease lubricated ball bearings. Motors shall be mounted on an adjustable base that provides for proper alignment and belt tension adjustment.

3. Airfoil supply fans. Forward curved fans are not acceptable.

   Supply fan shall be a double width, double inlet (DWDI) airfoil centrifugal fan. All fans shall be mounted using shafts and hubs with mating keyways. Fans shall be Class II type and fabricated from heavy-gauge aluminum. Fan blades shall be continuously welded to the back plate and end rim.

4. Airfoil return fans.

   A single width, single inlet (SWSI) airfoil centrifugal return air fan shall be provided. The fan shall be Class II construction. The fan wheel shall be Class II construction and fabricated from heavy-gauge aluminum with fan blades continuously welded to the back
plate and end rim. The fan shall be mounted using shafts and hubs with mating keyways. (Exhaust or relief fans are not acceptable)

H. INDOOR AIR FAN VARIABLE AIR VOLUME CONTROL

1. Separate electronic variable frequency drives shall be provided for the supply and return air fans. Each drive shall be mounted in the fan section. Drives shall meet UL Standard 95-5V and the variable frequency drive manufacturer shall have specifically approved them for plenum duty application. The completed unit assembly shall be listed by a recognized safety agency, such as ETL. Drives are to be accessible through a hinged door assembly complete with a single handle latch mechanism. Mounting arrangements that expose drives to high temperature, unfiltered ambient air are not acceptable.

2. The drive output shall be controlled by the factory installed main unit control system and drive status and operating speed shall be monitored and displayed at the main unit control panel.

I. ELECTRICAL

1. Unit wiring shall comply with NEC requirements and with all applicable UL standards. All electrical components shall be UL recognized where applicable. All wiring and electrical components provided with unit shall be number and color coded and labeled according to the electrical diagram provided for easy identification. The unit shall be provided with a factory wired weatherproof control panel with deadfront cover. Unit shall have a single point power terminal block for main power connection. A terminal board shall be provided for low voltage control wiring. Branch circuit fusing, 115 volt control circuit transformer and fuse, system switches, high temperature sensor, and a 115 volt receptacle with a separate electrical connection shall also be provided with unit (separate 120V power for service lights to be provided by others). UV lights will be powered from unit provided transformer. Each compressor and condenser fan motor shall be furnished with contactors and inherent thermal overload protection. A separate keylocked control panel shall house all controls for the condensing section. Supply and return fan motors shall have contactors and external overload protection. Knockouts shall be provided in the bottom of the main control panels for field wiring entrance thru the unit’s curb. All 115-600 volt internal and external wiring between control boxes and components shall be protected from damage by raceways or conduit.

J. HEATING AND COOLING SECTIONS

1. The cooling coil section shall be installed in a draw through configuration, upstream of the supply air fan. The coil section shall be complete with factory piped cooling coil and sloped drain pan. Hinged access doors on both sides of the section shall provide convenient access to the cooling coil and drain pan for inspection and cleaning.

2. Cooling coil performance schedule is based on mixed air and coil leaving air temperatures, not including fan motor heat. Manufacturer shall add motor heat to the DX coil LAT to calculate unit LAT on draw through models. Scheduled total and sensible capacities are gross capacities, are minimum accepted values, and do not include fan motor heat.

3. Direct expansion (DX) cooling coils shall be fabricated of seamless 1/2" diameter high efficiency copper tubing that is mechanically expanded into high efficiency aluminum plate fins. Coils shall be a multi-row, staggered tube design. All multiple compressor units shall have two independent refrigerant circuits and shall use an interlaced coil circuiting that keeps the full coil face active at all load conditions.
4. All coils shall be factory leak tested with high pressure air under water.

5. A stainless steel, positively sloped drain pan shall be provided with the cooling coil. The drain pan shall extend beyond the leaving side of the coil and underneath the cooling coil connections. The drain pan shall have a minimum slope of 1/8" per foot to provide positive draining. The drain pan shall be connected to a threaded drain connection extending through the unit base. Units with stacked cooling coils shall be provided with a secondary drain pan piped to the primary drain pan.

K. UV LIGHTS

1. Provide factory installed UV lights downstream of cooling coil. Housings shall be constructed of 304 SS. UV lights shall be wired to a door switch (Include switch to any door providing access to UV lights) which will shut-off lights when door is opened. Unit shall be UL certified with UV lights installed. There shall be a minimum of 2 rows of lights per 48” of coil height. Light banks shall span the entire width of coil face. UV lights will be powered from factory supplied control panel.

L. FILTERS

1. Unit shall be provided with a draw-through filter section. The filter section shall be supplied complete with the filter rack as an integral part of the unit. The draw-through filter section shall be provided with cartridge filters.

2. 12" deep 80-85% efficient, UL Std. 900, Class 1, cartridge filters shall be provided. 2” panel, 30% efficient pre-filters shall be included. Cartridge filters shall consist of filter media permanently attached to a metal frame and shall slide into a gasketed, extruded aluminum rack contained within the unit. The filter rack shall have secondary gasketed, hinged end panels to insure proper sealing. Filters shall be accessible from both sides of the filter section.

M. OUTDOOR/RETURN AIR SECTION

1. Unit shall be provided with an outdoor air economizer section. The 0 to 100% outside air economizer section shall include outdoor, return, and exhaust air dampers. Outdoor air shall enter from both sides of the economizer section through horizontal, louvered intake panels complete with rain lip and bird screen. The floor of the outdoor air intakes shall provide for water drainage. The economizer section shall allow return air to enter from the bottom of the unit. The outside and return air dampers shall be sized to handle 100% of the supply air volume. The dampers shall be opposed sets of parallel blades, arranged vertically to converge the return air and outdoor air streams in multiple, circular mixing patterns

2. McQuay UltraSeal low leak dampers shall be provided on outdoor or return dampers. Damper blades shall be fully gasketed and side sealed and arranged horizontally in the hood. Damper leakage shall be less than 0.2% at 1.5 inches static pressure differential. Leakage rate to be tested in accordance with AMCA Standard 500. Damper blades shall be operated from multiple sets of linkages mounted on the leaving face of the dampers.

3. A barometric exhaust damper shall be provided to exhaust air out of the back of the unit. Exhaust louvers and a bird screen shall be provided to prevent infiltration of rain and foreign materials. Exhaust damper blades shall be lined with urethane gasketing on contact edges.

4. Control of the outdoor or return dampers shall be by a factory installed actuator. Damper actuator shall be of the modulating, spring return type. If outdoor air is suitable for “free”
cooling, the outdoor air dampers shall modulate in response to the unit’s temperature control system. An adjustable enthalpy control shall be provided to sense the dry-bulb temperature and relative humidity of the outdoor air stream to determine if outdoor air is suitable for “free” cooling.

N. DISCHARGE AND RETURN PLENUM OPTIONS

1. A supply air discharge plenum shall be provided. The plenum section shall have a bottom discharge opening.

O. CONDENSING SECTION

1. Air Cooled Condenser
   a. The condensing section shall be open on the sides and bottom to provide access and to allow airflow through the coils. Condenser coils shall be multi-row and fabricated from 3/8” high efficiency rifled copper tubing mechanically bonded to high efficiency aluminum fins. Each condenser coil shall be factory leak tested with high-pressure air under water. Each refrigerant circuit shall include a subcooling circuit to provide 15 degrees of liquid subcooling. Condenser coil guards shall provide protection from incidental contact to coil fins. Coil guards to be constructed of cross wire welded steel with PVC coating.
   
   b. Condenser fans shall be direct drive, propeller type designed for low tip speed, vertical air discharge, and include service guards. Fan blades shall be constructed of steel and riveted to a steel center hub. Condenser fan motors shall be heavy-duty, inherently protected, three-phase, non-reversing type with permanently lubricated ball bearing and integral rain shield.
   
   c. Units shall have at least one condenser fan controlled to maintain positive head pressure. An ambient thermostat shall prevent the refrigeration system from operating below 45º F ambient.

2. Scroll Compressors
   a. Each unit shall have multiple, heavy-duty Copeland scroll compressors.
   
   b. Each compressor shall be complete with gauge ports, crankcase heater, sight-glass, anti-slug protection, motor overload protection and a time delay to prevent short cycling and simultaneous starting of compressors following a power failure.
   
   c. Compressors shall be isolated with resilient rubber isolators to decrease noise transmission.
   
   d. Each unit shall have two independent refrigeration circuits. Each circuit shall be complete with a liquid line solenoid valve, low pressure control, filter drier, liquid moisture indicator/sight-glass, thermal expansion valve, liquid line shutoff valve with charging port, discharge line shutoff valve, a manual reset high pressure safety switch, high pressure relief device and pump down switch. The thermal expansion valve shall be capable of modulation from 100% to 25% of its rated capacity. Sight-glasses shall be accessible for viewing without disrupting unit operation. Each circuit shall be dehydrated and factory charged with Refrigerant 22 and oil.
e. Refrigeration capacity control shall be accomplished by staging of the unit’s multiple compressors. All compressor capacity control staging shall be controlled by the factory installed main unit control system.

P. CONTROLS

1. Each unit shall be equipped with a complete MicroTech® II microprocessor based control system. The unit control system shall include all required temperature and pressure sensors, input/output boards, main microprocessor and operator interface. The unit control system shall perform all unit control functions including scheduling, temperature controls, alarms, unit diagnostics and safeties. All boards shall be individually replaceable for ease of service. All microprocessors, boards, and sensors shall be factory mounted, wired and tested.

2. The microprocessor shall be a stand-alone DDC controller not dependent on communications with any on-site or remote PC or master control panel. The microprocessor shall maintain existing set points and operate stand alone if the unit loses either direct connect or network communications. The microprocessor memory shall be protected from voltage fluctuations as well as any extended power failures. All factory and user set schedules and control points shall be maintained in nonvolatile memory. No settings shall be lost, even during extended power shutdowns.

3. The main microprocessor shall support an RS-232 direct connection to a product service tool or a modem. A communications port shall be provided for direct communication into the BAS network.

4. All digital inputs and outputs shall be protected against damage from transients or wrong voltages. Each digital input and digital output shall be equipped with an LED for ease of service. All field wiring shall be terminated at a separate, clearly marked terminal strip.

5. The microprocessor memory shall be protected from all voltage fluctuations as well as any extended power failures. The microprocessor shall support an RS-232 direct connect from an IBM PC or 100% true compatible using MicroTech software. The microprocessor shall maintain existing set points and operate stand alone if the rooftop loses either direct connect or network communications.

6. The microprocessor shall have a built-in time schedule. The schedule shall be programmable from the unit keypad interface. The schedule shall be maintained in nonvolatile memory to insure that it is not lost during a power failure. There shall be one start/stop per day and a separate holiday schedule. The controller shall accept up to sixteen holidays each with up to a 5-day duration. Each unit shall also have the ability to accept a time schedule via BAS network communications.

7. If the unit is to be programmed with a night setback or setup function, an optional space sensor shall be provided. Space sensors shall be available to support field selectable features. Sensor options shall include Zone sensor with tenant override switch, or Zone sensor with tenant override switch and heating/cooling set point adjustment.

8. User Interface (UI)

a. The keypad/display character format shall be 20 characters x 4 lines. The character font shall be a 5 x 8 dot matrix. The display shall be a super twist liquid crystal display (LCD) with black characters on yellow background providing high visibility. The display form shall be in plain English coded formats. Lookup tables are not acceptable.
b. The keypad shall be equipped with 8 individual touch-sensitive membrane key switches. All control settings shall be password protected from changes by unauthorized personnel.

9. The display shall provide the following information:
   a. Supply, return, outdoor and space air temperature.
   b. Duct and building static pressure— the control contractor is responsible for providing and installing sensing tubes.
   c. Supply fan and return fan status and airflow verification.
   d. Supply and return VFD speed.
   e. Outside air damper position and economizer mode.
   f. Cooling and changeover status.
   g. Occupied, unoccupied, and dirty filter status.
   h. Date and time schedules.
   i. Up to 4 current alarms and 8 previous alarms with time and date.

10. The keypad shall provide the following set points as a minimum:
    a. Six control modes including off manual, auto, heat/cool, cool only, heat only and fan only.
    b. Four occupancy modes including auto, occupied, unoccupied and bypass (tenant override with adjustable duration).
    c. Control changeover based on return air temperature, or space temperature.
    d. Primary cooling and heating set point temperature based on supply or space temperature.
    e. Night setback and setup space temp.
    f. Cooling and heating control differential (or dead band).
    g. Cooling and heating supply temperature reset options based on one of the following: Return air temperature, outdoor air temperature, space temperature, Airflow, or external (1-5VDC) signal.
    h. Reset schedule temperature.
    i. High supply, low supply and high return air temperature alarm limits.
    j. Ambient compressor and heat lockout temperatures.
    k. Auto or manual lead lag method on compressors.
    l. Compressor interstage timers duration.
m. Duct static pressure.

n. Return fan tracking (VaneTrol) settings that include minimum/maximum with and without remote exhaust operation.

o. Return fan tracking (VaneTrol) settings that include minimum/maximum vfd speed with and without remote exhaust operation.

p. Minimum outdoor airflow reset based on external reset (1-5 VDC), percent of CFM capacity, and fixed outdoor damper position.

q. Economizer changeover based on enthalpy, dry bulb or network signal.

r. Current time and date.

s. Occupied/unoccupied time schedules with allowances for holiday/ event dates and duration.

t. Three types of service modes including timers normal (all time delays,) timers fast (all time delays 20 seconds,) and normal.

2.3 SPLIT SYSTEM AIR CONDITIONING UNIT, AIR COOLED.

A. Split System Air Conditioning Unit: Cooling only, split type, air cooled, ground mounted with electrical voltages as scheduled.

Units shall be air-cooled direct expansion fan coil. Outdoor section shall be factory assembled having direct-drive condenser fans with horizontal or vertical air discharge, Scroll type compressor, refrigerant coil, fan motor(s), pre-wired control panel and a holding charge of refrigerant R-410A. Indoor fan coil unit shall have horizontal discharge and will include evaporator coil, fan and motor, condensate pan with drain, thermal expansion valve, pre-wired control panel and programmable remote thermostat control.

Unit shall have SEER/COP complying with California Energy Conservation Standards, CCR, Title 24. U.L. listed and rated at ARI Standard 210 / 240.

1. Nominal unit cooling, capacities, electrical characteristics, and operating conditions shall be as indicated on Drawings.

2. Evaporator and condenser coils shall be copper with mechanically bonded, smooth Aluminum plate fins. All tube joints shall be brazed with copper or silver alloy. Coils shall be pressure-tested at factory.

3. Condenser Fan and Motors: Condenser fan shall be direct driven, propeller type arranged for horizontal or vertical discharge. Condenser fan motors shall have inherent protection, and shall be permanently lubricated type, resiliently mounted for quiet operation. Each fan shall have a safety guard.

4. Evaporator fan section shall have a squirrel cage or centrifugal forward-curved blades, double inlet fans mounted on a solid shaft. Fan shall be statically and dynamically balanced and shall run on permanently lubricated bearings.

5. Cabinets shall be made of galvanized steel, bonderized and finished with baked enamel. Cabinet interior shall be insulated with 1" thick neoprene covered fiberglass. Cabinet panels to be hinged for easy removal for service to all operating components.
6. Compressor shall be serviceable hermetic scroll type, warranted unconditionally for 5 years. Compressor shall have access valves. It shall be mounted on rubber isolators so as to reduce sound vibration. It shall be equipped with high and low-pressure protection.

7. Controls: Compressor motor assembly shall be protected with low pressure switches, internal overloads, internal thermostat, internal relief valve, and anti-recycle relay, or time cycle device to prevent rapid cycling of compressor after any "off" cycle. Unit shall incorporate an automatic relay for indoor circulating air blower. Control panel shall be pre-wired in unit casing.

8. Low Ambient Operation: Head pressure control shall be provided for operation at outside air temperature below 45°F.

9. Filters: Filters shall be 2" replaceable media type, Farr 30/30, or approved equal, installed in a 2" rack filter section and complete with an access door.

10. An in-line filter-drier shall be included in the refrigerant liquid line.

11. Manufacturer: Carrier, Bryant, or approved equal.

2.4 SPLIT SYSTEM AIR CONDITIONING UNIT, AIR COOLED

A. Cooling only, split type, air cooled, ground mounted with electrical voltages as scheduled.

Indoor units shall be air-cooled direct expansion fan coil. Outdoor heat pump unit shall be factory assembled having direct-drive condenser fans with horizontal or vertical air discharge, Scroll type compressor, refrigerant coil, fan motor(s), pre-wired control panel and a holding charge of refrigerant R-410A. Indoor fan coil unit shall have horizontal discharge and will include evaporator coil, fan and motor, condensate pan with drain, thermal expansion valve, pre-wired control panel and programmable remote thermostat control.

Unit shall have SEER/COP complying with California Energy Conservation Standards, CCR, Title 24. U.L. listed and rated at ARI Standard 210 / 240.

1. Nominal unit cooling, capacities, electrical characteristics, and operating conditions shall be as indicated on Drawings.

2. Evaporator and condenser coils shall be copper with mechanically bonded, smooth Aluminum plate fins. All tube joints shall be brazed with copper or silver alloy. Coils shall be pressure-tested at factory.

3. Condenser Fan and Motors: Condenser fan shall be direct driven, propeller type arranged for horizontal or vertical discharge. Condenser fan motors shall have inherent protection, and shall be permanently lubricated type, resiliently mounted for quiet operation. Each fan shall have a safety guard.

4. Evaporator fan section shall have a squirrel cage or centrifugal forward-curved blades, double inlet fans mounted on a solid shaft. Fan shall be statically and dynamically balanced and shall run on permanently lubricated bearings.

5. Cabinets shall be made of galvanized steel, bonderized and finished with baked enamel. Cabinet interior shall be insulated with 1" thick neoprene covered fiberglass. Cabinet panels to be hinged for easy removal for service to all operating components.
6. Compressor shall be serviceable hermetic scroll type, warranted unconditionally for 5 years. Compressor shall have access valves. It shall be mounted on rubber isolators so as to reduce sound vibration. It shall be equipped with high and low-pressure protection.

7. Controls: Compressor motor assembly shall be protected with low pressure switches, internal overloads, internal thermostat, internal relief valve, and anti-recycle relay, or time cycle device to prevent rapid cycling of compressor after any “off” cycle. Unit shall incorporate an automatic relay for indoor circulating air blower. Control panel shall be pre-wired in unit casing.

8. Low Ambient Operation: Head pressure control shall be provided for operation at outside air temperature below 45°F.

9. Filters: Filters shall be 2" replaceable media type, Farr 30/30, or approved equal, installed in a 2" rack filter section and complete with an access door.

10. An in-line filter-drier shall be included in the refrigerant liquid line.

11. Manufacturer: Carrier, Bryant, or approved equal.

2.6 INLINE EXHAUST FANS

A. Fan shall be duct mounted, belt driven centrifugal square inline. Fan shall be manufactured at an ISO 9001 certified facility. Fan shall be listed by Underwriters Laboratories (UL 705) and UL listed for Canada (cUL 705). Fan shall bear the AMCA certified ratings seal for sound and air performance.

B. The fan shall be of bolted construction utilizing corrosion resistant fasteners. Housing shall be minimum 18 gauge galvanized steel with integral duct collars. Bolted access doors shall be provided on three sides, sealed with closed cell neoprene gasketing. Pivoting motor plate shall utilize threaded L-bolt design for positive belt tensioning. Housing shall be pre-drilled to accommodate universal mounting feet for vertical or horizontal installation. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM. Unit shall be shipped in ISTA certified transit tested packaging.

C. Wheel shall be centrifugal backward inclined, constructed of 100% aluminum, including a precision machined cast aluminum hub. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-96, Balance Quality and Vibration Levels for Fans.

D. Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and enclosure.

E. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball type in a pillow block cast iron housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

F. Belts shall be oil and heat resistant, non-static type. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.

Manufacturer: Greenheck, Cook, Penn or approved equal.
2.7 UTILITY VENT SET

A. Fan shall be a single width, single inlet, backward inclined flat blade, belt driven centrifugal vent set. Fan shall be manufactured at an ISO 9001 certified facility. Fan shall be listed by Underwriters Laboratories (UL/cUL 705) for US and Canada. For restaurant applications, fan shall be listed by Underwriters Laboratories (UL/cUL 762) for US and Canada. Fan shall bear the AMCA certified ratings seal for air performance.

B. The fan shall be of bolted and welded construction utilizing corrosion resistant fasteners. The scroll wrapper shall be a minimum 14 gauge steel and the scroll side panels shall be a minimum 12 gauge steel. The entire fan housing shall have continuously welded seams for leakproof operation. A performance cut-off shall be furnished to prevent the recirculation of air in the fan housing. The fan housing shall be field rotatable to any one of eight discharge positions and shall have a minimum 1-1/2 inch outlet discharge flange. Bearing support shall be minimum 10 gauge welded steel. Side access inspection ports shall be provided with quick release latches for access to the motor compartment without removing the weather cover. Lifting lugs shall be provided for ease of installation. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM, static pressure, and maximum fan RPM. Unit shall be shipped in ISTA certified transit tested packaging.

C. Steel fan components shall be electrostatically applied, baked polyester powder coating. Each component shall be subject to a five stage environmentally friendly wash system, followed by a minimum 2 mil thick baked powder finish. Paint must exceed 1,000 hour salt spray under ASTM B117 test method.

D. Wheel shall be steel centrifugal backward inclined, non-overloading flat blade type. Blades shall be continuously welded to the backplate and deep spun inlet shroud. Wheel hub shall be keyed and securely attached to the fan shaft. Wheel inlet shall overlap an aerodynamic aluminum inlet cone to provide maximum performance and efficiency. Wheel shall be balanced in accordance with AMCA Standard 204-96, Balance Quality and Vibration Levels for Fans.

E. Motor shall be heavy duty type with permanently lubricated sealed ball bearings and furnished at the specified voltage, phase and enclosure.

F. Bearings shall be designed and tested specifically for use in air handling applications. Construction shall be heavy duty regreasable ball or roller type in a cast iron pillow block housing selected for a minimum L50 life in excess of 200,000 hours at maximum cataloged operating speed.

G. Blower shaft shall be AISI C-1045 hot rolled and accurately turned, ground and polished. Shafting shall be sized for a critical speed of at least 125% of maximum RPM.

H. Belts shall be oil and heat resistant, non-static type. Drives shall be precision machined cast iron type, keyed and securely attached to the wheel and motor shafts. Drives shall be sized for 150% of the installed motor horsepower. The variable pitch motor drive must be factory set to the specified fan RPM.

I. Manufacturer: Greenheck, Cook, Penn or approved equal.

2.8 GRAVITY VENTILATORS

A. Unit shall be a hooded aluminum, roof mounted gravity intake ventilator. Fan shall be manufactured at an ISO 9001 certified facility.

B. The unit shall be of bolted and welded construction utilizing corrosion resistant fasteners. The aluminum hood shall be constructed of minimum 14 gauge marine alloy aluminum, bolted to a
minimum 8 gauge aluminum support structure. The aluminum base shall have continuously welded curb cap corners for maximum leak protection. Birdscreen constructed of 1/2" mesh shall be mounted across the intake opening. Unit shall bear an engraved aluminum nameplate. Nameplate shall indicate design CFM and static pressure. Unit shall be shipped in ISTA certified transit tested packaging.

C. Manufacturer: Greenheck, Cook, Penn or approved equal.

PART 3 - EXECUTION

3.1 GENERAL

A. Examine areas under which work of this Section will be performed. Correct conditions detrimental to proper and timely completion of work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 EQUIPMENT FOUNDATIONS

A. Equipment foundations, where indicated, shall be of sufficient size and weight, and of proper design to preclude shifting of equipment under operating conditions, or under any abnormal conditions that could be imposed upon equipment.

B. Foundations shall meet requirements of equipment manufacturer and, when required by the Architect, Contractor shall obtain from equipment manufacturer, approval of foundation design and construction for equipment involved. Equipment vibration shall be maintained within design limits, and shall be dampened and isolated. Isolators shall be bolted to a steel member so as to be readily removable.

3.3 EQUIPMENT DESIGN AND INSTALLATION

A. Uniformity: Unless otherwise specified, equipment of same type or classification shall be product of same manufacturer.

B. Application: Only use equipment recommended by manufacturer, and approved by the Owner or the Architect.

C. Equipment Installation: Equipment installation shall be strictly in accordance with these Specifications, and installation instructions of manufacturers. Equipment mounted on concrete foundations shall be grouted before piping is installed. All piping shall be installed in such a manner as not to place a strain on any of the equipment. Flanged joints shall be adequately extended before installation.

All piping shall be graded, anchored, guided and supported, without low pockets.

1. Erect equipment in a neat and workmanlike manner, properly aligned, leveled and adjusted for satisfactory operation.

2. Install so that connecting and disconnecting of piping and accessories can be readily accomplished, and so that all parts are readily accessible for inspection, service and repair. Space shall be provided to readily remove filters, coils, compressors and fan wheels. All access doors shall be hinged with cam lock door handles.

3.4 ROOF-TOP EQUIPMENT MOUNTING
A. All Units: Install unit on a prefabricated isolation curb with seismic restraints secured directly to roof. Follow manufacturer’s recommended installation manuals. Submit shop drawings for approval of the Architect.

3.5 NOISE AND VIBRATION

A. Operation of Equipment: Mechanical equipment and piping systems shall operate with noise and vibration to design level or less.

B. Corrective Measures: If such objectionable noise and vibration should be produced, make necessary changes to produce satisfactory results.

3.6 FIELD TESTS AND INSPECTION

A. General: Perform all field inspections, field tests, and trial operations as specified in Section 15010. Provide all labor, equipment and incidentals required for testing. The Owner Inspector will witness all field tests and trial operations as specified in Section 15010.

B. Equipment and Material: Equipment and material certified as having been successfully tested by manufacturer, in accordance with referenced Specifications and standards, will not require re-testing before installation. Equipment and materials not tested at the place of manufacture will be tested before or after installation, as applicable or necessary, to determine compliance with reference Specifications and standards.

C. Start-Up and Operational Test: System shall be started up and initially operated with all components operating. During this test, various strainers or filters shall be periodically cleaned until no further accumulation of foreign material occurs. Exercise care so that minimum loss of water occurs when strainers are cleaned. Adjust safety and automatic control instruments as necessary to place them in proper operation and sequence. See also Section 15010.

D. Single-zone and VAV systems shall be provided with factory start-up.

E. Extent of Field Tests: After installation and before acceptance, work of this Section shall be subjected to all necessary field tests, including those specified here and in Section 15010.

F. Operation and Maintenance Data: Provide required operation and maintenance data as specified in Section 15010.

3.7 REFRIGERANT PIPING

A. Unless otherwise indicated, main liquid and suction lines from condensing unit to evaporator coil shall be of sizes specified by manufacturer.

B. All refrigeration piping shall be refrigeration grade copper tubing, type “L” hard drawn. In instances where refrigeration lines should be inaccessible and must be snaked through conduit or a trench, that portion of tubing required to complete connections through conduit or trench may be soft drawn. Extreme care shall be taken to keep entire system clean and dry during installation. Pipe to be sealed until installed.

C. All refrigeration lines, both hard and soft drawn, shall be straight and free from kinks, restrictions or traps and horizontal runs shall be sloped towards compressor 1” to 10’ wherever possible.

D. All joints shall be made with Silfos 15, Silvaloy 15 or equal, high melting-point solder.
E. Any flare nuts required on suction lines shall be of the short forged or "frost-proof" type. All other fittings shall be standard sweat-soldered type. All ells and return bends shall be long radius type. Install leak lock material.

F. Refrigeration Piping: All joints shall be silver brazed and leak tested. Field fabricated lines shall be thoroughly flushed and cleaned before connection. Bleed nitrogen through lines during silver brazing, and cap and seal lines when not completed and connected to equipment.

G. Sleeve all penetrations of floors, walls and ceiling to allow for free motion of piping. Use #24 gage galvanized iron pipe and chrome plated escutcheon plates. Pack annular space between pipe and sleeve with incombustible material, fiberglass or approved equal, and seal each end with mastic to make waterproof.

H. Install insulated couplings at points of connection between all dissimilar metals for cathodic protection. Insulate copper tubing from ferrous materials and hangers with 2" thickness of 3" wide strip, 10 mil. polyvinyl tape wrapped around pipe.

I. Support all piping so that it is firmly held in place by iron hangers and supports, per manufacturer's recommendations. Provide saddles to protect pipe insulation.

J. Make connections of copper and brass pipe and tubing with 95-5 tinantimony, ASTM B32, Grade A solder.

K. Insulate all refrigerant suction lines.

L. On split systems insulate both suction and liquid lines. See Section 15250 for insulation material.

END OF SECTION
PART 1 - GENERAL

1.1 SUMMARY

A. Provisions of Division 1 apply to this section.

B. Section Included: This section includes providing and installing:
   1. Exposed (LumeAirTube) heating and air conditioning ductwork outside of the equipment enclosures.
   2. Integrated linear diffusers.

C. Related Work in Other Sections:
   1. All other ductwork not a part of the Specialty Duct System herein specified.
   2. All ductwork in equipment enclosures and non-exposed ductwork, connections, dampers and air balance.

1.2 QUALITY ASSURANCE

A. All materials for Work under this section shall comply with the following standards:
   2. ASHRAE
   3. ADC CODE
   4. DSA
   5. Los Angeles County Building Codes and Local Codes, latest edition.

B. Installation Methods: The recommended installation methods of the manufacturer of the approved items, when those methods have been approved by the Architect, shall become the basis for acceptance or rejection of the actual installation methods used in the Work.

C. Composite System: Work of this section shall include “single responsibility” with reference to compatibility of materials and components: LumeAirTube, accessories, coordination and erection of the complete system.

D. Systems: The LumeAirTube system, as herein described, is intended to be the total concept of air distribution, air diffusion, and as such, including support systems, and related accessories, except as specifically excluded, and as required for the system.
E. Establish locations of required hangar cables, ductwork, air diffusers, etc. connected with their respective operations, so that the completed Work will finish in true alignment and precise position, with proper support at all points.

F. Workmanship: To be performed in accordance with the manufacturer’s recommended installation direction and specification.

G. Mechanical Work performed as part of this Section’s Work shall conform to applicable requirements in Division 15.

1.3 SUBMITTALS

A. Shop Drawings: Submit complete Shop Drawings to the Architect showing all components, layouts, details, sections, mechanical elements, including installation and connection details.

B. Samples, Brochures, Data Sheets: Submit in triplicate including color chart for Architect’s selection of the final factory applied “Powder Coat” color.

PART 2 - PRODUCTS

2.1 PRODUCTS

A. LumeAirTube

1. Exposed Duct: Refer to other sections of Division 15 for applicable requirements and Specifications. Duct shall have “hair-line” joints at spacing as shown on the drawings. Vertical hanger cables shall occur at each joint and shall attach to the concealed internal sleeve, all as detailed on the Architectural and/or mechanical Drawings. The LumeAirTube shall have factory powder-coat finish in color as selected by the Architect.

a. Elbows: All sheet metal elbows shall be non segmented type, (12” dia. or less), and segmented (gores) for diameters more than 12” all with uniform turning radius minimum 1.5 radius.

b. Support: Aircraft vertical and sway bracing cable hangers and connector accessories. Secure to the structure with the special cable connector and bolts, screws or powder activated shots all as detailed on the Drawings.

2. Linear Air Diffuser Slot: Diffuser shall be nominal 48” or 60” long with one pair of die-formed pattern controls (weirs). The air slot shall be as shown on the drawings and be an integral part of the tube unit. The diffuser slot shall include an equalizing extractor for the entire length of the slot.

a. Pattern Controllers: Weir pattern controllers supported by spacer channels in nom. 24” or 30” increments the entire length of the slot. The controllers shall allow for infinite field adjustments to control the direction and projection of the air stream to satisfy Job conditions and provide draft-free air distribution. Fixed pattern controllers are not acceptable.

b. Equalizing Extractor: The diffuser component shall be installed to insure uniformity of air delivery and perpendicular distribution.

c. Finish: The LumeAirTube duct and air slot components shall be factory painted “powder-coat” in a color as selected by the Architect from the manufacturer’s standard color charts.
d. Performance: The linear diffuser shall have data for air distribution and acoustical performance in accordance with ADC Test Code 1062-GRD-84.

B. All materials specified above are based upon systems as distributed by Leban Group, Hacienda Heights, CA.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Requirements

1. Install all materials necessary for the complete LumeAirTube System. Perform installation in accordance with the manufacturer’s recommended installation specifications and as approved. Note “point of connection” per the mechanical Drawings.

2. Determine locations of required connections, hanger and sway cables, air diffusers, etc. to end that the complete Work will finish in true alignment and precise positions, with proper support at the required locations.

3. Consult mechanical Drawings to determine LumeAirLube air requirements, capacities and locations.

4. The entire run of LumeAirTube shall be installed level and straight with cable hangers plumb at each tube intersection.

3.2 CLEAN UP AND COMPLETION

A. Clean exposed portions of duct and linear diffusers and replace any damaged components at no cost to the Owner and to the approval of the Architect. Remove daily, debris generated by the Work of this Section.

B. Cooperate with the Work of other trades and provide necessary air balancing data as required.

3.3 DEFECTIVE WORK

A. Remove and replace all damaged, bent, cracked or scratched sheet metal or plastic materials, specified herein. Align joints so that they are “hair-line”.

B. Guarantee: Provided written warranty/guarantee as required under General Conditions.

END OF SECTION
SECTION 15880
AIR TRANSMISSION AND AIR DISTRIBUTION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Providing ductwork and appurtenances required to complete air transmission and distribution system of heating, ventilating, and air conditioning systems indicated on Drawings and as specified.

1.2 SUBMITTALS

A. Submit in accordance with Division 01 and Section 15010.

B. Submit Following Manufacturer's Data:

1. Complete list of all items to be furnished and installed under this Section. Material lists that do not require performance data shall include manufacturers’ names, types and model numbers.

2. Manufacturers' specifications and other data required to demonstrate compliance with specified requirements. Literature shall include descriptions of equipment, types, models, sizes, capacity tables or curves marked to indicate performance characteristics, electrical requirements, options selected, space requirements (including allowances for servicing) and any other data necessary to ensure compliance with requirements of these Specifications and performances indicated on Drawings. Data shall also include name and address of nearest service and maintenance organization that regularly stocks repair parts. Listings of items that function as parts of an integrated system shall be furnished at one time.

3. Shop drawings indicating methods of installation of equipment and materials, sizes and gages of ducts, and details of supports. Check Drawings and coordinate with other trades before submittal. Items to be covered shall include but not be limited to following:

a. Layout of ductwork, and equipment drawn to scale, to establish that equipment will fit into allotted spaces with clearance for installation and maintenance. Show proposed details for attachment and anchoring to and hanging from structural framing of building. Show vibration isolation units, foundations and supports, and openings for passage of pipes and ducts. If departures from the Contract Drawings are deemed necessary by Contractor, details of such departures, including changes in related portions of project and reasons for such changes, shall be submitted with Drawings. Approved departures shall be made at no additional cost to the Owner.

b. Drawings indicating locations and sizes of sleeves and prepared openings for pipes and ducts.

c. Typical details of supports for equipment and ductwork.

1.3 QUALITY ASSURANCE

A. Installers and Manufacturer's Qualifications: Comply with provisions stated under Section 15010.
1.4 PRODUCT HANDLING
A. Protection, Replacements, Delivery and Storage: Comply with provisions stated in Section 15010.

1.5 COORDINATION
A. Coordinate all activities in accordance with provisions of Section 15010.

PART 2 - PRODUCTS

2.1 GENERAL
A. Unless otherwise noted, all provisions, including amendments thereto, of the 1985 first edition of the HVAC DUCT CONSTRUCTION STANDARDS of Sheet Metal and Air Conditioning Contractors National Association (referred to as SMACNA) and latest issue of the California Mechanical Code (CMC), are hereby made part of this Section. Any references made thereto shall be strictly followed.

B. Rectangular, round and flat oval ducts shall be manufactured and installed in accordance with requirements of the HVAC DUCT CONSTRUCTION STANDARDS OF SMACNA.

C. Sheet metal ducts shall be fabricated from galvanized steel, aluminum or stainless steel.

D. Galvanized steel ducts shall be fabricated of galvanized steel sheet, lock forming grade, conforming to ASTM A525 and A527.

E. Galvanized steel ducts gage thickness and permissible joints and seams to conform to requirements in Table No. 2 Construction Details for Rectangular Sheet Metal Ducts, this Section.

F. Ducts shall be reinforced in accordance with SMACNA Standards.

1. Cross Broken Duct: Duct sizes 19" wide and larger which have more than 10 square feet of unbraced panel shall be beaded or cross broken. This requirement is applicable to #20 gage or less thickness and 3" W.G. or less pressure. For details see SMACNA Manual.

G. Round, Oval and Flexible Duct; for Galvanized Steel Ducts:

1. Round Spiral Ducts and Fittings: Fabricated from galvanized sheet steel shall be machine-formed spiral pipe with sealed spiral locking joints. All fittings shall have continuous corrosion-resistant welds. Ducts and fittings shall be as manufactured by United Sheet Metal or approval equal. Use gages of ducts and fittings recommended by manufacturer.

2. Details of seams and transverse joints for round duct and fittings shall conform to SMACNA Standards.

3. Flat oval ducts shall be provided as indicated on the Contract Drawings. Details in SMACNA Manual.

4. Minimum duct wall thickness for flat oval duct construction shall be as indicated in of SMACNA Manual.

5. Non-metallic flexible duct for Tee-Bar Suspended Ceiling only shall be used with approval of Mechanical Engineer after submittal of installation and bench details and certified test data in accordance with the Air Diffusion Council Test Code FD-72. Flexible duct shall be rated for not less than 6" W.G. static pressure.
6. Flexible duct shall be metallic or non-metallic, insulated or Uninsulated-insulated, factory fabricated complying with NFPA Standard 90A or 90B, tested in accordance with UL Standard, UL-181.


8. These provisions apply for ducts used for indoor comfort heating, ventilating and air conditioning service only.

9. Specifications herein shall not supersede application contingencies dictated by flexible duct manufacturer if those are more stringent.

H. Fittings and Other Construction Details: Details of fittings such as elbows, turning vanes, branch take off and connections, duct access doors, connections for grilles, registers, and ceiling diffusers, flexible connector at fan, etc., shall conform to applicable provisions in Section II or SMACNA Manual.

I. Duct Seam and Joint Sealant: Furnish duct seam and joint sealant or tape for all metal ducts. Sealant for low-pressure ducts shall be 3M Company "Miracle D17" or other approved equivalent, for use with a Calking gun. Tape joints with canvas using Borden Chemical Division "Arabol" or other approved adhesive. Provide sealing material for medium-pressure ducts as described in the SMACNA Manual for those pressures.

2.3 ACOUSTICAL DUCT AND PLENUM LINERS

A. Duct liners shall conform to requirements of Section 15250.

2.4 DAMPERS

A. Manually Operated Volume Control Damper:

1. Rectangular multi-blade type, opposed blade operation, #16 gage galvanized steel blades; Center pivoted on 3/8" diameter steel trunnions. Interlocking edges; All dampers shall be in own angle frame, full duct size as indicated on Drawings; Frame of minimum #16 gage steel channel construction. Provide with damper operator and axles positively locked to blade.

RUSKIN MD 35, or approved equal.

2. Round. Frame shall be constructed of not less than #16 gage galvanized steel, blades of not less than #16 gage galvanized steel channel construction with factory neoprene seals, 1/2" diameter axle shafts and locking hand quadrant.

RUSKIN CDR. S25, or approved equal.

3. Oval. Frame shall be constructed of not less than #14 gage galvanized steel channels with factory blade seals of not less than #12 gage galvanized steel with not less than 1/2" diameter axle shafts. Use Ruskin standard construction for frame, blade and axle size, thickness and material variation. Provide adjustable locking hand quadrant.

RUSKIN CDO25 or approved equal.

B. Motorized Volume Control Damper:
1. Rectangular: Multi-blade type opposed blade operation, #16-gage minimum steel channel frame construction. #16-gage galvanized steel blades center pivoted on ½” diameter steel trunnions. Interlocking edges. Dampers shall be in own angle frame. Full duct size as indicated on the Contract Drawings. Complete with matching two-position motorized actuator with linkages, 120 VAC by Barber Colman, Honeywell, or equal.

   RUSKIN DAMPER CD35, POTTORFF, or approved equal.

2. Round: Butterfly type constructed with minimum #18 gaged galvanized steel frame with steel angle reinforcement on above 20” diameter. Blade two-layer, minimum #14-gage equivalent thickness. Neoprene seal to ensure air tightness in closed position. Complete with matching two-position motorized actuator with linkage 120 VAC by Barber Colman, Honeywell, or approved equal.

C. Automatic Fire Dampers:

1. Fire Damper shall conform to requirements of and listed by State of California Fire Marshal, and NFPA Pamphlet #90A. Dampers shall have airflow resistance not to exceed 0.05” water gage static pressure at 900 fpm or 0.25” water gage at 2000 fpm. Dampers shall be installed in approved steel sleeve at each penetration of a rated partition.

   a. Vertical Mounted Fire Dampers: Fire damper shall be curtain type with blades removed from the air stream to allow for maximum free area. Dampers will be provided in factory sleeves as tested and listed by manufacturer. Dampers shall be rated for 1-1/2 hours for installation in one or two hour partitions. Provide UL listed fusible links of adequate size and temperature rating. Dampers to be installed according to the manufacturer's recommended installation instructions provided with units. Provide suitable access for inspection and servicing of each damper.

      POTTORFF Model VFD-10 ISB (CSFM No. 3225-368:101) or approved RUSKIN equal.

   b. Ceiling Fire Dampers: Ceiling fire dampers shall be butterfly type with ceramic material to minimize heat radiation. Dampers shall be rated for one hour and should come as an integral sleeve ceiling box that will accept air distribution, have a U.L. listed and pre-mounted hanger tabs. Dampers to be installed according to the manufacturer's recommended installation instructions.

      POTTORFF Model CFD-15 ES (CFSM No. 3225-368:104) or approved RUSKIN equal.

D. Relief Dampers: Parallel multi-blade type. Constructed of #20 gage galvanized sheet steel, or aluminum alloy with solid stops all around. Bearings of self-lubricated type. Damper shall open on a positive pressure within space and close to a backdraft. Interlocking edges shall prevent dust infiltration when closed.

AIR BALANCE  POTTORFF  RUSKIN  METAL FORM

E. Duct Access Panel: Provide factory fabricated access panel in ducts where required for servicing fire or smoke dampers, and at other locations as required in Part 3 under Access Plates and Panels. Units shall consist of removable panel, gasketed and pressure sealed by controlled spring tension locks. Construct unit, including all interior parts, of same material as duct. Units shall be constructed so as to be suitable for use in systems of up to 5” water gage static pressure.

2.5 AIR DISTRIBUTION DEVICES
A. General:

1. Grilles, registers, diffusers, and appurtenances shall conform to requirements specified herein and shall be of type and sizes as specified and indicated on Drawings. Performance shall be in accordance with Air Diffusion Council Test Code 1602R2 including airflow velocity, pressure, temperature, and sound measurements.

2. Sponge neoprene, rubber, vinyl or felt border gaskets shall be provided for all surface-mounted registers, grilles or diffusers.

3. Maximum sound level for supply diffusers and return and exhaust grilles shall not exceed NC 35.

4. Ceiling diffusers shall be provided with equalizing deflectors: Anemostat, Tuttle and Bailey or approved equal.

5. Ceiling mounted grilles, registers and diffusers shall be provided with a factory applied baked enamel dull finish, bone white, to match acoustical ceiling tile.

6. Grilles or registers to be mounted on painted walls or other surfaces shall be furnished with a baked prime coat, to be finish painted under Painting Section 09910.

7. Ceiling diffusers, return grilles with duct connections, and exhaust grilles shall be provided with loose key operated opposed blade volume control. Volume controls for return grilles without duct connections are not required.

B. Ceiling Diffusers, Round, Square, Rectangular:

1. Acoustical Tile on Plaster Ceilings or Exposed Ceilings: Units shall be square or rectangular modular core type flush and flanged for surface mounting: Titus Model PMC or approved equal.

2. Prefabricated Acoustical Tile Ceilings with Inverted Exposed T-Bars: Units shall be square or rectangular modular core lay-in, flush panel type with a nominal overall dimension of 24" x 24": Titus Model PMC or approved equal.

C. Ceiling Grilles, Return:

1. Prefabricated Acoustical Tile Ceilings with Inverted Exposed T-Bars: Units shall be square lay-in, flush perforated panel type with a nominal overall dimension of 24" x 24": Titus Model PXP or approved equal.

D. Ceiling Diffuser, Return, Relief, Exhaust, Ceiling, Square, Rectangular:

1. Acoustical Tile on Plaster Ceilings or Exposed Ceilings: Units shall be square type flush and flanged for surface mounting: Titus Model PAR or approved equal.

2. Prefabricated Acoustical Tile Ceilings with Inverted Exposed T-Bars: Units shall be square lay-in, flush perforated panel type with a nominal overall dimension of 24" x 24": Titus Model PAR or approved equal.

E. Registers, Supply, Return, Wall:

1. Sidewall supply register shall be double deflecting type with loose key operated opposed blade volume control: Titus Model 300 or approved equal.
2. Sidewall return register shall be single deflecting type with horizontal fixed face bars set at 45 degree angle flush and flanged for surface mounting and complete with loose key operated opposed blade volume control: Titus Model 350 or approval equal.

F. Linear Diffuser:
1. Supply: Titus Model ML.
2. Return: Titus Model MLR.

G. Security Registers:
The security registers, supply and exhaust operations, shall be maximum security type. Security registers shall comply with National Institute of Corrections guidelines for suicide prevention and California Title 24.
1. Exposed Ceilings or Security Ceilings: Units shall be square type flush and flanged for surface mounting: Titus Model SG-SD or approved equal.

2.6 VARIABLE AIR VOLUME TERMINALS

A. Furnish and install Titus Model DESV Single Duct Variable Air Volume Terminal Units of the sizes and capacities as scheduled. Terminals must be certified by ARI and shall bear the ARI 880 seal.

B. Terminals shall be constructed of not less than 22 gauge galvanized steel casings with a baked enamel paint finish, may be used as an alternative. The terminal casing shall be mechanically assembled (spot-welded casings are not acceptable).

1. Casing shall be internally lined with ½" thick, 4 pound per cubic foot skin, dual density fiberglass insulation, rated for a maximum air velocity of 3600 f.p.m. In addition to using adhesive complying with NFPA 90A, the insulation shall incorporate a secondary mechanical fastener attached to the unit casing wall (clench nail). Minimum thermal conductivity shall be 0.24. Insulation must meet all requirements of UL 181 and NFPA 90A. Raw insulation edges on the discharge of the unit must be covered with metal liner to eliminate flaking of insulation during field duct connections.

2. All appurtenances including control assemblies, control enclosures, hot water heating coils, and electric heating coils shall not extend beyond the top and bottom of the unit casing. At an inlet velocity of 2000 f.p.m., the static pressure drop across the basic terminal or basic terminal with a sound attenuator shall not exceed .08” W.G. for all unit sizes.

C. The primary air valve shall consist of a minimum 22 gauge cylindrical body that includes embossment rings for rigidity. The damper blade shall be connected to a solid shaft by means of an integral molded sleeve which does not require screw or bolt fasteners. The shaft shall be manufactured of a low thermal conducting composite materials and include a molded damper position indicator visible from the exterior of the terminal for ease of service. The valve assembly shall include internal mechanical stops for both full open and closed positioning. The damper blade seal shall be secured without use of adhesives. The air valve leakage shall not exceed 1% of maximum inlet rated airflow at 3” W.G. inlet pressure.

D. Primary Airflow Sensor: Differential pressure airflow sensor shall traverse the duct using the equal cross sectional area or log-linear traverse method along two perpendicular diameters. Single axis sensor shall not be acceptable for duct diameters 6” or larger. A minimum of 12 total pressure sensing points shall be utilized. The total pressure inputs shall be averaged using a pressure chamber located at the center of the sensor. A sensor that delivers the differential pressure signal from one end of the sensor is not acceptable. The sensor shall output an amplified differential pressure signal that is at least 2.5 times the equivalent velocity pressure signal obtained from a
conventional pitot tube. The sensor shall develop a differential pressure of 0.03” W.G. at an air velocity of < 450 FPM. Documentation shall be submitted which substantiates this requirement. Brass balancing taps and airflow calibration charts shall be provided for field airflow measurements.

E. Hot Water Coil: Single duct terminal shall include an integral hot water coil where indicated on the plans. The coil shall be manufactured by the terminal unit manufacturer and shall have a minimum 22 gauge galvanized sheet metal casing with a minimum G60 zinc coating. Stainless steel casings, or galvanized steel casings with a baked enamel paint finish, may be used as an alternative. Coil to be constructed of copper fins with full fin collars to assure accurate fin spacing and maximum tube contact. Fins shall be spaced with a minimum of 10 per inch and mechanically fixed to seamless copper tubes for maximum heat transfer. Each coil shall be tested at a minimum of 350 PSIG under water.

F. Sound Attenuating Equipment – Duct Silencers:

1. Provide factory fabricated duct silencers of tubular or rectangular type, for high or low velocity service, with arrangements, sizes and capacities as indicated on Drawings. Construct silencers of galvanized steel with casing seams sealed or welded to be airtight at a pressure differential of 8 inches water gauge between inside and outside of unit, and stiffen or brace as required to prevent structural failure or deformation at same condition, or audible vibration during normal operation. Furnish an inert acoustical absorbing filler material or inorganic mineral or fibrous glass that is vermin, moisture-proof, and will impart no odor into air stream. Filler material shall have fire hazard classification values, when tested in accordance with ASTM E 84, NFPA 255, or UL 723, not exceeding the following:
   a. Flame Spread: 15
   b. Fuel Contribution: 0
   c. Smoke Development: 0

2. Select and provide silencers from acoustical and aerodynamic rating tables based on actual test readings or interpolated values of such readings obtained from tests made by recognized independent laboratories. Tests shall be in accordance with ASTM E 477.

3. Select and provide silencers for air pressure drops not exceeding those indicated on Drawings, and of types, sizes and models for which noise reduction values, dynamic insertion loss, in decibels reference 10-12 watts, are not less than indicated on Drawings.

   Silencers shall be Industrial Acoustic Co., or equal.

G. Direct Digital Controls: For each VAV terminal, provide a control package consisting of a digital controller with integral flow-compensated, differential pressure transducer and an electric damper actuator. Systems with actuator integral to the electronic controller are not acceptable. All components shall be furnished, manufactured, mounted, piped and wired by the terminal unit manufacturer. Provide a 24 VAC control transformer to match the power requirements of the building.

1. For each VAV terminal, provide a direct digital thermostat, manufactured and furnished by the terminal unit manufacturer. The thermostat base shall be capable of being mounted directly to drywall or to a single-gang junction box. The thermostat circuit board shall incorporated a glass encapsulated, hermetically sealed, rapid response thermistor, a hidden temperature setpoint with scale marked in one degree Fahrenheit increments, and minimum and maximum airflow limit adjustments. All thermostat signals shall be low voltage, low current and short circuit protected DC.

2. The flow-compensated differential pressure transducer shall be permanently mounted on the direct digital control circuit board. The direct digital control shall drive the transducer in
such a way as to produce a voltage output proportional to flow. Transducers with outputs proportional to differential pressure are not acceptable. The control shall use the flow proportional voltage output to maintain desired airflow within five percent regardless of changes in system static pressure. Inlet mounted, single point hot-wire velocity transducers are not acceptable.

3. The actuator shall be capable of stalling indefinitely at the terminal’s mechanical stops without damage to the actuator or the terminal and maintain positive mechanical pressure against the terminals closed foam seal to prevent excessive airflow leakage. End switches used for limiting damper travel are not acceptable. In the stall position, current to the actuator motor shall be electronically limited to prevent damage due to excessive power dissipation. Drive voltage to the actuator shall be low voltage, low current DC and shall be varied so that the damper only travels at full speed when required. 24 VAC floating tri-state actuators are not acceptable.

4. The electronic control circuit board shall incorporate different type terminals for AC and DC connections to prevent damage caused by inadvertent wiring errors. The thermostat, duct sensor, and contact closure terminations shall use screw terminal connectors. The 24 VAC terminations shall be quick-connect type. The circuit board shall also incorporate an automotive-style, glass tube fuse for ease of local replacement.

5. Each thermostat shall include both a heating and cooling minimum airflow adjustment. The control system shall allow the heat and heating minimum to be disabled by a dry contract closure provided by the controls contractor.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which work of this Section will be performed. Correct conditions detrimental to proper and timely completion of work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 DUCTWORK

A. Construct all ductwork using details of fabrication, and methods of support as indicated in the SMACNA Manuals and California Mechanical Code (CMC), unless specified or indicated otherwise in following Paragraphs or on Drawings. In event of conflict, the most stringent requirement shall be used.

B. Unless otherwise approved, construct ducts to conform accurately to dimensions indicated and to be straight and smooth on inside, with joints neatly finished.

C. DUCT DIMENSIONS INDICATED ARE NET INSIDE DIMENSIONS. SHOULD DUCT BE INDICATED WITH ACOUSTIC LINING, ADD TWICE THE THICKNESS OF THE ACOUSTIC LINER IN BOTH DIMENSIONS (WIDTH AND HEIGHT) TO OBTAIN THE GROSS SHEET METAL DUCT DIMENSIONS.

D. Anchor ducts to building structural slab, framing and roof decking and detail method of anchoring and fastening if not indicated on Drawings. All supports shall be seismically constructed.

F. Construct and install ducts so as to be completely free from vibration under all conditions of operation.
G. Indicate on layout drawing, required for suspended ductwork, location of supports, loads imposed on each fastening or anchor, typical details for anchorage, and details for special anchorage for supports attached to metal roof decking.

H. Attach supports only to building structural framing members and concrete slabs.

I. Where supports are required between structural framing members, detail and install suitable intermediate metal framing.

J. Ducts handling air conditioning or heating supply air shall be insulated in accordance with requirements of Section 15250.

(1) Ducts exposed to weather shall have exterior insulation with weather jacket and interior lining as indicated on Table 2, Section 15250.

K. Ferrous angles and structural members and joining collars specified for construction and support of ductwork and plenums, shall be primed with one heavy coat of approved asphaltic aluminum paint before installation or fabrication. Metal surface shall be thoroughly cleaned before application of paint. Galvanizing may be used instead of painting. Duct hanger rods installed concealed in furred ceilings and walls need not be primed or painted.

L. Broken places in galvanized coating shall be acid washed and then completely soldered over or painted with galvanizing paint, Devcon Z or ZRC "Cold Galvanizing" compound.

M. For ducts of brushed stainless steel shall be as indicated on drawings.

3.3 DUCT CONSTRUCTION

A. Minimum ductwork gages, joints, reinforcing, and bracing shall conform to the following Tables 1 and 2. Plenums and castings shall not be thinner than the duct thickness listed in Table 2 for corresponding dimensions. Additional bracing shall be used to prevent objectionable panel vibration.
B. TABLE 1 - SHEET METAL THICKNESS FOR CIRCULAR DUCTS AND FLAT - OVAL (FOR STATIC PRESSURES LISTED):

<table>
<thead>
<tr>
<th>Gage Thickness</th>
<th>Diameter of Duct</th>
<th>Horizontal support</th>
<th>Girth</th>
</tr>
</thead>
<tbody>
<tr>
<td>2&quot; water column</td>
<td>Max. Diameter</td>
<td>max. distance</td>
<td>Joints</td>
</tr>
<tr>
<td>maximum S.P. Round / Oval</td>
<td>(inches)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>26 24</td>
<td>To 9</td>
<td>10'-0&quot;</td>
<td>2&quot; slip</td>
</tr>
<tr>
<td>26 24</td>
<td>9 - 14</td>
<td>8'-0&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>24 22</td>
<td>14 - 23</td>
<td>8'-0&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>22 20</td>
<td>23 - 37</td>
<td>8'-0&quot;</td>
<td>4&quot;</td>
</tr>
<tr>
<td>20 18</td>
<td>37 - 51</td>
<td>6'-0&quot;</td>
<td>1-1/4 x 1-1/8&quot; Flange</td>
</tr>
</tbody>
</table>

1. Acceptable longitudinal seams are grooved, snap lock and standing, sealed and taped, or sealed spiral or continuously welded. For exhaust duct, taping may be omitted.

C. TABLE 2 - CONSTRUCTION DETAILS FOR RECTANGULAR SHEET METAL DUCTS FOR LOW PRESSURE SYSTEM WHERE VELOCITIES DO NOT EXCEED 2000 FEET PER MINUTE

1. For pressures in excess of 2" water column, duct wall thickness shall be two gages heavier than set forth in this table.

2. Duct specifications shown below are applicable when ducts larger than 18" are cross broken. Where cross breaking is not used, duct wall thickness shall be two gages heavier on ducts 19" through 60" wide unless longitudinal standing seams are used.

MINIMUM METAL GAGES

<table>
<thead>
<tr>
<th>Minimum Gage Thickness Steel</th>
<th>(Max. Side) Gross</th>
<th>Duct Permissible Girth</th>
<th>Horizontal Support</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Dimensions (in inches)</td>
<td>Joints &amp; Longitudinal Seams</td>
<td>Maximum Distance</td>
</tr>
<tr>
<td>26 24</td>
<td>Up through 12</td>
<td>Drive slip, plain &quot;S&quot; slip, or 1&quot; pocket lock</td>
<td>10' - 0&quot;</td>
</tr>
<tr>
<td>24 22</td>
<td>13 through 18</td>
<td>Drive slip, plain &quot;S&quot; slip, 1&quot; pocket lock</td>
<td>10' - 0&quot;</td>
</tr>
<tr>
<td>24 22</td>
<td>19 through 30</td>
<td>Hemmed &quot;S&quot; slip, 1&quot; bar slip, or 1&quot; pocket lock on 5' centers. Hemmed &quot;S&quot; slip, 1&quot; slip, or 1&quot; pocket lock on 5' centers with 1&quot;x 1&quot;x 1/8&quot; angles on center line between.</td>
<td>10' - 0&quot;</td>
</tr>
</tbody>
</table>
Hemmed "S" slip, 1" bar slip, or 1" pocket lock on 10' centers with cross break 1" standing seam on 5' centers.

22 20 31 through 42 1" bar slip, reinforced bar slip, or pocket lock 5' centers. 8' - 0" 1" bar slip, reinforced bar slip, or pocket lock on 10' centers with 1" x 1" x 1/8" angles on center line between.

1" standing seam on 5' centers inside longitudinal standing seams with 1" x 1" x 1/8" angles on 5' centers on exterior.

22 20 43 through 54 1-1/2" bar slip, reinforced bar slip, or pocket lock on 4' centers. 8'-0" 1-1/2" bar slip, reinforced bar slip, or pocket lock on 8' centers with 1-1/2" x 1-1/2" x 1/8" angles on center line between.

1-1/2" bar slip, reinforced bar slip, or pocket lock on 4' centers with cross break.

*20 18 55 through 60 1-1/2" standing seam on 3' centers inside longitudinal standing seam with 1-1/2" x 1-1/2" x 1/8" angles on 4" centers on exterior. 8'-0"

*20 18 61 through 84 Reinforced bar slip, angle slip, alternate bar slip, or angle reinforced pocket lock on 4' centers using 1-1/2" x 1-1/2" 1/8" 1-1/2" x 1/8" angles on centerline between reinforced bar slip, angle slip, alternate bar slip, or angle reinforced pocket lock on 8' centers using 1-1/2" x 1-1/2" x 1/8" reinforcing angles 2' on centers in between 1-1/2" angle reinforced standing seam on 2' center using 1-1/2" x 1-1/2" x 1/8" reinforcing angles. Inside longitudinal standing seams with 1-1/2" x 1-1/2" 1/8" angles on 2' centers on exterior. 6'-0"

* Button punch snap lock seams, "Lockformer" acceptable as an alternate only on 20 and 22 gage galvanized steel ducts. For aluminum duct, Button Punch SnapLock will not be permitted.
D. Ferrous angles and structural members and joining collars specified herein for the construction and support of ductwork and plenums, shall be primed with one heavy coat of approved asphaltic aluminum paint before installation or fabrication. The metal surface shall be thoroughly cleaned before application of the paint. Galvanizing may be used instead of painting. Duct hanger rods installed concealed in furred ceilings and walls need not be primed or painted.

E. Broken places in galvanized coating shall be acid washed and then completely soldered over or painted with galvanizing paint, Devcon Z or ZRC “Cold Galvanizing” compound.

F. No "S" or drive slip type girth or longitudinal seam shall be used on any ductwork installed outdoors or mounted on roofs. Use angle-reinforced government lock only.

G. Broken places in galvanized coating shall be acid washed and then completely soldered over or painted with galvanizing paint, Devcon Z or ZRC “Cold Galvanizing” compound.

3.4 DUCT AND PLENUM WITH LINERS

A. Ducts and plenums lined with acoustical insulation are as indicated on Drawings.

B. Duct dimensions indicated on Drawings are net. Add thickness of acoustic liners to obtain gross sheet metal duct dimensions.

C. Refer to Section 15250 for duct liner specifications and installations.

3.5 DUCT ELBOWS AND TURNING VANES

A. Duct elbows, including supply, exhaust, and return, shall be made with a centerline radius of 1.5 times duct width parallel to radius whenever possible, and in no case shall centerline radius be less than width of duct parallel to radius.

B. Where space does not permit above radius, or where square elbows are indicated on Drawings, turning vanes of an approved type shall be installed whether indicated on Drawings or not.

C. Turning vanes shall be thick double-wall vane type, Titus Y or Z, Tuttle and Bailey Ducturn, or equal. "DuroDyne" vane rail system duct turns may be used, provided that they are of thick double wall type and shop Drawings are submitted to and approved by the Mechanical Engineer. Duct turning vanes shall be of same material as ductwork, and shall be rigidly fixed in ductwork.

3.6 DUCT JOINTS AND SEAMS

A. Conditioned air supply ducts shall have joints and seams taped for air tightness or welded, except spiral seam factory machine formed duct components. Spiral seam is exempted. Joints between slip-fit components may be assembled with an approved seam and sheet metal screws, and taped.

B. Other ducts shall have joints and seams sealed by calking, taping, soldering, or welding. Ducts for grease hood exhaust shall use grease-tight welding or brazing on external surface for joints and seams. Fiberglass ducts shall have a thermally activated closure system, Manville “Fortifiber Therm-Lock with Automatic Bond Indicator dots” or approved equal.

C. No “S” or drive slip type girth or longitudinal seam shall be allowed on any exterior or exposed rooftop mounted ductwork. Use angle-reinforced government lock only.

D. Calking, tapping, or other joint or seam treatment shall not be used as a substitute for good workmanship.
E. Unless otherwise detailed, taping shall be with Duro-Dyne FT-2, 2" wide tape, applied over S-2 duct sealer or Arabol and canvas tape or listed "Miracle" tape. No ducts shall be covered or insulated on outside until joints are approved by the Owner Inspector. A second coat of Arabol or adhesive shall be applied 24 hours after initial application if any separation occurs. Use only approved and U.L. or Factory Mutual listed material for sealing and calking.

F. Seams around fan and coil housing and plenums shall be sealed with gaskets or calking compound, to provide an airtight assembly.

G. Ductwork connected to range hoods shall have grease-tight seams, and shall be constructed and installed so that grease or other material cannot become pocketed in any portion thereof, and system shall slope downward toward hood not less than 1/4" per lineal foot. (Refer to the City of Los Angeles Building Code). Joint calking or sealing compound shall be listed by THE CITY OF LOS ANGELES.

Duro-Dyne S-2 or approved equal, as recommended and guaranteed by manufacturer for this specific application shall be applied in accordance with manufacturer's recommendations. Metal surfaces shall be thoroughly cleaned before applying calking compound. Galvanized surfaces shall be etched, if necessary, to obtain a good bond between metal and calking compound.

3.7 DUCT TRANSITION

A. Slopes in sides of transition pieces shall be no greater than 1 to 5. No abrupt changes or offsets of any kind in duct system will be permitted, except when approved by the Mechanical Engineer. Radius turns or turning vanes may be used as previously noted, or special approved guiding vaned may be utilized.

3.8 DUCT TEST HOLES

A. Holes in ducts and plenums shall be provided for using pitot or static tubes for taking air measurements to balance or check air systems. Holes shall be covered with neoprene gasketed sheet metal cover or plugged with a fitted neoprene plug chained to duct.

3.9 SOUND ATTENUATING EQUIPMENT

A. Install sound attenuators where required and indicated on Drawings. Refer to manufacturer's instructions for proper installation.

3.10 FLEXIBLE CONNECTIONS

A. At points where sheet metal connections are made to fans or air handling units, or where ducts of dissimilar metals are connected, a flexible connection of commercial grade "Duralon" by Dury-Dyne Corporation, or other approved non-combustible material, shall be installed and securely fastened by zinc-coated steel clinch-type bands or a flange type connection. Inlet and outlet openings shall be axially in-line, maximum deviation of centerline shall be less than 5% of diameter or shortest dimension of a rectangular inlet of fan or air handling unit, with system at rest. Duct end of connection shall be seismically restrained if more than 4'-0" from last support.

3.11 AIR TERMINAL DEVICES

A. General: Install supply devices, where indicated, after ducts, plenums, and casings have been cleaned and blown free of small particles, as specified. Devices shall be aligned to be parallel to ceiling construction or walls and ceiling surfaces, and shall be pulled tightly to compress gaskets and to fit neatly against surfaces.
After system is in operation, if drafts, dead spots, or excessive noise are noticeable in conditioned spaces due to improper selection of type and size diffuser, grille, or register, change unit to proper size and type without additional cost to the Owner.

B. Diffusers: Support surface-mounted ceiling diffusers from angles or channels resting on and fastened to ceiling construction. Do not support from ducts. Install lay-in diffusers on T-bar ceilings, to be supported by ceiling structure. In addition, provide sheet metal adaptor box above each diffuser to allow space for volume controller with round collars for connection to round ducts where indicated on Drawings. Fasten duct-mounted diffusers to duct collars.

C. Registers and Grilles:

1. Install wall supply registers at least 6" below ceiling, unless otherwise indicated. Locate return and exhaust registers 6" below ceiling unless otherwise indicated.

2. Support ceiling diffuser type inlets, registers, and grilles as described above for ceiling diffusers.

3. Fasten wall mounted and duct mounted registers and grilles to flanges of duct collars.

3.12 DAMPERS

A. Manually operated dampers, gravity dampers, fire dampers, and motor operated dampers shall be furnished and installed as specified herein and as indicated. Upon completion of installation, dampers shall be checked, lubricated, and adjusted so that they operate freely, without binding. Dampers shall be of standard commercial manufacture, complete with damper frame. Where painting is required they shall be shop finished unless otherwise noted.

1. Balancing dampers shall be installed in all main supply ducts from fan discharge plenums, where 2 or more ducts are connected to each plenum, even though such balancing dampers are not indicated. Each zone shall have a manual volume damper. A sheet metal screw shall be run through handle, into duct, to lock damper in place after final contractor balancing.

2. Each supply, return, or exhaust branch shall have a manual volume damper.

3. Dampers installed in accessible locations shall have locking and indicating quadrants; Ventlock, or Duro-Dyne Corporation.

4. Dampers installed in ductwork in furred ceiling spaces or in roof spaces with less than 30" of clearance below beams, joists, or other construction, and where access panels are not provided shall have damper rods extended below ceiling and terminated with a concealed damper regulation; Ventlock or Young.

5. Dampers not identified as splitter, extractor, or butterfly dampers shall be of multi-louver type arranged for opposed blade operation. Damper shall be same dimension as adjoining duct, and be tight closing. Blades shall be not greater than 4". Dampers shall be not less than 20-gage steel. Damper bearings shall be Teflon, or approved equal.

6. Motor operated damper shall be furnished by temperature control manufacturer as part of temperature control equipment and shall conform to requirements of Section 15970: Temperature Control Systems.

7. Dampers shall have accessible operating mechanism, and where operators occur in finished portions of building, operators shall be chromium-plated with exposed edges.
rounded. Splitter dampers shall not be used unless specified and construction details approved by the Architect.

8. Dampers shall not be installed in combustion air ducts.

9. Access Panel shall be installed for access at each damper’s operating mechanism.

3.13 FIRE AND SMOKE DAMPERS

A. Fire dampers or combination fire and smoke dampers shall be installed and accessible at each duct penetration of rated walls and partitions and as required by State Fire Marshall and NFPA 90A.

B. Fire dampers shall be sized and adjoining duct enlarged to assure full size air passage of connecting ductwork.

C. Install smoke dampers as indicated on Drawings and as required in ducts penetrating smoke isolation separations.

D. Combination fire and smoke dampers: Combination fire and smoke dampers shall be louver bladed type. Units shall be tested and listed under UL 555 and UL 555S. Rating 1-1/2 hours for installation in one or 2-hour partitions. The seals shall be non-degradable steel to steel. Leakage shall not exceed 15 cfm/sq. ft. at one inch w.g. and shall be tested at 850 degrees F. Dampers shall be capable of being remotely controlled and reset for pressurization and smoke evacuation. Dampers shall be provided in sleeves with pre-mounted non-stall motor actuators and dual-position indicators, resettable switch and panels for remote annunciation. The complete assembly shall be factory cycled and tested prior to shipment. Provide suitable access for inspection and servicing of each damper. Pottorff Model FSD142 (CSFM No. 3225-368:110) with non-stall motor, and fire releasing device shall be UL33 listed melting fusible links, or Ruskin Model FSD60 (CSFM No. 3225-245:005, 102) with electric fuse link and electric non-stall motor.

3.14 DUCT SMOKE DETECTOR

A. Duct Smoke detector shall be installed in accordance with requirements of the Uniform Mechanical Code, current edition.

B. Duct Smoke detector shall be installed in systems of over 2000 CFM capacity to detect presence of smoke and automatically stop Air Handling Unit(s) or fan(s).

C. Smoke detector shall be installed:

1. In supply system downstream of filters.

D. For exceptions, see Uniform Mechanical Code.

3.15 BACKDRAFT DAMPERS

A. Backdraft dampers shall be installed at locations indicated in accordance with the State of California Energy Conservation Standards, Title 24, CCR.

3.16 DUCT SLEEVES AND PREPARED OPENINGS

A. Furnish duct sleeves for 15" diameter ducts or less passing through floors, walls, ceilings, or roof and install during construction of the floor, wall, ceiling, or roof. Install round ducts larger than 15" diameter and square and rectangular ducts passing through floors, walls, ceilings or roof through prepared openings. Provide duct sleeves and prepared openings for duct mains and duct branches.
B. Provide 1” clearance between duct and sleeve or between insulation and sleeves for insulated ducts, except at grilles, registers, and diffusers.

C. Provide prepared openings for round ducts larger than 15” in diameter and for square and rectangular ducts with 1” clearance between duct and openings or between insulation and opening for insulated ducts, except at grilles, registers, and diffusers.

D. Provide closure collar of galvanized sheet metal not less than 4” wide unless otherwise indicated on Drawings on each side of walls or floors where sleeves or prepared openings are provided except where grilles or diffusers are installed. Install collar tight against surface. Fit sharp edges of collar installed around insulated duct to preclude tearing or puncturing insulation covering vapor barrier. Fabricate collars from round ducts in steel. Use not less than 4 nails to attach collars where openings are 12” in diameter or less and not less than 8 nails where openings are 20” in diameter or less.

E. Pack space between sleeve or opening and duct or duct insulation with commercial grade packing yarn.

3.17 FLEXIBLE DUCT RUNOUTS

A. Runouts from branches, risers or mains to air terminal units and outlets may be pre-insulated, factory fabricated flexible ducts complying with NFPA #90A. Flexible ductwork shall not exceed 7'-0" in length. When required to suspend flexible ducts, furnish hangers of type recommended by manufacturers of pre-insulated flexible duct and install at intervals recommended. Method of attachment to other components of air distribution system for a vapor tight joint shall be in accordance with printed instructions of flexible duct manufacturer. Bend radius shall be 1½ time diameter of duct, measured from centerline. Bends greater than 90-degree angle are not permitted. Non-metallic flexible duct shall be permitted only in Tee Bar Suspended Ceilings.

3.18 DUCT HANGERS AND SUPPORTS

A. Single horizontal ducts shall be suspended from heavy steel hanger straps securely fastened to overhead structural members. Ducts shall be supported by a hanger strap passing around and fastened to duct with not less than 2 Parker #10 screws set approximately 2” in from each edge, to form a supporting stirrup attached to overhead supports. Rectangular ducts shall have 2 hanger straps, one located on each side of duct. Round ducts may be hung from a single hanger strap unless conditions require that duct be held tight against ceiling, in which case 2 hanger straps may be brought down each side of duct, oriented at right angles to axis of duct and securely fastened to duct standing leg seam or angle iron stiffener with a minimum of two ¼” bolts for each side of duct. Hanger straps shall be galvanized and a minimum size of 1 1/8” x #14 gage. Angels of galvanized steel of 1 1/8” x 1 1/8” x #16 gage (#14 gage for ducts 60” or greater) may be used in lieu of straps.

B. Where ducts are run adjacent one above the other, they shall be individually supported on a trapeze of steel angles with 3/8” supporting steel rods securely fastened to overhead construction. A minimum distance of 3” shall be maintained between ducts wherever possible, but in no event shall distance be less than 2”. Minimum sizes of steel angles shall be 1-1/2” x 1-1/2” x 1/8” for duct sizes through 60” in greatest dimension, 2” x 2” x 1/8” for duct sizes 61” through 84”, 2” x 2” x 3/16” for duct sizes 85” through 96”, and 2” x 2” x 1/4” for duct sizes over 97”.

C. All ducts 30” square area and greater and all ducts 20’-0” long and longer shall be seismically restrained. See Seismic Restraints (Section 15240).

D. Hangers shall not be supported by, or fastened to, non-structural members including blocking. Toggle or Molly type bolts shall not be used.
E. Vertical ducts shall be supported with suitable angles on each side of each duct located at each floor and at intervals not to exceed 8'-0". Angles shall be sized for required span so that they will be rigid, without any bending or sagging.

F. Where method of duct manufacture or hanging cannot be in accordance with previous Paragraphs because of interference or structural difficulties Contractor shall submit detail of an alternate method to the Architect for approval before work is begun.

G. Roof mounted ductwork shall be held at a minimum 12 inches above roof and shall be supported by galvanized welded pipe, one on each side, and fastened to roof in pitch pan filled cold process cement. Install supports at each turn, unit connections, and each penetration, also space at maximum 6 feet off center in general.

3.19 ACCESS PLATES AND DOORS

A. Access plates and doors shall be furnished and installed wherever stops, valves, fire dampers, fusible links, coils, damper operating mechanism, control equipment, lubrication fittings, air filters, air handling equipment and similar items normally requiring adjustment or servicing are installed in concealed spaces.

B. Access plates and doors shall be located to permit convenient access to equipment; of a size to permit removal of equipment for servicing. Access plates shall be no less than 12" x 12" in usable opening. Proper servicing of equipment requires adequate access for maintenance personnel. Access doors shall not be less than 24" x 24", unless otherwise detailed. 2 or more valves shall not be located in same access area unless sufficient clearance is provided for operation, servicing and removal of each valve.

C. Openings in ducts or plenums whose longer dimension does not exceed 12" may be covered by a plate of same material as duct, gasketed and fastened to duct or plenum with sheet metal screws.

D. Access plates in floors shall not be less than 8" x 8" and shall be carborundum surface brass with cast brass frames anchored into concrete. Access plates in tile walls shall be chromium plated brass and polished. Approved serrated plates furnished as part of a clean-out assembly are acceptable in floors instead of a separate plate.

E. Access plates and doors in walls and ceilings of finished rooms and in locations normally accessible to students shall be supplied with continuous piano hinges, unless otherwise specified, and a special flush type spring loaded latch requiring an Allen wrench to operate. Access devices shall be installed after plastering in plaster ground openings.

F. Access panels or doors penetrating one-hour fire resistive ceilings shall meet code requirements for such openings.

G. Access panels shall be fire-rated equal to Milcor manufactured by Inland Steel Products Co. Access doors shall be approved for installation in openings penetrating one-hour fire resistive ceilings. Access doors shall have a flush, key-operated cylinder lock, furnished with 2 keys each, instead of Allen headlock for non-rated ceilings.

H. Access panels that are part of an integrated ceiling are covered in Section 09510: Acoustical Ceilings. Identification markers (decals) shall be affixed to adjacent supports, under this portion of work, to indicate location and type of mechanical device to be serviced. Standard identification markers will be supplied by the Owner to Contractor for installation.

I. Access panels installed in ducts or plenums located in heater or equipment rooms containing gas-fired equipment shall be supplied with heavy duty spring closing hinges and refrigerator door type
catches unless otherwise required. When these panels are intended for maintenance personnel access, catches shall be operable from both interior and exterior.

J. Other access panels, except those specified above, shall be equipped with suitable hinges and one or more sash fasteners.

K. Panels located in ducts and plenums shall be installed with gaskets made of synthetic rubber, felt or similar material to make an airtight installation. Panels shall be constructed and reinforced to prevent vibration.

L. Letter words "FIRE DAMPERS" on panels over fire dampers and words "DO NOT OPEN - HEATER IS OPERATING" on panels located in heater or equipment rooms. Letters shall be approximately 3" high, if space is available.

M. Furnish a key to operate latch access plates, one for each access plate, but not to exceed 5 keys for any one contract.

N. Access plates and panels shall have manufacturer's name or trade mark and model number cast or stamped thereon, or upon a label permanently affixed thereon.

O. Duct Through Roof Flashing: Provide duct through roof flashing as detailed in the SMACNA standards or as indicated on drawings.

P. Refer to SMACNA Figures 2-12 and 2-13 for access plate and door construction.

3.20 PRESSURE TESTING

A. Test and make substantially airtight supply, return, and exhaust ducts, plenums, and casings, at static pressure indicated for system before covering with insulation or concealing in masonry. Substantially airtight shall be construed to mean that no air leakage is noticeable through senses of feeling or hearing at duct joints. Test ductwork for leaks at 1-1/2 times operating pressure but at a minimum of 2" of water.

END OF SECTION
PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Furnishing and installing temperature controls for air conditioning, heating, and ventilating systems as indicated. Work shall include but not be limited to following:

1. Furnishing and installing automatic control valves and automatically operated dampers, except those furnished as part of a unit.
2. Furnishing and installing the following: All electric relays (magnetic starters excepted), electric or mechanical linkages, duct sensors, thermostats, dampers and motorized valves, and all appurtenances and accessories required to make a complete and operable electric, electronic control installation.
3. All wiring and conduits, unless otherwise noted, for control systems, including wiring required to connect magnetic starters, (specified in other Sections) to control systems.
5. Furnishing shop drawings and operational data of systems as installed and finally adjusted.
6. Formal instruction of the District's operating personnel in operation of equipment.

B. Following items are specified in other Sections:
1. Magnetic starters, contacts, power relays and variable resistors or controllers for motors, and other electrical devices.
2. Load carrying wiring for above listed devices and wiring for starting switches not interconnected with temperature control system. (Division 16).
3. Electrical power to control panels and other equipment. (Division 16).
4. Installing automatic valves in pipe lines.
5. Installing automatic dampers.
6. Automatic controls and valves not connected with comfort heating, ventilating and air conditioning systems.
7. Packaged self contained equipment specified complete with temperature controls.
8. DDC control equipment specified in DDC Systems: Section 15975.

1.2 RELATED SECTIONS

A. Basic Mechanical Materials and Methods: Section 15050.
B. Heating and Air Conditioning Piping Systems: Section 15500.
C. Heating Equipment: Section 15550.
D. Environmental Control Systems: Section 15975.
E. Air Conditioning and Air Handling Equipment: Section 15850.
F. Air Transmission and Air Distribution Systems: Section 15880.

1.3 SUBMITTALS

A. Submit in accordance with Section 01300: Submittals.
1. Complete list of items proposed to be furnished and installed under this Section.
2. Manufacturer's specifications and other data required to demonstrate compliance with specified requirements.
3. Manufacturer's recommended installation procedures, which when reviewed and accepted by the Architect/Engineer, will become basis for inspecting and accepting or rejecting actual installation procedures used on the work.

B. Shop drawings showing temperature control diagrams, complete with equipment appurtenances required for system. Include sequence of operation description for each system. Comply with provisions of Project Record Drawings under Division 1.

C. Operating Instructions: Comply with provisions of Section 15010: Basic Mechanical Requirements. Personally explain and demonstrate operation of system to representative of the District's Maintenance and Operation's Branch and Test and Balance Unit or to future operator, if available.

D. Guarantee: Refer to Section 15010: Basic Mechanical Requirements.

1.4 QUALITY ASSURANCE

A. Manufacturer and Installer Qualifications: Comply with provisions stated under Section 15010: Basic Mechanical Requirements.

1.5 PRODUCT HANDLING

A. Production, Replacement, Delivery and Storage: Refer to Section 15010: Basic Mechanical Requirements and Section 15050: Basic Mechanical Materials and Methods.

PART 2 - PRODUCTS

2.1 TEMPERATURE CONTROLS

A. Provide temperature controls of electric, electronic microprocessor - DDC type, or a combination thereof, as indicated on Drawings that will provide required sequences or operation control.

2.2 MANUFACTURERS

A. Equipment in any system shall be of same manufacturer or their standard furnished items. Installation, testing, and adjusting of control system shall be under continuous supervision of manufacturer's authorized personnel.

B. Electric, electronic or Direct Digital microprocessor based control equipment shall be one of following manufacturers, unless otherwise noted:
   1. Johnson Controls, Inc.
   2. Siemens.
   3. Honeywell, Inc.

2.3 ELECTRIC EQUIPMENT AND ACCESSORIES

A. Electric control equipment and accessories shall include but not be limited to following:
   1. Electric control devices as indicated on Drawings and described herein, including thermostats, temperature controllers, valve and damper operators, switches, relays and control panels for instruments as required to provide a complete and operable system.
   2. Wiring and conduit, unless otherwise noted, or control systems including wiring required to connect magnetic starters (specified in other Sections) to control systems.

B. Room Thermostats:
   1. Thermostats for various air conditioning units shall be low voltage 5 wire minimum, for combination heating and cooling stages with automatic change over and complete with temperature adjustment button & digital display. The thermostat cable or wire shall be color
coded as recommended by manufacturer to prevent voltage drop. Robertshaw No. 300-208 for two stage heat/one stage cool or equal. Provide thermostat guard. Subbase and Guard cover shall accommodate installed thermostat. Thermostats located on outside walls shall be mounted on insulated backplates or as specified by unit manufacturer.

2. Other types of room thermostats for application as follows:
   a. Honeywell T822-C - for cooling only.
   b. Honeywell T 7100 Microelectronic commercial thermostat with Q 7100 subbase provide electronic control of 18 to 30 VAC single zone HVAC equipment. Thermostat is either stand alone, or arranged in a temperature averaging network consisting of two three, four, or four six sensors for corresponding rooms or zones.
   c. Honeywell T921 Proportional thermostat, low voltage, three wire controller for valve, damper motors and balancing relays. Unit manufacturer may specify or recommend optional thermostat.
   d. Provide tamper proof locking thermostat guards for a, b, and c above. Covers shall be opaque beige plastic in student occupied areas, clear plastic cover in administrative areas. Use Honeywell model TG 500 and TG 501 Universal Thermostat Guards or as recommended by thermostat manufacturer.

C. Duct Mounted Thermostats: Duct mounted thermostats shall be modulating or 2 position as required to accomplish sequence of operation.

D. Valve and Damper Motors: Damper motors shall be equipped with oil immersed gear trains and ample capacity to handle required loads under normal operating conditions. Where indicated, spring return type motors are to be supplied. Valve motors to be two position or proportional, spring return or now spring return.

E. Time Clocks:
   1. TC-1: Time clock shall be solid state digital electronic type capable of 28 ON/OFF set points to be distributed through the week, complete with a day repeat feature, time and set points to be adjustable to nearest minute with a minimum ON duration of one minute and a maximum of 7 days, LED readout to show day of week and time of day using 12 hour AM/PM indicator, wired to be powered by 120 volt 60 cycle source and switch configuration to be SPDT with a rating of 5 amps. UL listed, enclosed in standard case NEMA Type 1, Intermatic Model ET715C or Paragon EC 71/18S, with battery operated carry-over.
   2. TC-2: Interval timer (by-pass) shall be manually set and spring operated type Instermatic Model FF6H or Mark Time Model 90007, 0 to 6 hours, without hold feature, or approved equal.

F. Wiring:
   1. Wiring in connection with control systems regardless of voltage, power supply circuits excepted, is part of work of this Section. Wiring shall comply with Section 16050: Basic Electrical Materials.

2.4 ELECTRONIC EQUIPMENT AND ACCESSORIES

A. Electronic equipment and accessories shall include, but not be limited to following:
   1. Electronic controls and devices as indicated on Drawings and described herein including thermostats, temperature controllers, valve and damper operators, switches, relays and control panels for instruments as required to provide a complete and operable system.
   2. Wiring and conduit, unless otherwise noted, for control systems including wiring required to connect magnetic starters (specified in other Sections) to control systems.

B. Room Thermostats: Room thermostats shall be electronic type, using a resistance sensing element to provide, through electronic bridge circuit, a direct acting and reverse-acting signal to operator being controlled, and shall have separate and independent band width
adjustments for both direct-acting and reverse-acting output, and be complete with concealed adjustment and guard.

C. Controllers:
1. Electronic controllers will be solid-state type utilizing electronic bridge control circuitry and having capability of providing a separate, direct acting and reverse-acting signal across null with band width adjustments and settings for both direct-acting and reverse-acting signals.
2. Output signals shall be 0-16 volt DC and shall be capable of operating one or 2 electronic operators.
3. Controllers shall be capable of being furnished with main and auxiliary sensing circuits for master and submaster type applications. These circuits shall be available for local or remote set point ranges. Sensing elements utilized with these controllers shall be nickel wire resistance element type.
4. Electronic controllers shall be capable of being used with more than one actuator for sequencing. Controllers shall be panel-mounted.

D. Auxiliary Devices:
1. Furnish and install all necessary auxiliary electronic devices as appropriate to accomplish sequence as specified. These totally electronic devices shall include (but not be limited to) such items as load limiting controllers, low signal selectors, high signal selectors, remote reset control devices, remote set point control devices, floating alarm units, staging networks, damper position indicators, unison amplifiers, reversing networks, sequencing networks and electronic power supplier.
2. Indication meters shall be furnished on panels to indicate output signals from controllers and auxiliary devices.

2.5 DIRECT DIGITAL CONTROL EQUIPMENT AND ACCESSORIES

A. DDC controller and sensors are supplied under Section 15975: Environmental Control System.

B. Damper and Valve Operators: Damper and valve operators shall be capable of providing smooth proportional control under design temperature and pressure conditions. Operators shall be electronic or floating as indicated on Drawings. If electronic operators are indicated, they shall be designed for a control signal of either 0-10 VAC or 4-20 ma.

C. Control Valves: Valves 2" and under shall have screwed ends; 2-1/2" and larger shall have flanged ends. Valve body and packing shall be suitable for 1.5 times pressure of medium served.
1. All valves shall have seats designed to close tight at operating pressure and temperature.
2. Straight-through valves shall be single seated and shall have contoured plugs or V-port plugs with modified equal percentage flow characteristics.
3. Three-way valves shall have contoured plugs or V-port plugs with modified flow characteristics to provide a constant total flow.
4. Actual pressure drop at full design capacity shall be noted on submittal drawings. Maximum allowable pressure drop is 5 psig.

D. Miscellaneous Sensors: Miscellaneous sensors indicated on Drawings to be provided under this Section shall have an output signal of 4-20 ma.

PART 3 - EXECUTION

3.1 TEMPERATURE CONTROL SYSTEM INSTALLATION

A. Control system shall be installed in accordance with control manufacturer's instructions as accepted by the Architect.

3.2 CONTROL PANELS OR CABINETS
A. Switches, clocks, temperature control instruments, and remote bulb thermometers, whose capillary tubes are under 25'-0" in length, shall be mounted in control panels with required wiring, piping, and tubing behind panel. Control panels shall be galvanized steel sheet metal, with light gray hammertone enamel finish, not lighter than #14 gage. Control panels shall comply with the Los Angeles City Electrical Work Specifications. Panels shall be attached to wall at locations indicated, or as directed. Adjustable apparatus shall be provided with screwed or riveted green Micarta plate engraved in white to indicate function. A clear space of 30" in front shall be maintained.

B. At locations indicated on Drawings, control cabinets shall be provided with door locks. Door locks shall be the flush type, latched, Corbin #15751, 5/8" for metal door, keyed to a Corbin Cat. #60 key. Cabinet shall be prime coated and finish painted under Painting: Section 09900. Cabinet shall be flush mounted.

3.3 ROOM THERMOSTAT

A. Room thermostat shall be wall mounted at a height of approximately 4'-0". Room thermostats not permitted on outside walls, at chalkboards, between shelving, in recesses or above heat producing equipment. When installation is necessary in tackboards, approval shall be secured from the Architect. Units shall be installed as close to edge of the tackboard as possible. Room thermostats shall be equipped with approved tamperproof cover. Thermostats shall have set point windows and integral thermometers. Office thermostats shall have extended adjustment knobs; all others shall have key adjustments. Unless indicated otherwise, room thermostats shall have non-switching subbases.

3.4 COORDINATION

A. Temperature Controls Contractor shall coordinate his work with other aspects of system balancing to obtain a complete operating mechanical system in accordance with design intent, including coordinating with balancing agency subcontractor.

B. Temperature Controls Contractor shall be responsible for coordinating his work with all aspects of alarm, fire alarm, and smoke detector, provided under Electrical Sections.

3.5 SEQUENCE OF OPERATION

A. Each system, electric, electronic, or direct digital control shall operate as graphically and described on Drawings. Contractor's submittal shall include a step-by-step description of sequence of operation for each piece of equipment in system.

3.6 CONTROL SYSTEM ADJUSTMENTS

A. Temperature Controls Contractor shall make all adjustments under operating conditions, to provide sequence of operation for controls indicated. If required operating conditions cannot be obtained prior to completion date of the Contract, due to outdoor seasonal temperatures, Controls Contractor shall return to job site when requested by the District and readjust control system when outdoor temperatures will permit proper operating conditions. Contractor shall start readjustment within 7 calendar days after notification. Final settings of controls and pressure ranges indicated by gages shall be indicated on Record Drawings.

3.7 RUNNING TIME METERS

A. A digital type, non-reset meter, shall be furnished to read cumulative operating time (in hours) for each of following equipment:
   1. Each refrigeration compressor, 10 HP or larger.
   2. Each circulating water pump, 2 HP or larger.
   3. Each heater or boiler, 400,000 BTUH or larger.
B. Each meter shall be marked to identify equipment being served. Meters shall be mounted in control panels serving their equipment or, for a pump, on an adjacent wall or structure. Meters may be located in central motor centers, when so provided, instead of adjacent to equipment.

C. Meter shall be non-resettable, totalizing reading 999.9 hours as a minimum for wiring in parallel with equipment served. Automatic Timing and Control Co., Model 5702, elapsed time indicator or approved equal.

END OF SECTION
PART 1 – GENERAL

1.1 WORK INCLUDED

A. Furnish a totally native Alerton BACnet-based system, including an operator’s workstation using Microsoft Windows 2000 Professional or XP Professional as the operating system and shall be based on a distributed control system in accordance with this specification. The operator’s workstation, all building controllers, application controllers, and all input/output devices shall communicate using the protocols and network standards as defined by ANSI/ASHRAE Standard 135–2001, BACnet. In other words, all workstations and controllers, including unitary controllers, shall be native BACnet devices. No gateways shall be used for communication to controllers installed under this section. Gateways may be used for communication to existing systems or to systems installed under other sections.

B. Provide all necessary BACnet-compliant hardware and software to meet the system’s functional specifications. Provide Protocol Implementation Conformance Statement (PICS) for Windows-based control software and every controller in system, including unitary controllers.

C. Prepare individual hardware layouts, interconnection drawings, and software configuration from project design data.

D. Implement the detailed design for all analog and binary objects, system databases, graphic displays, logs, and management reports based on control descriptions, logic drawings, configuration data, and bid documents.

E. Design, provide, and install all equipment cabinets, panels, data communication network cables needed, and all associated hardware.

F. Provide and install all interconnecting cables between supplied cabinets, application controllers, and input/output devices.

G. Provide and install all interconnecting cables between all operator’s terminals and peripheral devices (such as printers, etc.) supplied under this section.

H. Provide complete manufacturer’s specifications for all items that are supplied. Include vendor name of every item supplied.

I. Provide supervisory specialists and technicians at the job site to assist in all phases of system installation, startup, and commissioning.

J. Provide a comprehensive operator and technician training program as described herein.

K. Provide as-built documentation, operator’s terminal software, diagrams, and all other associated project operational documentation (such as technical manuals) on approved media, the sum total of which accurately represents the final system.

L. Provide new sensors, dampers, valves, and install only new electronic actuators. No used components shall be used as any part or piece of installed system.
1.2 SYSTEM DESCRIPTION

A. A distributed logic control system complete with all software and hardware functions shall be provided and installed. System shall be completely based on ANSI/ASHRAE Standard 135-2001, BACnet. This system is to control all mechanical equipment, including all unitary equipment such as VAV boxes, heat pumps, fan-coils, AC units, etc. and all air handlers, boilers, chillers, and any other listed equipment using native BACnet-compliant components. Non-BACnet-compliant or proprietary equipment or systems (including gateways) shall not be acceptable and are specifically prohibited.

B. Provide a MSTP BACnet interface for the integrated lighting control system by Lithonia and interface to other equipment as specified.

C. Operator's workstation software shall be Microsoft Windows 2000 Professional or XP Professional as the computer operating system. The Energy Management and Control System (EMCS) application program shall be written to communicate specifically utilizing BACnet protocols. Software shall include password protection, scheduling (including optimum start), alarming, logging of historical data, full graphics including animation, after-hours billing program, demand limiting, full suite of field engineering tools including graphical programming and applications. Systems using operating systems other than that described above are strictly prohibited.

D. Building controllers shall include complete energy management software, including scheduling building control strategies with optimum start and logging routines. All energy management software and firmware shall be resident in field hardware and shall not be dependent on the operator's terminal. Operator's terminal software is to be used for access to field-based energy management functions only. Application controllers shall be mounted next to controlled equipment and communicate with building controller via BACnet LAN.

E. Room sensors shall be provided with digital readout that allows the user to view room temperature, view outside air temperature, adjust the room setpoint within preset limits and set desired override time. User shall also be able to start and stop unit from the digital sensor. Include all necessary wiring and firmware such that room sensor includes field service mode.

1.3 APPROVED MANUFACTURERS

A. The bid shall be based on the BACtalk System from Alerton Technologies, Inc., installed by Climatec BTG (949) 474-0955 or an Apogee System by Siemens Building Technologies.

1.4 QUALITY ASSURANCE

A. Responsibility: The supplier of the EMCS shall be responsible for inspection and Quality Assurance (QA) for all materials and workmanship furnished.

B. Component Testing: Maximum reliability shall be achieved through extensive use of high-quality, pre-tested components. Each and every controller, sensor, and all other DDC components shall be individually tested by the manufacturer prior to shipment.
C. Tools, Testing and Calibration Equipment: The EMCS supplier shall provide all tools, testing, and calibration equipment necessary to ensure reliability and accuracy of the system.

D. The systems control contractor shall have been in business a minimum of five years and be the authorized installing contractor for the manufacturer of the BACnet components.

E. Control system shall be engineered, programmed and supported completely by representative’s local office that must be within 75 miles of project site.

1.5 REFERENCE STANDARDS

A. The latest edition of the following standards and codes in effect and amended as of supplier’s proposal date, and any applicable subsections thereof, shall govern design and selection of equipment and material supplied:
   1. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
   4. UL 916 Underwriters Laboratories Standard for Energy Management Equipment. Canada and the US.
   6. FCC Part 15, Subpart J, Class A
   7. EMC Directive 89/336/EEC (European CE Mark)

B. City, county, state, and federal regulations and codes in effect as of contract date.

C. Except as otherwise indicated the system supplier shall secure and pay for all permits, inspections, and certifications required for his work and arrange for necessary approvals by the governing authorities.

1.6 SUBMITTALS

A. Drawings
   1. The system supplier shall submit engineered drawings, control sequence, and bill of materials for approval.
   2. Drawings shall be submitted in the following standard sizes: 11” x 17” (ANSI B).
   3. Eight complete sets (copies) of submittal drawings shall be provided.
   4. Drawings shall be available on CD-ROM.

B. System Documentation
   Include the following in submittal package:
   1. System configuration diagrams in simplified block format.
   2. All input/output object listings and an alarm point summary listing.
   3. Electrical drawings that show all system internal and external connection points, terminal block layouts, and terminal identification.
   5. Manufacturer’s instructions and drawings for installation, maintenance, and operation of all purchased items.
   6. Overall system operation and maintenance instructions—including preventive maintenance and troubleshooting instructions.
   7. For all system elements—operator’s workstation(s), building controller(s), application controllers, routers, and repeaters,—provide BACnet Protocol Implementation Conformance Statements (PICS) as per ANSI/ASHRAE Standard 135-2001.
   8. Provide complete description and documentation of any proprietary (non-BACnet) services and/or objects used in the system.
9. A list of all functions available and a sample of function block programming that shall be part of delivered system.

C. Project Management
1. The vendor shall provide a detailed project design and installation schedule with time markings and details for hardware items and software development phases. Schedule shall show all the target dates for transmission of project information and documents and shall indicate timing and dates for system installation, debugging, and commissioning.

1.7 WARRANTY

A. Warranty shall cover all costs for parts, labor, associated travel, and expenses for a period of one year from completion of system acceptance.

B. Hardware and software personnel supporting this warranty agreement shall provide on-site or off-site service in a timely manner after failure notification to the vendor. The maximum acceptable response time to provide this service at the site shall be 24 hours Monday through Friday, 48 hours on Saturday and Sunday.

C. This warranty shall apply equally to both hardware and software.

1.8 RELATED WORK IN OTHER SECTIONS

The control system shall integrate with the lighting system, computer air conditioning units, UPS, generator equipment, battery room equipment and leak detection systems, fire alarm, and other systems as shown on the mechanical or electrical plans.

A. Refer to Division 0 and Division 1 for related contractual requirements.

B. Refer to Section 15000 for General Mechanical Provisions

C. Refer to Section 16000 for General Electrical Provisions

PART 2 – PRODUCTS

2.1 OPERATOR’S WORKSTATION

A. General structure of workstation interaction shall be a standard client/server relationship. Server shall be used to archive data and store system database. Clients shall access server for all archived data. Each client shall include flexibility to access graphics from server or local drive. Server shall support a minimum of 50 clients simultaneously.

B. BACnet Conformance
1. Operator’s workstation shall as a minimum support Point-to-Point (PTP) and Ethernet BACnet LAN types. It shall communicate directly via these BACnet LANs as a native BACnet device. Operator’s terminal shall comply with the requirements of a BACnet conformance class 3 device and support all BACnet services necessary to provide the following BACnet functional groups:
   a. Clock Functional Group
   b. Event Response Functional Group
   c. Time Master Functional Group
   d. Device Communications
2. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

3. Standard BACnet object types accessed by the workstation shall include as a minimum: Analog Value, Analog Input, Analog Output, Binary Value, Binary Input, Binary Output, Calendar, Device, Event Enrollment, File, Notification Class, Program and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

4. The Operator Workstation shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on wide area networks (WANs) and campus area networks (CANs). Workstation shall support Foreign Device Registration to allow temporary workstation connection to IP network.

C. Displays

1. Operator’s workstation shall display all data associated with project as called out on drawings and/or object type list supplied. Graphic files shall be created using digital, full color photographs of system installation, AutoCAD or Visio drawing files of field installation drawings and wiring diagrams from as-built drawings. Operator’s workstation shall display all data using three-dimensional graphic representations of all mechanical equipment. System shall be capable of displaying graphic file, text, and dynamic object data together on each display and shall include animation. Information shall be labeled with descriptors and shall be shown with the appropriate engineering units. All information on any display shall be dynamically updated without any action by the user. Workstation shall allow user to change all field-resident EMCS functions associated with the project, such as setpoints, weekly schedules, exception schedules, etc. from any screen no matter if that screen shows all text or a complete graphic display. This shall be done without any reference to object addresses or other numeric/mnemonic indications.

2. All displays and programming shall be generated and customized by the local EMCS supplier and installer. Systems requiring factory programming for graphics or DDC logic are specifically prohibited.

3. Binary objects shall be displayed as ACTIVE/INACTIVE/NULL or with customized text. Text shall be justified left, right or center as selected by the user. Also, allow binary objects to be displayed as individual change-of-state graphic objects on the display screen such that they overlay the system graphic. Each binary object displayed in this manner shall be assigned up to three graphic files for display when the point is ON, OFF or in alarm. For binary outputs, toggle the object’s commanded status when the graphic item is selected with the system mouse. Similarly, allow the workstation operator to toggle the binary object’s status by selecting with the mouse a graphic of a switch or light, for example, which then displays a different graphic (such as an “ON” switch or lighted lamp). Additionally, allow binary objects to be displayed as an animated graphic. Animated graphic objects shall be displayed as a sequence of multiple graphics to simulate motion. For example: when a pump is in the OFF condition, display a stationary graphic of the pump. When the operator selects the pump graphic with the mouse, the represented object’s status is toggled and the graphic of the pump’s impeller rotates in a time-based animation. The operator shall be able to click on an animated graphical object or switch it from the OFF position to ON, or ON to OFF. Allow operator to change graphic file assignment and also create new and original graphics online. System shall be supplied with a library of standard graphics, which may be used unaltered or modified by the operator. Systems that do not allow customization or creation of new graphic objects by the operator (or with third-party software) shall not be allowed.

4. Analog objects shall be displayed with operator modifiable units. Analog input objects may also be displayed as individual graphic items on the display screen as an overlay to the
system graphic. Each analog input object may be assigned a minimum of five graphic files, each with high/low limits for automatic selection and display of these graphics. As an example, a graphic representation of a thermometer would rise and fall in response to either the room temperature or its deviation from the controlling setpoint. Analog output objects, when selected with the mouse, shall be displayed as a prompted dialog (text only) box. Selection for display type shall be individual for each object. Analog object values may be changed by selecting either the “increase” or “decrease” arrow in the analog object spinner box without using the keypad. Pressing the button on the right side of the analog object spinner box allows direct entry of an analog value and accesses various menus where the analog value may be used, such as trendlogs.

5. Analog objects may also be assigned to an area of a system graphic, where the color of the defined area changes based on the analog object’s value. For example, an area of a floor-plan graphic served by a single control zone would change color with respect to the temperature of the zone or its deviation from setpoint. All editing and area assignment shall be created or modified online using simple icon tools.

6. A customized menu label (push-button) shall be used for display selection. Menu items on a display shall allow penetration to lower level displays or additional menus. Dynamic point information and menu label push buttons may be mixed on the same display to allow sub-displays to exist for each item. Each display may be protected from viewing unless operator has appropriate security level. A security level may be assigned to each display and system object. The menu label shall not appear on the graphic if the operator does not have the appropriate security level.

7. A mouse shall be used to move the pointer arrow to the desired item for selection of new display or to allow the operator to make changes to object data.

D. Password Protection

1. Provide security system that prevents unauthorized use unless operator is logged on. Access shall be limited to operator’s assigned functions when user is logged on. This includes displays as outlined above.

2. Each operator’s terminal shall provide security for 200 users minimum. Each user shall have an individual User ID, User Name and Password. Entries are alphanumeric characters only and are case sensitive (except for User ID). User ID shall be 0–8 characters, User Name shall be 0–29 characters, and Password shall be 4–8 characters long. Each system user shall be allowed individual assignment of only those control functions and menu items to which that user requires access. All passwords, user names, and access assignments shall be adjustable online at the operator’s terminal. Each user shall also have a set security level, which defines access to displays and individual objects the user may control. System shall include 10 separate and distinct security levels for assignment to users.

3. System shall include an Auto Logout Feature that shall automatically logout user when there has been no keyboard or mouse activity for a set period of time. Time period shall be adjustable by system administrator. Auto Logout may be enabled and disabled by system administrator. Operator terminal shall display message on screen that user is logged out after Auto Logout occurs.

E. Operator Activity Log

1. Operator Activity Log shall be included with system that tracks all operator changes and activities. System shall track what is changed in the system, who performed this change, date and time of system activity and value of the change before and after operator activity. Operator shall be able to display all activity, sort the changes by user and also by operation.

2. Log shall be gathered and archived to hard drive on operator workstation as needed. Operator shall be able to export data for display and sorting in a spreadsheet.

3. Any displayed data, that is changeable by the operator, may be selected using the right mouse button and the operator activity log shall then be selectable on the screen. Selection of the operator activity log using this method shall show all operator changes of just that displayed data.
F. Scheduling
1. Operator’s workstation shall show all information in easy-to-read daily format including calendar of this month and next. All schedules shall show actual ON/OFF times for day based on scheduling priority. Priority for scheduling shall be events, holidays and daily with events being the highest.
2. Holiday and special event schedules shall display data in calendar format. Operator shall be able to schedule holidays and special events directly from these calendars.
3. Operator shall be able to change all information for a given weekly or exception schedule if logged on with the appropriate security access.
4. System shall include a Schedule Wizard for set up of schedules. Wizard shall walk user through all steps necessary for schedule generation. Wizard shall have its own pull-down selection for startup or may be started by right clicking on value displayed on graphic and then selecting Schedule.
5. Scheduling shall include optimum start based on outside air temperature, current heating/cooling setpoints, indoor temperature and history of previous starts. Each and every individual zone shall have optimum start time independently calculated based on all parameters listed. User shall input schedules to set time that occupied setpoint is to be attained. Optimum start feature shall calculate the startup time needed to match zone temperature to setpoint. User shall be able to set a limit for the maximum startup time allowed.

G. Alarm Indication and Handling.
1. Operator’s workstation shall provide audible, visual, and printed means of alarm indication. The alarm dialog box shall always become the top dialog box regardless of the application(s), currently running. Printout of alarms shall be sent to the assigned terminal and port.
2. System shall provide log of alarm messages. Alarm log shall be archived to the hard disk of the system operator’s terminal. Each entry shall include a description of the event-initiating object generating the alarm. Description shall be an alarm message of at least 256 characters in length. Entry shall include time and date of alarm occurrence, time and date of object state return to normal, time and date of alarm acknowledgment and identification of operator acknowledging alarm.
3. Alarm messages shall be in user-definable text (English or other specified language) and shall be entered either at the operator’s terminal or via remote communication.
4. System shall include an Alarm Wizard for set up of alarms. Wizard shall walk user through all steps necessary for alarm generation. Wizard shall have its own pull-down selection for startup or may be started by right clicking on value displayed on graphic and then selecting alarm setup.

H. Trendlog Information
1. System server shall periodically gather historically recorded data stored in the building controllers and archive the information. Archived files shall be appended with new sample data, allowing samples to be accumulated. Systems that write over archived data shall not be allowed, unless limited file size is specified. Samples may be viewed at the operator’s workstation. Operator shall be able to scroll through all trended data. All trendlog information shall be displayed in standard engineering units.
2. Software shall be included that is capable of graphing the trend logged object data. Software shall be capable of creating two-axis (x, y) graphs that display up to ten object types at the same time in different colors. Graphs shall show object values relative to time.
3. Operator shall be able to change trend log setup information. This includes the information to be logged as well as the interval at which it is to be logged. All input, output, and value object types in the system may be logged. All operations shall be password protected. Setup and viewing may be accessed directly from any and all graphics on which object is displayed.
4. System shall include a trend Wizard for setup of logs. Wizard shall walk user through all necessary steps. Wizard shall have its own pull-down selection for startup, or may be started by right clicking on value displayed on graphic, and then selecting Trendlogs from the displayed menu.
I. Energy Log Information

1. System server shall be capable of periodically gathering energy log data stored in the field equipment and archive the information. Archive files shall be appended with new data, allowing data to be accumulated. Systems that write over archived data shall not be allowed unless limited file size is specified. Display all energy log information in standard engineering units.

2. All data shall be stored in data base file format for direct use by third-party programs. Operation of system shall stay completely online during all graphing operations.

3. Operator shall be able to change the energy log setup information as well. This includes the meters to be logged, meter pulse value, and the type of energy units to be logged. All meters monitored by the system may be logged. System shall support using flow and temperature sensors for BTU monitoring.

4. System shall display archived data in tabular format for both consumption and peak values. Data shall be shown in hourly, daily, weekly, monthly and yearly formats. In each format the user shall be able to select a specific period of data to view.

J. Demand Limiting

1. System shall include demand limiting program that includes two types of load shedding. One type of load shedding shall shed/restore equipment in binary fashion based on energy usage when compared to shed and restore settings. The other type of shedding shall adjust operator selected control setpoints in an analog fashion based on energy usage when compared to shed and restore settings. Shedding may be implemented independently on each and every zone or piece of equipment connected to system.

2. Binary shedding shall include minimum of 5 priority levels of equipment shedding. All loads in a given priority level shall be shed before any loads in a higher priority level are shed. Load shedding within a given priority level shall include two methods. In one the loads shall be shed/restored in a “first off-first on” mode and in the other the loads are just shed/restored in a linear fashion.

3. Analog shed program shall generate a ramp that is independently used by each individual zone or individual control algorithm to raise the appropriate cooling setting and lower appropriate heating setting to reduce energy usage.

4. Status of each and every load shed program shall be capable of being displayed on every operator terminal connected to system. Status of each load assigned to an individual shed program shall be displayed along with English description of each load.

K. Tenant Activity

1. System shall include program that monitors after-hours overrides by tenants, logs that data and generates a bill based on usage and rate charged for each tenant space. Tenant Activity program shall be able to assign multiple zones, from a list of every zone connected to system, to a particular tenant. Every zone is monitored for after-hour override usage and that data logged in server. Operator may then generate a bill based on the usage for each tenant and the rate charged for any overtime use.

2. Configuration shall include entry of the following information for use in logging and billing.
   a. Tenants contact name and address
   b. One or multiple tenant zones that make up a total tenant space including a separate billing rate for each separate zone.
   c. Minimum and maximum values an event duration and event limit
   d. Property management information
   e. Overall billing rate
   f. Seasonal adjustments or surcharge to billing rate
   g. Billing notification type such including, but not limited to printer, file and email
   h. Billing form template

3. Logging shall include recording the following information for each and every tenant event.
   a. Zone description
   b. Time the event begins
   c. Total override time
d. Limits shall be applied to override time.

4. A tenant bill shall be generated for a specific period using all the entered configuration data and the logged data. User with appropriate security level shall be able to view and override billing information. User shall be able to select a billing period to look to view and be able to delete events from billing and be able to edit a selected tenant activity event's override time.

L. Configuration/Setup
1. Provide means for operator to display and change system configuration. This shall include, but not be limited to, system time, day of the week, date of daylight savings set forward/set back, printer termination, port addresses, modem port and speed, etc. Items shall be modified using understandable terminology with simple mouse/cursor key movements.

M. Field Engineering Tools
1. Operator's workstation software shall include field-engineering tools for programming all controllers supplied. All controllers shall be programmed using graphical tools that allow the user to connect function blocks on screen that provide sequencing of all control logic. Function blocks shall be represented by graphical displays that are easily identified and distinct from other types of blocks. Graphical programming that uses simple rectangles and squares is not acceptable.
2. User shall be able to pick graphical function block from menu and place on screen. Provide zoom in and zoom out capabilities. Function blocks shall be downloaded to controller without any reentry of data.
3. Programming tools shall include a real time operation mode. Function blocks shall display real time data and be animated to show status of data inputs and outputs when in real time operation. Animation shall show change of status on logic devices and countdown of timer devices in graphical format.
4. Field engineering tools shall also include a database manager of applications that include logic files for controllers and associated graphics. Operator shall be able to select unit type, input/output configuration and other items that define unit to be controlled. Supply minimum of 250 applications as part of workstation software.
5. Field engineering tool shall include Device Manager for automatic detection of devices connected anywhere on the BACnet network by scanning of the entire network. This function shall display device instance, network identification, model number and description of connected devices. It shall record and display software file loaded into each controller. A copy of each file shall be stored on the computers hard drive. If needed, this file shall be downloaded to the appropriate controller by selection using the mouse.
6. System shall include backup/restore function that will back up entire system to selected medium and then restore system from that media.

N. Workstation Hardware
1. Provide operator's workstation(s) at location(s) noted on the plans.
2. Workstation/Server Computer Minimum Requirements
   a. Pentium IV, 2.5 Ghz or better
   b. 256 MB RAM or better
   c. 40GB hard disk or better
   d. High-performance graphics adapter
   e. Ethernet 10/100 network interface card
   f. Keyboard, monitor, mouse, 3.5-inch disk drive, and CD-ROM
   g. Windows 2000 Professional
   h. Modem, 56Kb Minimum
   i. Color Printer (Inkjet, Color Dye or Laser)
3. Laptop Computer Minimum Requirements
   a. Pentium IV, 1.5 Ghz or better
   b. 256 MB RAM or better
   c. 20GB hard disk or better
   d. Ethernet 10/100 network interface card
e. Windows 2000 Professional
f. Modem, 56Kb Minimum

O. Software
1. At the conclusion of project, contractor shall leave with owner a CD ROM that includes the complete software operation system and project graphics, setpoints, system parameters, etc. This backup shall allow the owner to completely restore the system in the case of a computer malfunction.

2.2 BUILDING CONTROLLER

A. General
1. All communication with operator workstation and all application controllers shall be via BACnet. Building controller shall incorporate as a minimum, the functions of a 3-way BACnet router. Controller shall route BACnet messages between the high-speed LAN (Ethernet 10/100MHz), master slave token passing (MS/TP) LANs, a point-to-point (PTP – RS-232) connection and modem.
   a. Each MS/TP LAN must be software configurable from 9.6 to 76.8Kbps.
   b. The RJ-45 Ethernet connection must accept either 10Base-T or 100Base-TX BACnet over twisted pair cable (UTP).
   c. The direct access port must be a female DB-9 connector supporting BACnet temporary PTP connection of a portable BACnet operator terminal at 9.6 to 115.2 Kbps over RS-232 null modem cable.
2. Building controller shall be capable of providing global control strategies for the system based on information from any objects in the system regardless if the object is directly monitored by the controller or by another controller. The program that implements these strategies shall be completely flexible and user definable. Any systems utilizing factory pre-programmed global strategies that cannot be modified by field personnel on-site or downloaded via remote communications are not acceptable. Changing global strategies via firmware changes is also unacceptable.
3. Programming shall be object-oriented using control function blocks, supporting DDC functions, 1000 Analog Values and 1000 Binary Values. All flowcharts shall be generated and automatically downloaded to controller. Programming tool shall be resident on workstation and the same tool used for all controllers.
4. Provide means to graphically view inputs and outputs to each program block in real-time as program is executing. This function may be performed via the operator’s workstation or field computer.
5. Building controller shall provide battery-backed real-time (hardware) clock functions.
6. Controller shall have a memory needed to ensure high performance and data reliability. Battery shall retain static RAM memory and real-time clock functions for a minimum of 1.5 years (cumulative).
7. Global control algorithms and automated control functions should execute via 32-bit processor.
8. Controller installation shall include memory-free gel-cell battery providing ongoing power conditioning and noise filtering for operation data integrity. It shall provide up to 5 minutes of powerless operation for orderly shutdown and data backup.

B. BACnet Conformance
1. Building Controller shall as a minimum support Point-to-Point (PTP), MS/TP and Ethernet BACnet LAN types. It shall communicate directly via these BACnet LANs as a native BACnet device and shall support simultaneous routing functions between all supported LAN types. Global controller shall be a BACnet conformance class 3 device and support all BACnet services necessary to provide the following BACnet functional groups:
   a. Clock Functional Group
   b. Files Functional Group
c. Reinitialize Functional Group
d. Device Communications Functional Group
e. Event Initiation Functional Group

2. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

3. Standard BACnet object types supported shall include as a minimum: Analog Value, Binary Value, Calendar, Device, File, Group, Notification Class, Program and Schedule object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

4. The Building Controller shall comply with Annex J of the BACnet specification for IP connections. This device shall use Ethernet to connect to the IP internetwork, while using the same Ethernet LAN for non-IP communications to other BACnet devices on the LAN. Must support interoperability on wide area networks (WANs) and campus area networks (CANs) and function as a BACnet Broadcast Management Device (BBMD).

C. Remote Communications

1. Provide all functions that will allow remote communications via modem to off-site locations. Include one modem along with all cabling necessary for installation for the system. It shall be possible to use the onboard modem or a separate modem connected via the PTP / RS-232 connection.

2. Provide Windows 2000 software for off-site computer that allows operator to view and change all information associated with system on color graphic displays. Operator shall be able to change all parameters in this section from off-site location including all programming of building controllers and all programmable application controllers including all terminal unit controllers.

3. Building controller shall have capability to call out alarm conditions automatically. If desired, controller may also send encoded message to digital pager. If an alphanumeric pager is in use by the operator, building controller shall be capable of sending a text or numeric string of alarm description. All building controllers connected to the local LAN shall be capable of calling out alarm messages through one or more shared modems connected to one or more of the building controllers on the local LAN.

4. Building controller shall have capability to call a minimum of 20 different phone numbers. Numbers called may be controlled by type of alarm or time schedule.

5. Owner shall provide standard voice-grade phone line for remote communication function.

6. Building controller and internal modem shall be capable of modem-to-modem baud rates of 33.6 Kbps minimum over standard voice-grade phone lines. Lower baud rates shall be selectable for areas where local phone company conditions require them.

D. Schedules

1. Each building controller shall support a minimum of 250 BACnet Schedule Objects and 250 BACnet Calendar Objects.

E. Logging Capabilities

1. Each building controller shall log as minimum 1000 trendlogs. Any object in the system (real or calculated) may be logged. Sample time interval shall be adjustable at the operator’s workstation.

2. Logs may be viewed both on-site or off-site via remote communication.

3. Building controller shall periodically upload trended data to networked operator’s workstation for long term archiving if desired.

4. Archived data stored in database format shall be available for use in third-party spreadsheet or database programs.
F. Alarm Generation
   1. Alarms may be generated within the system for any object change of value or state either real or calculated. This includes things such as analog object value changes, binary object state changes, and various controller communication failures.
   2. Each alarm may be dialed out as noted in paragraph 2 above.
   3. Alarm log shall be provided for alarm viewing. Log may be viewed on-site at the operator’s terminal or off-site via remote communications.
   4. Controller must be able to handle up to 1500 alarm setups stored as BACnet event enrollment objects – system destination and actions individually configurable.

2.3 AIR HANDLER & CENTRAL PLANT APPLICATION CONTROLLERS

A. Provide one or more native BACnet application controllers for each air handler and provide native BACnet application controllers as needed for central plant control that adequately cover all objects listed in object list. All controllers shall interface to building controller via MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include input, output and self-contained logic program as needed for complete control of units. Controllers shall be fully programmable using graphical programming blocks. Programming tool shall be resident on operator workstation and be the same tool as used for the building controller. No auxiliary or non-BACnet controllers shall be used.

B. BACnet Conformance
   1. Application controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as native BACnet devices. Application controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:
      a. Files Functional Group
      b. Reinitialize Functional Group
      c. Device Communications Functional Group
   2. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.
   3. Standard BACnet object types supported shall include as a minimum—Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File, and Program object types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

C. Application controllers shall include universal inputs with 10-bit resolution that accept 3K and 10K thermistors, 0–10VDC, 0–5 VDC, 4–20 mA and dry contact signals. Any input on a controller may be either analog or digital with a minimum of 3 inputs that accept pulses. Controller shall also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller shall include binary and analog outputs on board. Analog outputs shall be switch selectable as either 0–10VDC or 0–20mA. Software shall include scaling features for analog outputs. Application controller shall include 24VDC voltage supply for use as power supply to external sensors.

D. All program sequences shall be stored on board application controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and capable of multiple PID loops for control of multiple devices. All calculations shall be completed using floating-point math and system shall support display of all information in floating-point nomenclature at operator’s terminal. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely via
modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using programming tools as described in operator’s terminal section.

E. Application controller shall include support for intelligent room sensor (see section 2.9.B.) Display on intelligent room sensor shall be programmable at application controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence of operation for specific display requirements at intelligent room.

2.4 VAV BOX CONTROLLERS—SINGLE DUCT

A. Provide one native BACnet application controller for each VAV box that adequately covers all objects listed in object list for unit. All controllers shall interface to building controller via MS/TP LAN using BACnet protocol. No gateways shall be used. Controllers shall include on board CFM flow sensor, inputs, outputs and programmable, self-contained logic program as needed for control of units.

B. BACnet Conformance

1. Application controllers shall as a minimum support MS/TP BACnet LAN types. They shall communicate directly via this BACnet LAN at 9.6, 19.2, 38.4 and 76.8 Kbps, as a native BACnet device. Application controllers shall be of BACnet conformance class 3 and support all BACnet services necessary to provide the following BACnet functional groups:
   a. Files Functional Group
   b. Reinitialize Functional Group
   c. Device Communications Functional Group

2. Please refer to section 22.2, BACnet Functional Groups, in the BACnet standard, for a complete list of the services that must be directly supported to provide each of the functional groups listed above. All proprietary services, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

3. Standard BACnet object types supported shall include as a minimum—Analog Input, Analog Output, Analog Value, Binary Input, Binary Output, Binary Value, Device, File and Program Object Types. All proprietary object types, if used in the system, shall be thoroughly documented and provided as part of the submittal data. All necessary tools shall be supplied for working with proprietary information.

C. Application controllers shall include universal inputs with 10-bit resolution that can accept 3K and 10K thermistors, 0–5 VDC, and dry contact signals. Inputs on controller may be either analog or digital. Controller shall also include support and modifiable programming for interface to intelligent room sensor with digital display. Controller shall also include binary outputs on board. For applications using variable speed parallel fans, provide a single analog output selectable for 0-10 V or 0-20 mA control signals. Application controller shall include microprocessor driven flow sensor for use in pressure independent control logic. All boxes shall be controlled using pressure independent control algorithms and all flow readings shall be in CFM (LPS if metric).

D. All program sequences shall be stored on board application controller in EEPROM. No batteries shall be needed to retain logic program. All program sequences shall be executed by controller 10 times per second and shall be capable of multiple PID loops for control of multiple devices. Programming of application controller shall be completely modifiable in the field over installed BACnet LANs or remotely via modem interface. Operator shall program logic sequences by graphically moving function blocks on screen and tying blocks together on screen. Application controller shall be programmed using the same programming tool as Building Controller and as described in operator workstation section. All programming tools shall be provided as part of system.
E. Application controller shall include support for intelligent room sensor (see Section 2.9.B.) Display on room sensor shall be programmable at application controller and include an operating mode and a field service mode. All button functions and display data shall be programmable to show specific controller data in each mode based on which button is pressed on the sensor. See sequence for specific display requirements for intelligent room sensor.

F. On board flow sensor shall be microprocessor driven and precalibrated at the factory. Precalibration shall be at 16 flow points as a minimum. All factory calibration data shall be stored in EEPROM. Calibration data shall be field adjustable to compensate for variations in VAV box type and installation. All calibration parameters shall be adjustable through intelligent room sensor. Operator workstation, portable computers and special hand-held field tools shall not be needed for field calibration.

G. Provide duct temperature sensor at discharge of each VAV box that is connected to controller for reporting back to operator workstation.

2.5 SENSORS and MISCELLANEOUS DEVICES

A. Temperature Sensors
   1. All temperature sensors to be solid state electronic, factory-calibrated to within 0.5°F, totally interchangeable with housing appropriate for application. Wall sensors to be installed as indicated on drawings. Mount 48 inches about finished floor. Duct sensors to be installed such that the sensing element is in the main air stream. Immersion sensors to be installed in wells provided by control contractor, but installed by mechanical contractor. Immersion wells shall be filled with thermal compound before installation of immersion sensors. Outside air sensors shall be installed away from exhaust or relief vents, not in an outside air intake and in a location that is in the shade most of the day.

B. Intelligent Room Sensor with LCD Readout
   1. Sensor shall contain a backlit LCD digital display and user function keys along with temperature sensor. Controller shall function as room control unit, and shall allow occupant to raise and lower setpoint, and activate terminal unit for override use—all within limits as programmed by building operator. Sensor shall also allow service technician access to hidden functions as described in sequence of operation.
   2. The Intelligent Room Sensor shall simultaneously display room setpoint, room temperature, outside temperature, and fan status (if applicable) at each controller. This unit shall be programmable, allowing site developers the flexibility to configure the display to match their application. The site developer should be able to program the unit to display time-of-day, room humidity and outdoor humidity. Unit must have the capability to show temperatures in Fahrenheit or Centigrade.
   3. Override time may be set and viewed in half-hour increments. Override time count down shall be automatic, but may be reset to zero by occupant from the sensor. Time remaining shall be displayed. Display shall show the word “OFF” in unoccupied mode unless a function button is pressed.
   4. See sequence of operation for specific operation of LCD displays and function keys in field service mode and in normal occupant mode. Provide intelligent room sensors as specified in point list.
   5. Field service mode shall be customizable to fit different applications. If intelligent room sensor is connected to VAV controller, VAV box shall be balanced and all air flow parameters shall be viewed and set from the intelligent room sensor with no computer or other field service tool needed.

C. Wall Sensor
   1. Standard wall sensor shall use solid-state sensor identical to intelligent room sensor and shall be packaged in aesthetically pleasing enclosure. Sensor shall provide override function,
warmer/cooler lever for set point adjustment and port for plug-in of Field Service Tool for field adjustments. Override time shall be stored in controller and be adjustable on a zone-by-zone basis. Adjustment range for warmer/cooler lever shall also be stored in EEPROM on controller. All programmable variables shall be available to Field Service Tool through wall sensor port.

D. LCD Operator Terminal
1. The LCD operator terminal is a small wall- or panel-mounted operator terminal that connects directly to the BACnet LAN. The communication design and messaging structure shall comply with ANSI/ASHRAE Standard 135-2001, BACnet. Each operator terminal shall be able to display any BACnet object from anywhere in the BACnet network.
2. Each of these operator’s terminals shall have a keypad and an adjustable backlit LCD, with a simple menu structure to give occupants and technicians intuitive access to system information. It shall have a minimum 4-line by 20-character display to allow an operator to query and adjust system values.
3. The system shall allow the connection of up to 16 LCD operator terminals to each Building Controller. The operator shall have the ability to connect to each of these operator terminals with a laptop computer via an RS-232 cable to gain system access, troubleshooting, and display programming.
4. Provide LCD operator terminals in the locations shown on the drawings.

E. Field Service Tool
1. Field service tool shall allow technician to view and modify all setpoints and tuning parameters stored in application controller. In addition, technician shall be able to view status of all inputs and outputs on digital readout. Each piece of data shall have a data code associated with it that is customizable.
2. Field service tool shall plug into wall sensor and provide all the functionality specified. Operator workstation shall include the capability to disable operation of the field service tool.
3. Provide XX Field Service Tools for this project.

F. Network Connection Tool
1. Network connection tool shall allow technician to connect a laptop to any MS/TP network or at any MS/TP device and view and modify all information throughout the entire BACnet network. Laptop connection to tool shall be via Ethernet or PTP.
2. Provide quick connect to MS/TP LAN at each controller. Tool shall be able to adjust to all MS/TP baud rates specified in the BACnet standard.
3. Proved XX Network Connection Tools for this project.

2.6 ELECTRONIC ACTUATORS AND VALVES

A. Quality Assurance for Actuators and Valves
1. UL Listed Standard 873 and C.S.A. Class 4813 02 certified.
2. NEMA 2 rated enclosures for inside mounting, provide with weather shield for outside mounting.
3. Five-year manufacturers warranty. Two-year unconditional and three-year product defect from date of installation.

B. Execution Details for Actuators and Valves
1. Furnish a Freeze-stat and install “Hard Wire” interlock to disconnect the mechanical spring return actuator power circuit for fail-safe operation. Use of the control signal to drive the actuators closed is not acceptable.
2. Each DDC analog output point shall have an actuator feedback signal, independent of control signal, wired and terminated in the control panel for true position information and troubleshooting. Or the actuator feedback signal may be wired to the DDC as an analog input for true actuator position status.
3. VAV box damper actuation shall be Floating type or Analog (2-10vdc, 4-20ma).
4. Booster-heat valve actuation shall be Floating type or Analog (2-10vdc, 4-20ma).
5. Primary valve control shall be Analog (2-10vdc, 4-20ma).

C. Actuators for Damper and Control Valves ½" to 6" shall be Electric unless otherwise specified, provide actuators as follows:
1. UL Listed Standard 873 and Canadian Standards association Class 481302 shall certify Actuators.
2. NEMA 2 rated actuator enclosures are. Use additional weather shield to protect actuator when mounted outside.
3. 5 year Manufacturers Warranty. Two-year unconditional + Three year product defect from date of installation.
4. Mechanical spring shall be provided when specified. Capacitors or other non-mechanical forms of fail-safe are not acceptable.
5. Position indicator device shall be installed and made visible to the exposed side of the Actuator. For damper short shaft mounting, a separate indicator shall be provided to the exposed side of the Actuator.
6. Overload Protection: Actuators shall provide protection against actuator burnout by using an internal current limiting circuit or digital motor rotation sensing circuit. Circuit shall insure that actuators cannot burn out due to stalled damper or mechanical and electrical paralleling. End switches to deactivate the actuator at the end of rotation are acceptable only for Butterfly Valve actuators.
7. A push button gearbox release shall be provided for all non-spring actuators.
8. Modulating actuators shall be 24Vac and consume 10VA power or less.
9. Conduit connectors are required when specified and when code requires it.

D. Damper Actuators:
1. Outside Air and Exhaust Air Damper Actuators shall be Mechanical Spring Return. Capacitors or other non-mechanical forms of fail-safe are not acceptable. The actuator mounting arrangement and spring return feature shall permit normally open or normally closed positions of the damper as required.
2. Economizer Actuators shall utilize Analog control 2-10 VDC, Floating control is not acceptable.
3. Electric damper actuators (including VAV box actuators) shall be direct shaft mounted and use a V-bolt and toothed V-clamp causing a cold weld effect for positive gripping. Single bolt or setscrew type fasteners are not acceptable.
4. One electronic actuator shall be direct shaft mounted per damper section. No connecting rods or jackshafts shall be needed. Small outside air and return air economizer dampers may be mechanically linked together if one actuator has sufficient torque to drive both and damper drive shafts are both horizontal installed.
5. Multi-section dampers with electric actuators shall be arranged so that each damper section operates individually. One electronic actuator shall be direct shaft mounted per damper section. (See below execution section for more installation details.)

E. Valve Actuators ½" to 6"
1. Mechanical spring shall be provided on all actuators for pre-heat coil and actuators for AHU heating or cooling coil when units are mounted outside. See plans for fail save flow function: Normal Open or Normal Closed. Capacitors or other non-mechanical forms of fail-safe are not acceptable.
2. All zone service actuators shall be non-spring return unless otherwise specified.
3. The valve actuator shall be capable of providing the minimum torque required for proper valve close off for the required application.
4. All control valves actuators shall have an attached 3-foot cable for easy installation to a junction box.
5. Override handle and gearbox release shall be provided for all non-spring return valve actuators.
F. Control Dampers. The sheet metal contractor shall furnish and size all automatic control dampers unless provided with packaged equipment. The sheet metal contractor shall install all dampers unless provided with packaged equipment.

1. All dampers used for modulating service shall be opposed blade type arranged for normally open or normally closed operation as required. The damper is to be sized so that when wide open the pressure drop is a sufficient amount of its close-off pressure drop for effective throttling.

2. All dampers used for two-position or open-close control shall be parallel blade type arranged for normally open or closed operation as required.

3. Damper linkage hardware shall be constructed of aluminum or corrosion resistant zinc & nickel-plated steel and furnished as follows:

4. Bearing support bracket and drive blade pin extension shall be provided for each damper section. Sheet metal contractor shall install bearing support bracket and drive blade pin extension. Sheet metal contractor shall provide permanent indication of blade position by scratching or marking the visible end of the drive blade pin extension.

5. Drive pin may be round only if V-bolt and toothed V-clamp is used to cause a cold weld effect for positive gripping. For Single bolt or set-screw type actuator fasteners, round damper pin shafts must be milled with at least one side flat to avoid slippage.

6. Damper manufacturer shall supply alignment plates for all multi-section dampers.

G. Control Valves ½” to 6”: The BAS contractor shall furnish all specified motorized control valves and actuators. BAS contractor shall furnish all control wiring to actuators. The Plumbing contractor shall install all valves. Equal Percentage control characteristic shall be provided for all water coil control valves. Linear valve characteristic is acceptable for 3-way valves 2½ inches and above.

1. Characterized Control Valves shall be used for hydronic heating or cooling applications and small to medium AHU water coil applications to 100GPM. Actuators are non-spring return for terminal unit coil control unless otherwise noted. If the coil is exposed to the Outside Air stream then see plans for Spring Return requirement.

a. Leakage is Zero percent, Close-off is 200psi, Maximum differential is 30psi. Rangeability is 500:1.

b. Valves 1/2 inch through 2 inches shall be nickel-plated forged brass body, NPT screw type connections.

c. Valves 1/2 inch through 1-1/4 inches shall be rated for ANSI Class 600 working pressure.
   Valves 1-1/2 inch and 2 inches shall be rated for ANSI Class 400 working pressure.

d. The operating temperature range shall be 0° to 250° F.

e. Stainless steel ball & stem shall be furnished on all modulating valves.

f. Seats shall be fiberglass reinforced Teflon.

g. Two-way and three-way valves shall have an equal percentage control port. Full stem rotation is required for maximum flow to insure stable BTU control of the coil.

h. Three-way valve shall be applicable for both mixing and diverting.

i. The characterizing disc is made of TEFZEL and shall be keyed and held secure by a retaining ring.

j. The valves shall have a blow out proof stem design.

k. The stem packing shall consist of 2 lubricated O-rings designed for on-off or modulating service and require no maintenance.

l. The valves shall have an ISO type, 4-bolt flange, for mounting actuator in any orientation parallel or perpendicular to the pipe.

m. A non-metallic thermal isolation adapter shall separate valve flange from actuator.

n. One fastening screw shall secure the direct coupling of the thermal isolation adapter between the actuator and the valve. This will prevent all lateral or rotational forces from affecting the stem and its packing O-rings.

2. Actuator Mounting for Damper and Valve arrangements shall comply to the following:

a. Damper Actuators: Shall not be installed in the air stream

b. A weather shield shall be used if actuators are located outside. For Damper Actuators use clear plastic enclosure.
c. Damper or valve actuator ambient temperature shall not exceed 122 degrees F through any combination of medium temperature or surrounding air. Appropriate air gaps, thermal isolation washers or spacers, standoff legs, or insulation shall be provided as necessary.

d. Actuator cords or conduit shall incorporate a drip leg if condensation is possible. Water shall not be allowed to contact actuator or internal parts. Location of conduits in temperatures dropping below dew point shall be avoided to prevent water from condensing in conduit and running into actuator.

e. Damper mounting arrangements shall comply to the following:
   1) The ventilation subcontractor shall furnish and install damper channel supports and sheet metal collars.
   2) No jack shafting of damper sections shall be allowed.
   3) Multi-section dampers shall be arranged so that each damper section operates individually. One electronic actuator shall be direct shaft mounted per section.

f. Size damper sections based on actuator manufacturers specific recommendations for face velocity, differential pressure and damper type. In general:
   1) Damper section shall not exceed 24 ft-sq. with face velocity £ 1500 FPM.
   2) Damper section shall not exceed 18 ft-sq. with face velocity £ 2500 FPM.
   3) Damper section shall not exceed 13 ft-sq. with face velocity £ 3000 FPM.

g. Multiple section dampers of two or more shall be arranged to allow actuators to be direct shaft mounted on the outside of the duct.

h. Multiple section dampers of three or more sections wide shall be arranged with a 3-sided vertical channel (8” wide by 6” deep) within the duct or fan housing and between adjacent damper sections. Vertical channel shall be anchored at the top and bottom to the fan housing or building structure for support. The sides of each damper frame shall be connected to the channels. Holes in the channel shall allow damper drive blade shafts to pass through channel for direct shaft mounting of actuators. Open side of channel shall be faced down stream of the airflow, except for exhaust air dampers.

i. Multiple section dampers to be mounted flush within a wall or housing opening shall receive either vertical channel supports as described above or sheet metal standout collars. Sheet metal collars (12” minimum) shall bring each damper section out of the wall to allow direct shaft mounting of the actuator on the side of the collar.

3. Valve Sizing for Water Coil

   a. On/Off Control Valves shall be line size.

   b. Modulating Control Valve Body Size may be reduced at most two pipe sizes from the line size or not less than ½ the pipe size. The BAS contractor shall size all water coil control valves for the application as follows:
      1) Booster-heat valves shall be sized not to exceed 4-9psi differential pressure. Size valve for 50% Valve Authority. Valve design pressure drop is equal to the sum of coil drop plus the balance valve drop.
      2) Primary valves shall be sized not to exceed 5-15psi differential pressure. Size valve for 50% Valve Authority. Valve design pressure drop is equal to the sum of coil drop plus the balance valve drop.
      3) Butterfly valves shall be sized for modulating service at 60-70 degree rotation. Design velocity shall be 12 feet per second or less when used with standard EPDM seats.

   c. Valve Mounting arrangements shall comply to the following:
      1) Unions shall be provided on all ports of two-way and three-way valves.
      2) Install three-way equal percentage Characterized Control valves in a mixing configuration with the “A” port piped to the coil.
      3) Install 2½ inch and above, Three-Way globe valves, as manufactured for mixing or diverting service to the coil.
      4) Two-Way valve shall be piped in the return side of the coil in order to minimize ambient heat at the
2.7 ENCLOSURES

A. All controllers, power supplies and relays shall be mounted in enclosures.

B. Enclosures may be NEMA 1 when located in a clean, dry, indoor environment. Indoor enclosures shall be NEMA 12 when installed in other than a clean environment.

C. Enclosures shall have hinged, locking doors.

D. Provide laminated plastic nameplates for all enclosures in any mechanical room or electrical room. Include location and unit served on nameplate. Laminated plastic shall be 1/8" thick sized appropriately to make label easy to read.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Prior to starting work, carefully inspect installed work of other trades and verify that such work is complete to the point where work of this Section may properly commence.

B. Notify the owners’ representative in writing of conditions detrimental to the proper and timely completion of the work.

C. Do not begin work until all unsatisfactory conditions are resolved.

3.2 INSTALLATION (GENERAL)

A. Install in accordance with manufacturer's instructions.

B. Provide all miscellaneous devices, hardware, software, interconnections installation and programming required to ensure a complete operating system in accordance with the sequences of operation and point schedules.

3.3 LOCATION AND INSTALLATION OF COMPONENTS

A. Locate and install components for easy accessibility; in general, mount 48 inches above floor with minimum 3'-0" clear access space in front of units. Obtain approval on locations from owner’s representative prior to installation.

B. All instruments, switches, transmitters, etc., shall be suitably wired and mounted to protect them from vibration, moisture and high or low temperatures.

C. Identify all equipment and panels. Provide permanently mounted tags for all panels.

D. Provide stainless steel or brass thermowells suitable for respective application and for installation under other sections—sized to suit pipe diameter without restricting flow.

3.4 INTERLOCKING AND CONTROL WIRING

A. Provide all interlock and control wiring. All wiring shall be installed neatly and professionally, in accordance with Specification Division 16 and all national, state and local electrical codes.
B. Provide wiring as required by functions as specified and as recommended by equipment manufacturers, to serve specified control functions. Provide shielded low capacitance wire for all communications trunks.

C. Control wiring shall not be installed in power circuit raceways. Magnetic starters and disconnect switches shall not be used as junction boxes. Provide auxiliary junction boxes as required. Coordinate location and arrangement of all control equipment with the owner's representative prior to rough-in.

D. Provide auxiliary pilot duty relays on motor starters as required for control function.

E. Provide power for all control components from nearest electrical control panel or as indicated on the electrical drawings—coordinate with electrical contractor.

F. All control wiring in the mechanical, electrical, telephone and boiler rooms to be installed in raceways. All other wiring to be installed neatly and inconspicuously per local code requirements. If local code allows, control wiring above accessible ceiling spaces may be run with plenum rated cable (without conduit).

3.5 DDC OBJECT TYPE SUMMARY

A. Provide all database generation.

B. Displays
   1. System displays shall show all analog and binary object types within the system. They shall be logically laid out for easy use by the owner. Provide outside air temperature indication on all system displays associated with economizer cycles.

C. Run Time Totalization
   1. At a minimum, run time totalization shall be incorporated for each monitored supply fan, return fan, exhaust fan, hot water and chilled water pumps. Warning limits for each point shall be entered for alarm and or maintenance purposes.

D. Trendlog
   1. All binary and analog object types (including zones) shall have the capability to be automatically trended.

E. Alarm
   1. All analog inputs (High/Low Limits) and selected binary input alarm points shall be prioritized and routed (locally or remotely) with alarm message per owner's requirements.

F. Database Save
   1. Provide back-up database for all stand-alone application controllers on disk.

3.6 FIELD SERVICES

A. Prepare and start logic control system under provisions of this section.

B. Start-up and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

C. Provide the capability for off-site monitoring at control contractor's local or main office. At a minimum, off-site facility shall be capable of system diagnostics and software download. Owner shall provide phone line for this service for 1 year or as specified.
D. Provide Owner's Representative with spare parts list. Identify equipment critical to maintaining the integrity of the operating system.

3.7 TRAINING

A. Provide application engineer to instruct owner in operation of systems and equipment.

B. Provide system operator's training to include (but not limited to) such items as the following: modification of data displays, alarm and status descriptors, requesting data, execution of commands and request of logs. Provide this training to a minimum of 3 persons.

C. Provide on-site training above as required, up to 16 hours as part of this contract.

D. Provide tuition for at least one individual for a one-week factory training class. If applicable, costs for travel, lodging and meals will be the responsibility of the Owner.

3.8 DEMONSTRATION

A. Provide systems demonstration under provisions of Section 15010.

B. Demonstrate complete operating system to owner's representative.

C. Provide certificate stating that control system has been tested and adjusted for proper operation.

PART 4 – WEBTALK BROWSER

4.1 WEBTALK BROWSER

A. General Description

BAS supplier shall provide web-based access to the system as part of standard installation. User shall be able to access all displays of real-time data that are part of the BAS via a standard Web browser. Web browser shall tie into the network via owner-supplied Ethernet network connection. Web-page host shall be a separate device that resides on the BAS BACnet network, but is not the BAS server for the control system. BAS server must be a separate computer from the Web-page host device to ensure data and system integrity. The web-page software shall not require a per user licensing fee or annual fees. The web-page host must support a minimum of 15 simultaneous users with no additional cost to the owner. There should be no additional cost in the future to expand the system to accommodate as many as 150 users.

B. Browser Technology

Browser shall be standard version of Microsoft IE 5.5 or later and Netscape Navigator 4.76 or later. No special vendor-supplied software shall be needed on computers running browser. All displays shall be viewable and the Web-page host shall directly access real-time data from the BAS BACnet network. Data shall be displayed in real time and update automatically without user interaction. User shall be able to change data on displays if logged in with the appropriate user name and password.

C. Communications

Web-page host shall include two Ethernet network connections. One network connection shall be dedicated to BAS BACnet network and shall be used to gather real-time data from all the BACnet
devices that form the BAS. This network shall communicate via BACnet, allowing the Web-page host to gather data directly from units on the local LAN or from other projects connected over a WAN. This network shall also provide the connection to the BAS server for Web page generation.

The second Ethernet connection shall provide the physical connection to the Internet or an IP-based WAN. It shall be the port that is used for the browser to receive Web pages and data from the Web-page host. The Web-page host shall act as a physical barrier between the BAS network and the WAN or Internet connection that allows the browser to receive web pages and data. The two separate network connections provide for a physical barrier to prevent raw BACnet traffic being exposed on the IP network.

The Web-page host shall provide for complete isolation of the IP and BACnet networks by not routing networking packets between the two networks.

BAS BACnet Ethernet network shall be provided and installed by the BAS supplier. Owner shall provide and incur any monthly charges of WAN/Internet connection.

4.2 DISPLAY OF DATA

A. Web page graphics shown on browser shall be replicas of the BAS displays. User shall need no additional training to understand information presented on Web pages when compared to what is shown on BAS displays. Web page displays shall include animation just as BAS displays. Fans shall turn, pilot lights shall blink, coils shall change colors, and so on.

B. Real-time data shall be shown on all browser Web pages. This data must be directly gathered via the BACnet network and automatically updated on browser Web page displays without any user action. Data on the browser shall automatically refresh as changes are detected without re-drawing the complete display.

C. It shall be possible for user from browser Web page to change data if the user is logged on with the appropriate password. Clicking on a button or typing in a new value shall change digital data. Using pull-down menus or typing in a new value shall change analog data.

D. Data displays shall be navigated using pushbuttons on the displays that are simply clicked on with the mouse to select a new display. Alternatively, the standard back and forward buttons of the browser can be used for display navigation.

4.3 WEB PAGE GENERATION

Web pages shall be generated automatically from the BAS displays that reside on the BAS server. User shall access Web-page host via the network and shall initiate a web page generation utility that automatically takes the BAS displays and turns them into Web pages. The Web pages generated are automatically installed on the Web page host for access via any computer’s standard browser. If the system requires use of an HTML editor for generation of Web pages, the owner shall be provided with a minimum of (40) hours HTML training for two operators as part of the bid. Provide all factory and third-party software required for the owner to generate or modify 2 and 3 dimensional displays.

4.4 PASSWORD SECURITY AND ACTIVITY LOG

Access via Web browser shall utilize the same hierarchical security scheme as BAS system. User shall be asked to log in once the browser makes connection to Web-page host. Once the user logs in, any and all changes that are made shall be tracked by the BAS system. The user shall be able to change only those items that the user has authority to change. A user activity report shall
show any and all activity of the users that have logged in to the system regardless of whether those changes were made using a browser or via the BAS workstation.

4.5 BACnet COMMUNICATION

Web-page host shall communicate using the ASHRAE BACnet protocol standard to all devices on the BAS network.

4.6 BACK-UP CAPABILITY

The web browser shall not inhibit the use of a dial-up modem as a back-up to the Intranet or Internet access

END OF SECTION
PART 1 – GENERAL

1.1 SECTION INCLUDES

A. Perform testing, adjusting and balancing of completed heating, ventilating, and air conditioning systems and prepare reports and recommendations.

1.2 DEFINITIONS

A. Definitions are as indicated in applicable AABC, ASHRAE, ANSI publications, and Sections 01070 and 15010.

1. TAB: Testing, Adjusting and Balancing.
2. AABC: Associated Air Balance Council

1.3 TESTING, ADJUSTING AND BALANCING AGENDA:

A. Definition: Proposed procedures and proposed forms, diagrams and reports for documenting testing, adjusting and balancing work.

B. Preparation: By testing, adjusting and balancing agency for review and approval by the Architect and the City Engineer.

C. Agenda shall include one complete set of AABC or NEBB publications listed in Article 1.03, Paragraph A, applicable publications, or, in case of other testing, adjusting and balancing organizations, comparable publications to establish an approved systematic and uniform set of procedures.

D. Agenda shall also include the following detailed narrative procedures, system diagrams and forms for test results.

1. Specific standard procedures required and proposed for each system.
2. Specified test forms for recording each procedure and for recording sound and vibration measurements.
3. Systems diagrams for each air, and water system. Diagrams may be single line. In addition to information recorded for standard AABC or NEBB procedures, following information is required:
   a. Air handling units: Prepare pressure profile and show design ad actual CFM outside air, return air, supply air). Measure and record each mode (minimum OLA and 100% OA) where economizer cycle is specified. Record pressure drops of all components (coils, heat recovery devices, filters, sound attenuators, louvers, dampers, fans) and compare with design values. Pressure profile and component pressure drops are performance indicators and are not to be used for flow measurements. Set and record purge airflow for heat recovery wheels.
   b. Duct distribution systems: Prepare pressure profiles from air handling unit to extremities of system. As a minimum, show pressure at each floor, main branch, and airflow, measuring device. Make pitot tube traverses of all trunk lines and major branch lines where required for analysis of distribution system. Airflow measuring devices installed in ductwork, if available, may be utilized. Record residual pressures at inlets of volume controlled terminals at ends of system. Show actual pressures at all static pressure control points utilized for constant or variable flow systems.
c. Variable air flow systems: Include in test forms provisions for measuring and reporting CFM (supply, return, exhaust, outside), GPM (primary, secondary) system pressures, motor loads, other pertinent data, at full unthrottled capacity and at design (100%) flows. Record additional flow, pressure, and motor loads for supply and return/exhaust system capacities in 10% increments down to a minimum attainable by the system to verify fan tracking and control. Modulate systems by varying supply temperature of air or other approved means.

d. Water systems: Record system fill pressures and expansion tank (level, pressure, temperature) conditions. Record shut-off heads for all pumps and compare with pump curves to determine if correct pump impellers have been installed.

1.4 SUBMITTALS

A. Submit in accordance with Section 01300: Submittals.

B. Work Certification: Submit name of organization proposed to perform work as herein described, for review within 35 days after Contract Award. Include in submittal the certified qualifications of all persons responsible for supervising and performing actual work.

C. Testing and Balancing Contractor shall submit, for approval, 6 copies of procedures to test and balance all mechanical systems.

D. Upon approval of the testing, adjusting and balancing agency submit agenda for approval.

E. Preliminary Report: Review drawings and specifications, examine system installation and submit a written report indicating deficiencies in system that would preclude proper adjusting, balancing, and testing of system.

F. After completion of tests, submit complete test reports for approval. Where test results differ from specified design conditions, indicating a Contract Deficiency, include explanatory comments in report. Contractor shall submit 8 copies of final Testing and Balancing Reports prior to requesting final inspection of project. Distribution of the reports shall be by the Architect as follows:
  2 copies to Contractor
  3 copies to Design and Construction Branch
  1 copy to Inspector
  2 retained by the Architect

1.5 QUALITY ASSURANCE

A. Qualifications of Agency and Personnel: Obtain services of an independent, qualified testing organization acceptable to the Architect to perform testing and balancing work as herein specified. Testing organization shall submit proof that it meets technical standards for membership in the AABC as published in the AABC; or, organization is a member of the Associated Air Balance Council; or, certified by the National Environmental Balancing Bureau (NEBB).

B. Performance Criteria: Work shall be performed in accordance with approved TAB agenda.

C. Test Equipment Criteria: Basic instrumentation requirements and accuracy/calibration required by AABC (Section Two) or Section II of the NEBB Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems.
1.6 APPLICABLE PUBLICATIONS

A. Following publications form a part of this specification to extent indicated by reference thereto. In
text, publications are referred to by the initials of organization.
1. American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE):
2. Associated Air Balance Council (AABC): National Standards for Field Measurement and
3. American Society of Mechanical Engineers (ASME): Section VIII, Pressure Vessels, Division
   1, 1977
   B486 ..... Paste Solder
   B88 ..... Seamless Copper Water Tube,
   B280 ..... Seamless Copper Tube for Air Conditioning and Refrigeration Field Service
   D635 ..... Rate of Burning and/or Extent and Time of Burning of Self-supporting Plastics in a
   Horizontal Position,
   D1693 ..... Environmental Stress-Cracking of Ethylene Plastics,
5. National Fire Protection Association (NFPA):
   70 ...... National Electric Code
   90A ...... Installation of Air Conditioning and Ventilating Systems
   Measurement and Control Terminology.
7. Underwriters Laboratories, Inc. (UL).

1.7 PRODUCT HANDLING

A. Protection: Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements at no additional
cost to the City.

1.8 COORDINATION

A. Coordinate all activities in accordance with provisions of Section 15010.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 GENERAL

A. At least 14 days before specified occupancy or date of completion of overall contract, Contractor
shall put all heating, ventilating, and air conditioning equipment into operation and shall continue
operation of same during each work day for not less than five eight-hour periods, until all
adjusting, balancing, testing, demonstrations, and instructions on systems have been completed.
Final instructions and demonstrations and preparation of reports shall be done during the 2-week
period.

B. When an individual building is ready for occupancy, all above equipment relative to that portion of
work shall be put into service, tested, and adjusted.
C. Coordinate testing, adjusting and balancing procedures with any phased construction requirements for project so that usable increments of finished work may be accepted for beneficial occupancy. Systems serving partially occupied phases of project may require balancing for each phase prior to final balancing.

D. Conduct final procedures after system has been completed and is in full working order. Put all HVAC systems into full operation and continue operation of the systems during each working day. Accomplish testing, adjusting and balancing procedures in accordance with the agenda approved by the Architect.

3.2 FIELD EXAMINATION

A. Before starting testing, adjusting and balancing, Contractor shall ascertain that following conditions are fulfilled:
1. Ensure that all water heating and water cooling systems have been flushed, cleaned, filled and high points vented.
2. Boilers and hot water are filled.
3. Refrigerant systems are fully charged with specified refrigerant.
4. Over-voltage and current protection have been provided for motors.
5. Equipment has been labeled as required.
6. Curves and descriptive data on each piece of equipment to be tested and adjusted are available as required.
7. Operations and maintenance manuals have been supplied.
8. Controls manufacturer and boiler-burner representatives shall be available for consultation and supervision of adjustments during tests.
10. Automatic control systems completed and operating.

3.3 TESTING, ADJUSTING AND BALANCING

A. For each heating, ventilating, or air conditioning system following shall be performed, recorded and submitted in approved forms for review. Readings shall include but not be limited to following:
1. Distribution Systems:
   a. Outside Climatic Conditions: Outside air DB, WB, atmospheric conditions, during final adjusted cfm run.
   c. Heat Exchangers (furnaces, duct heaters, heating or cooling coils): Face velocity, WB and DB temperatures in and out.
   d. Diffusers or Registers and Grilles: Supply or return air:
      Identification number, location, type, size, manufacturer, number and factor, airflow hood factor, design cfm and fpm, and final adjusted cfm and fpm tabulated; fpm tabulation; not required if airflow hood is used.
   e. Variable Air Volume Diffusers: Items in (1) required, except that cfm minimum and maximum values shall be added to design and final adjusted cfm tabulation.
   f. Variable Air Volume Terminal Unit: Identification number, location, manufacturer, model number, size, minimum static pressure, design cfm minimum and maximum, and actual cfm minimum and maximum.
   g. Space Conditions - Final and balanced condition DB and WB temperatures.
   h. Fans and air handling equipment make, type, and model cfm, static pressure, fan rpm, outlet velocity, brake horsepower, etc.
   i. Motors rpm, voltage, and ampere draw.
   j. Sound levels in decibels at each diffuser, grille or register in occupied areas. Sound levels shall be measured approximately 5'-0" above floor on a line approximately 45 degrees from the floor.
degrees to center of opening, on the "A" and "C" scales of a General Radio Company sound level meter, or similar instrument.

k. Report shall also include ambient sound levels of rooms in which above openings are located, taken without air-handling equipment operating. A report shall also be made of any noise caused by mechanical vibration, which is at an intensity deemed to be objectionable.

2. Hot Water Heating System:
   a. Heating Coils: Identification number, location, cfm, gpm, coil pressure drop, entering and leaving water temperatures, entering and leaving air DB temperatures.
   b. Pumps: Pressure at the suction and discharge of each pump; gpm flow, manufacturer, make, type, and model.
   c. Boilers: Manufacturer model and serial number, heat output of boilers (see Test and Adjusting procedures); inlet and outlet water temperatures of boiler. Inlet and outlet pressure of boiler; hot water flow in gpm. Gas input to boiler-burner unit during this period; control set points.

3. Air Conditioning, Condensing and Refrigeration Units:
   a. Suction pressure and temperature.
   b. Discharge pressure and temperature.
   c. Amps and volts.
   d. Make, type, and model of unit; capacity rating.
   e. Ambient temperature: WB, DB

4. Air Moving Equipment - Fan Systems: Identification number, location, manufacturer, model or size and serial numbers, cfm requirements, total and/or external static pressure, fan and motor rpm, fan and motor sheave size, belt size and number.

5. Fan Motor: Manufacturer, frame, horsepower, rpm, voltage and phase, amperage, service factor, mag-starter heater elements and/or fuse size.

6. All Pumps: Identification number, location, manufacturer, size, impeller, service: chilled or hot water, gpm, feet head, suction and discharge pressure.

7. Pump Motor: Manufacturer, frame, horsepower, voltage and phase, amperage, service factor, mag-starter heater elements.

3.4 WATER FLOW ADJUSTMENT

A. Test, adjust, and balance the water flow in systems. Provide flow-metering device for use with installed balancing valves as required.

B. Adjust pump flow by adjusting and setting balancing valves, to obtain amperage reading on a clamp-on ammeter, to correspond to amperage indicated on pump's curves for required flow.

3.5 PUMP TESTING

A. Pumps shall be tested by using a clamp-on ammeter to:
   1. Verify the pump is moving the specified amount of water (gpm) as shown on the pump capacity; and
   2. Verify that the motor is not drawing more current than indicated on motor plate rating. When actual flows of primary pumps are found by test to vary more than 5% from specified amount, system shall be re-balanced to regulate flow within this tolerance. When a flow indicating device(s) is in circuit, it shall be used to verify pump flows.

B. When testing is completed, a pump capacity chart with pump number and location indicated thereon, shall be marked indicating operating point of pump on the curve. Chart shall then be sealed in clean plastic and posted on wall near pump or in a location selected by the City Engineer.
3.6 TESTING, ADJUSTING AND BALANCING OF HOT WATER BOILERS AND NON-DOMESTIC TYPE WATER HeATERS

A. After adjusting, balancing and testing of pumps has been completed, the boiler(s) shall be tested for:
   1. Specified heat output and
   2. Proper operation of controls. Boilers shall not be initially operated or tests performed with students or faculty on site.

B. Heat output of hot water boilers shall be adjusted to within 2-1/2% of the AGA output rating indicated on nameplate, under steady stated conditions.

C. Heat output of boilers shall be determined by following formula: Temperature rise x gallons per minute x 500 = BTU/per hour. Temperature rise is difference in inlet and outlet thermometer readings.

D. Temperature controllers and safety devices shall be tested during operating tests, with all other controls and devices, except one under test, being by-passed.

E. Boiler make-up pump capacity shall be tested with boiler water temperature at maximum design temperature by temporarily jumping the 2 temperature controllers, setting make-up pump pressure switch above setting of boiler, pressure relief valve and firing boiler, with relief valve discharging for not less than 5 minutes. Test shall be made with circulating pump de-energized.

   Should boiler water temperature exceed 250° F. during this test, the City Engineer will request the Mechanical Engineer to undertake a design investigation.

F. Gas pressure in burner manifold shall be tested with boiler operating at full firing rate.

G. Upon completion of tests, controls and devices shall be returned to their normal operating condition and boiler shall remain in service.

H. If full load tests cannot be run, due to outside weather conditions, Contractor shall conduct such tests within six months, when conditions permit.

3.7 FINAL TABULATION

A. After heating, ventilating, and air conditioning components have been balanced, entire system shall be put into operation and all pressures, temperatures, gpm, cfm, velocities, etc., recorded and checked against design schedules. Design requirements shall be listed on reports and final tabulation shall be within a tolerance of plus or minus 10% of design requirements.

B. Readings at various locations as described herein will be made every hour for 4 hours, during normal working hours. Boilers, forced warm air furnaces, and chillers shall be started up far enough in advance to meet design conditions of day during period of testing.

3.8 VIBRATION TESTING

A. Furnish instruments and perform vibration measurements as specified in Section 15240: Sound Vibration and Seismic Control. Provide measurements for all rotating HVAC equipment half horsepower and larger, including centrifugal/screw compressors, pumps, fans and motors.
B. Record initial and final measurements for each unit of equipment on test forms. Where vibration readings exceed allowable tolerance and efforts to make corrections have proved unsuccessful, forward a separate report to the Architect.

3.9 SOUND TESTING

A. Perform and record sound measurements as specified in paragraph 3.03(A) (1) in this section. Take readings in additional rooms as designated by the Architect.

B. Take measurements with a calibrated sound level meter and octave band analyzer of accuracy required by AABC or NEBB.

C. Sound reference levels, formulae and coefficients shall be according to ASHRAE handbook, 1986 Systems Volume; Chapter: Sound and Vibration Control.

D. Determine compliance with Specifications as follows:
   1. Where sound pressure levels are specified, including noise criteria in Section 15240: Sound, Vibration and Seismic Control.
      a. Reduce background noise as much as possible by shutting off unrelated audible equipment.
      b. Measure octave band sound pressure levels with specified equipment "off".
      c. Measure octave band sound pressure levels with specified equipment "on".
      d. Use difference in corresponding readings to determine sound pressure due to equipment.
         DIFF.: 0 1 2 3 4 5 9-10 or More
         FACTOR: 10 7 4 3 2 1 0
         Sound pressure level, due to equipment, equals sound pressure level with equipment "on" minus factor.
         e. Plot octave bands of sound pressure level due to equipment for typical rooms, on a graph which also shows noise criteria (NC) curves.
   2. When sound power levels are specified:
      a. Perform steps Article 3.10, Paragraph D, 1.a. through 1.d.
      b. For indoor equipment: Determine room attenuating effect; i.e., difference between sound power level and sound pressure level. Determine sound power level will be sum of sound pressure level due to equipment, plus room attenuating effect.
      c. For outdoor equipment: Use directivity factor and distance from noise source to determine distance factor, i.e., difference between sound power level and sound pressure level. Measured sound power level will be sum of sound pressure level due to equipment, plus distance factor.
   3. Where sound pressure levels are specified in terms of dbA, measure sound levels using the "A" scale of meter. Single value readings will be used instead of octave band analysis.

E. Where measured sound levels exceed specified level, installing Contractor or equipment manufacturer shall take remedial action approved by the Architect and necessary sound tests shall be repeated.

END OF SECTION
SECTION 16050
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following electrical materials:

1. Concrete equipment bases.
2. Touchup painting.

1.03 SUBMITTALS

A. Product Data for each type of product specified.
B. Shop Drawings detailing fabrication and installation of supports and anchorage for electrical items.
C. Coordination Drawings for electrical installation.

1. Prepare Coordination Drawings according to 01330, “3 Submittal Procedures” to \( \frac{1}{4}''=1'-0'' \) or larger. Detail major elements, components, and systems of electrical equipment and materials in relation to each other and to other systems, installations, and building components. Indicate locations and space requirements for installation, access, and working clearance. Show where sequence and coordination of installations are important to the efficient flow of the Work. Coordinate drawing preparation with effort specified in other Specification Sections. Include the following:

a. Provisions for scheduling, sequencing, moving, and positioning large equipment in the building during construction.

b. Floor plans, elevations, and details, including the following:

1) Clearances to meet safety requirements and for servicing and maintaining equipment, including space for equipment disassembly required for periodic maintenance.

2) Equipment support details.

3) Exterior wall, roof, and foundation penetrations of cable and raceway; and their relation to other penetrations and installations.

4) Fire-rated interior wall and floor penetrations by electrical installations.

5) Waterproof exterior wall and roof penetrations by electrical installations.
6) Sizes and locations of required concrete pads and bases.

c. Reflected ceiling plans to coordinate and integrate installing air outlets and inlets, light fixtures, alarm and communication systems components, sprinklers, and other ceiling-mounted items.

D. Operations and Maintenance manuals: Include all data required as part of submittals; documentation of testing, cleaning, and start-up; maintenance instructions; recommended spare part lists; and other data as required in each Section of Division 1 and 16.

1.04 QUALITY ASSURANCE

A. Perform all work in accordance with the following rules including State and local amendments (Rules are defined as codes, standards and regulations):

1. Codes:

   California Building Code ................................................................. CBC
   California Fire Code ........................................................................ CFC
   California Plumbing Code .............................................................. CPC
   California Mechanical Code ............................................................ CMC
   California Electrical Code ............................................................... CEC
   California Code of Regulations ...................................................... CCR
   CCR Title 24 California Energy Conservation Codes ....................... CEC

   Applicable Local Codes and Ordinances

2. Standards:

   Americans with Disabilities Act ..................................................... ADA
   American National Standards Institute .......................................... ANSI
   American Society for Testing and Materials ................................. ASTM
   Association of Edison Illuminating Companies .............................. AEIC
   Certified Ballast Manufacturers .................................................... CBM
   Diesel Engine Manufacturer’s Association .................................... DEMA
   Electronics Industries Association .............................................. EIA
   Electrical Testing Laboratories ..................................................... ETL
   Factory Mutual ........................................................................... FM
   Federal Aviation Agency ............................................................... FAA
3. Regulations:

California Occupational Safety Health Act ................................................. OSHA
California State Fire Marshal ................................................................. CSFM
California State Department of Public Health ......................................... CSDPH
South Coast Air Quality Management District ....................................... SCAQ

4. Where standards of Specifications for materials, workmanship, or design criteria are higher than those of applicable rules, Specifications shall take precedence; otherwise the rules shall govern.

5. Nothing in these Specifications is to be interpreted as permitting work not conforming to the rules.

6. Should there be any direct conflict between the rules and the Specifications, the rules shall govern.

7. Charges for all materials and labor required for the compliance with rules and regulations shall be included in the Contract Price.

B. Cooperation with Trades: Cooperate with other trades in putting this installation in place at a time when space required is accessible, and in such manner that all other work in the space may be installed is of prime importance. Schedule work and cooperate with the others to avoid delays, interference, and unnecessary work, conforming to the construction schedule, making the installation when and where directed.
C. Protection of Equipment: Contractor shall be responsible for damage to any of the work before acceptance. Should the equipment become damaged, restore it to its original condition and finish before final acceptance.

D. Inspection: Do not permit or cause any work to be covered or enclosed until it has been inspected, tested, and approved by the building official inspecting the installation and the Owner's Representative. Should any of the work be enclosed or covered before inspection and testing, Sub-contractor shall, at its own expense, uncover the work; and, after it has been inspected, tested and approved, make all repairs with such materials as may be required to restore this work and that of other trades to its original and proper condition.

E. The Owner, at its option, may verify the inspections or re-inspect any item. Inspections shall include examination for quality of workmanship, neatness, part and wiring identification, conformance to building codes, and compliance with system specifications and shop drawings. The Owner reserves the right to reject materials and workmanship found unacceptable during inspections.

F. The Owner shall have the right at all times to inspect or otherwise evaluate the work performed or being performed and the premises in which the work is being performed.

G. Damage: Repair any damage to the premises and/or equipment occasioned by this work. Repair all damage to any part of the premises caused by materials and equipment furnished or installed for a period of one (1) year after date of acceptance.

H. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed and Labeled": As defined in the National Electrical Code, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.05 SEQUENCING AND SCHEDULING

A. Coordinate electrical equipment installation with other building components.

B. Arrange for chases, slots, and openings in building structure during progress of construction to allow for electrical installations.

C. Coordinate installing required supporting devices and set sleeves in poured-in-place concrete and other structural components as they are constructed.

D. Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning prior to closing in the building.

E. Coordinate connecting electrical service to components furnished under other Sections.

F. Coordinate connecting electrical systems with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies.
G. Coordinate requirements for access panels and doors where electrical items requiring access are concealed by finished surfaces.

1.06 SUBMITTALS

A. Electrical Test Reports.

B. Start-Up and Commissioning Reports.

C. Demonstration and Training Program Requirements as specified in Division 1.

1.07 RECORD DRAWINGS

A. Upon completion of the Work, provide the Owner with two (2) complete sets of reproducible “record” drawings and two (2) sets of Compact Discs upon which shall show actual installed Work. All floor plans and equipment schedules shall be prepared in AutoCad 2000 or latest version.

1.08 MAINTENANCE AND OPERATING MANUALS

A. Upon completion of the Work, provide the Owner with two (2) complete sets of maintenance and operating manuals.

1.09 WARRANTY

A. Warrant all equipment, materials, supplies, and work against defective construction or workmanship for a period of one (1) year following the Date of Substantial Completion of the Work.

PART 2 – PRODUCTS

2.01 CONCRETE EQUIPMENT BASES

A. Forms and Reinforcing Materials: As specified in Division 3 Section "Cast-in-Place Concrete."

B. Concrete: 3000-psi, 28-day compressive strength as specified in Division 3 Section, “Cast-in-Place Concrete.”

2.02 TOUCHUP PAINT

A. For Equipment: Provided by equipment manufacturer and selected to match equipment finish.

B. For Non-equipment Surfaces: Matching type and color of undamaged, existing adjacent finish.

C. For Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

2.03 MANUFACTURERS
A. Qualifications: Firms regularly engaged in manufacture of products specified, of types and capacities required, whose products have been in satisfactory use in similar service for not less than 5 years, unless otherwise specified.

B. Subject to compliance with requirements specified, provide material or product from one of the manufacturers listed for each item.

2.04 SPARE MATERIALS

A. Extra materials which are furnished should match products installed, be packaged with protective covering for storage and water resistance, and identified with labels describing contents and use location(s).

PART 3 – EXECUTION

3.01 EQUIPMENT INSTALLATION REQUIREMENTS

A. Install components and equipment to provide the maximum possible headroom where mounting heights or other location criteria are not indicated.

B. Install items level, plumb, and parallel and perpendicular to other building systems and components, except where otherwise indicated.

C. Install equipment to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Give right of way to raceways and piping systems installed at a required slope.

3.02 INSTALLATION

A. Sleeves: Install for cable and raceway penetrations of concrete slabs and walls, except where core-drilled holes are used. Install for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls and extend 2-inches above finish floor. Caulk perimeter.

B. Firestopping: Apply to cable and raceway penetrations of fire-rated floor and wall assemblies. Perform firestopping as specified in Section 07841, "Through Penetration Firestop Systems" to reestablish the original fire-resistance rating of the assembly at the penetration.

C. Install concrete pads and bases according to requirements of Section 03300, "Cast-in-Place Concrete."

D. Install utility-metering equipment according to utility company's written requirements. Provide grounding and empty conduits as required by company.

3.03 TOUCHUP PAINTING

A. Thoroughly clean damaged areas and provide primer, intermediate, and finish coats to suit the degree of damage at each location.
B. Follow paint manufacturer’s written instructions for surface preparation and for timing and application of successive coats.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including General Conditions and Division-1 Specification Sections, apply to the Work of this Section.

1.02 DESCRIPTION OF WORK

A. Extent of electrical connections for equipment is indicated by the requirements of this Section. Electric connections are hereby defined to include, but not necessarily limited to, electrically associated devices such as disconnect switches, lock-out switches, contactors, magnetic or manual starters, etc.

B. Types of electrical power connections specified in this Section includes the following:

1. To switchgear.
2. To switchboards.
3. To panelboards.
4. To transformers.
5. To motor control centers.
6. To emergency / standby generator systems.
7. To automatic transfer switches.
8. To uninterruptible power source systems equipment.
9. To telephone equipment.
10. To rolldown doors.
11. To electrically operated doors and gates.
12. To electric water coolers.
13. To irrigation controllers.
14. To fountain system.
15. To illuminated signs.
16. To trash compactors.
17. To domestic hot water heaters.
18. To instantaneous electric water heaters.
19. To hot water dispensers.
20. To gas shut-off valves.
21. To computer systems and equipment.
22. To HVAC, plumbing and fire protection equipment.
23. To packaged mechanical equipment such as: fans, pumps, compressors, etc.
24. To contactors.
25. To motors.
26. To motor starters and contactors.
27. To disconnect switches.
28. From motor starters and disconnect switches to motors.
29. To lighting fixtures and lighting controls.
30. To master units of fire detection, and alarm systems, building automation system, lighting control systems, CO detection system, etc.

C. All temperature control, building automation and HVAC equipment interlock wiring, raceways and associated devices are specified in Division 15, the HVAC sections. All alarms, plumbing and fire protection control and equipment interlock wiring, raceways and associated devices are specified in the Plumbing and Fire Protection Sections of Division 15.

D. Motor starters and controls not furnished integrally with equipment are specified in applicable Division-16 sections.

E. Refer to Division-15 sections for motor starters and controls furnished integrally with equipment; not work of this section.

F. Junction boxes, disconnect switches, lock-out switches, contactors, etc. required for motors and other electrical units of equipment are specified in applicable Division-16 sections.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors and terminals, of types and ratings required, and ancillary connection materials, including electrical insulating tape, electrical flux, and cable ties, whose products have been in satisfactory use in similar service for not less than 5 years.

B. NEC Compliance: Comply with applicable portions of NEC as to type products used and installation of electrical connections (terminals and splices), for junction boxes, motor starters, and disconnect switches.

C. NEMA Compliance: Comply with applicable portions of NEMA standards pertaining to electrical connections for equipment.
D. ANSI Compliance: Comply with applicable ANSI standards pertaining to products and installation of electrical connections.

E. UL Labels: Provide electrical connection products and materials which have been UL-listed and labeled.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following (for each type of product):

1. AMP Products Corp.
2. Appleton Electric Co.
4. Burndy Corp.
5. T and B/Thomas and Betts Corp.

2.02 MATERIALS AND COMPONENTS:

A. General: For each electrical connection indicated, provide complete assembly of materials, including but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, electrical solder, electrical soldering flux, heat-shrinkage insulating tubing, cable ties, solderless wire nuts, and other items and accessories as needed to complete splices and terminations of type indicated.

B. Duct, Conduit, Tubing and Fittings: Provide duct, conduit, tubing and fittings of type and size indicated. Where type and size are not indicated, provide proper selection to comply with NEC requirements for raceways. Provide products complying with Section 16110, "Raceways and Boxes."

C. Wire, Cable and Connectors:

1. General: Provide wires, cables and connectors complying with Section 16120, "Conductors and Cables."

2. Wire: Unless otherwise indicated, provide wires/conductors for electrical connections which match wires/conductors of wiring supplying power.

D. Electrical Connection Accessories: Provide electrical insulating tape, heat-shrinkable insulating tubing and boots, solder, electrical soldering flux, wire nuts and cable ties as recommended for use type by accessories manufacturers in type services indicated.

PART 3 - EXECUTION

3.01 INSTALLATION OF ELECTRICAL CONNECTIONS
A. Install electrical connections as indicated, in accordance with connector manufacturer's written instructions and with recognized industry practices, and complying with requirements of NEC and NECA's "Standard of Installation" to ensure that products fulfill requirements.

B. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and the installed equipment.

C. Coordinate installation of electrical connections for equipment with equipment installation work.

D. Cover splices with electrical insulation equivalent to, or of higher rating, than insulation on conductors being spliced.

E. Prepare cables and wires, by cutting and stripping covering armor, jacket, and insulation properly to ensure a uniform and neat appearance where cables and wires are terminated.

F. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing and maintenance.

G. Tighten wire-binding connector screws firmly. Tightening of connections in switchgear, switchboards, transformers, motor control centers, panelboards, etc. shall be done in the presence of an Owner's representative after installation and prior to energization of equipment.

H. Provide flexible conduit for motor connections, and for other electrical equipment connections where subject to movement and vibration.

I. Provide liquid-tight flexible conduit for connection of motors, transformers and for other electrical equipment where subject to movement and vibration, and also where subjected to one or more of the following conditions:

1. Exterior location.
2. Moist or humid atmosphere where condensate can be expected to accumulate.
3. Corrosive atmosphere.
4. Subjected to water spray.
5. Subjected to dripping oil, grease, or water.

J. Connections to motors and equipment subject to vibration and vibration isolated equipment shall be from above and shall not transfer vibration from the equipment to the building structure.

K. Refer to Section 16195 "Electrical Identifications" for identification of electrical power supply conductor terminations with markers approved as to type, colors, letter and marker sizes, by Architect. Affix markers at each point of termination, as close as possible to each point of connection.
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including General Conditions and Division-1 Specification Sections, apply to the Work of this Section.

1.02 DESCRIPTION OF WORK

A. Extent of electrical equipment noise control, vibration isolation and seismic restraints is indicated by the Drawings, specified in other Division-16 Sections, and by this Section.

B. Types of electrical equipment noise control, vibration isolation and seismic restraints include the following:

1. Vibration isolation of transformers.
2. Flexible conduits at transformer connections.
3. Flexible conduits at connections to motors and other vibrating equipment.
4. Electrical box-pads at stud partitions where sound insulation is provided.
5. Vibration isolation of engine generators.
7. Seismic restraint for vibration isolated equipment.
8. Flexible conduit at structural seismic joints.

1.03 SUBMITTALS

A. Submit the following under the provision of Section 01330. The submittal shall contain the following information:

1. Catalog cuts and data sheets on specific vibration isolators, mufflers, electrical box pads and other equipment to be utilized, showing compliance with the specification.
2. An itemized list showing the items of equipment to be isolated, the isolator type and model number selected, isolator loading and deflection.
3. Calculations by a Structural Engineer licensed in the State of California certifying that the seismic restraints will act in accordance with the relevant codes.
   b. Seismic zone: Zone 4.
4. Certification by the manufacturer or its representative that their vibration isolation equipment has been installed correctly.

1.04 COORDINATION

A. Coordinate Work with other trades to avoid rigid contact between isolated transformers, raceways and the building. Inform other trades following this Work to avoid any contact which would reduce the vibration isolation.

1.05 CONFLICTS AND DISCREPANCIES

A. The Contractor shall bring to the Architect’s attention prior to installation any conflicts with other trades which will result in unavoidable contact to the equipment, raceways, etc., described herein, due to inadequate space, etc. Corrective work necessitated by conflicts after installation shall be at the Contractor’s expense.

B. The Contractor shall bring to the Architect’s attention any discrepancies between the Specifications and field conditions, changes required due to specific equipment selection, etc., prior to installation. Corrective Work necessitated by discrepancies after installation shall be at the Contractor's expense.

1.06 INSPECTION AND INSTRUCTION

A. The Contractor shall obtain approval from the Architect of any installation to be covered or enclosed prior to such closure.

B. The Contractor shall comply with instructions from the vibration isolation manufacturer as to the proper installation and adjustment of vibration isolation devices and seismic restraints.

1.07 ISOLATOR CONFIGURATION FOR FLOOR MOUNTED OR SUSPENDED EQUIPMENT

A. Provide a maximum of four vibration isolators located at the corners of the equipment unless approval is obtained from Structural Engineer for additional isolators.

1.08 SEISMIC RESTRAINTS

A. Provide seismic restraints in compliance with the requirements of the following Codes and Standards:

1. 1997 UBC.


B. UBC Occupancy: Essential Facilities

1.09 SEISMIC BRACING DESIGN AND CERTIFICATION

A. The Division 16 contractor shall provide services of a structural engineer to design seismic restraints, provide field inspections and certify that the systems have been installed in accordance with the design. Structural engineer shall be holding a current Texas registration and have been engaged in seismic design and supervision for building electrical systems for not less than 5 years.
1.10 RESPONSIBILITY OF MANUFACTURER

A. Vibration isolation manufacturer shall:
   1. Determine vibration isolation sizes and locations.
   2. Provide equipment isolation system as scheduled or specified.
   4. Provide installation instructions and drawings.
   5. Provide calculations signed by a Structural Engineer licensed in the State of California certifying that the seismic restraints will act in accordance with the relevant State and local codes and will maintain equipment in captive position.

1.11 VIBRATION ISOLATION AND NOISE CONTROL REQUIREMENTS

A. Floor Mounted Transformers
   1. Type HMN, 3-inch static deflection.
   2. Locate at 4 corners of transformer.
   3. Bolt to floor.

B. Suspended Transformers
   1. Type HN isolation hangers, 0.2 inch static deflection.
   2. Locate at 4 corners.
   3. Provide seismic restraints.

C. Flexible Electrical Connections.
   1. At all transformers within buildings.
   2. At connections to motors or other vibrating equipment.

D. Emergency Generator
   1. Generator set: spring vibration isolators - type MSL, 2.0 inch static deflection type with type A frame.
   2. Generator exhaust: critical muffler.
   3. Noise level output to be controlled to meet the local Noise Ordinance.

1.12 ELECTRICAL BOX PADS

A. Provide electrical box pads on all junction boxes located within sound insulated drywall partitions.
PART 2 - PRODUCTS

2.01 VIBRATION ISOLATORS

A. General Properties

1. All vibration isolators shall have either known undeflected heights or other markings so that, after adjustment, when carrying their load, the deflection under load can be verified, thus determining that the load is within the proper range of the device and that the correct degree of vibration isolation is being provided according to the design.

2. All isolators shall operate in the linear portion of their load versus deflection curve. Load versus deflection curves shall be furnished by the manufacturer and must be linear over a deflection range 50% above the design deflection.

3. The ratio of lateral to vertical stiffness shall not be less than 1.0 or greater than 2.0.

4. The vertical natural frequency for each support point, based upon the load per isolator and isolator stiffness, shall not differ by more than + or - 10%.

5. Wave motion through the isolator shall be reduced to the following extent: isolation above the resonant frequency shall follow the theoretical prediction based upon an undamped single degree of freedom system, with a minimum isolation of 50 decibels above 150 cycles per second.

6. All neoprene mountings shall have a shore hardness of 50 to 60 after minimum aging of 20 days or corresponding oven aging.

7. All vibration isolation equipment exposed to moisture or an outdoor environment shall be coated as follows:
   a. All steel parts to be hot-dipped galvanized.
   b. All bolts to be cadmium plated.
   c. All springs to be cadmium plated and neoprene coated.

B. Isolator Types and Descriptions

1. Type HN is a suspension hanger with a steel box frame and a molded neoprene element in shear. A neoprene grommet shall be provided at the location where the hanger rod passes through the hanger box so that no metal-to-metal contact occurs.

2. Type MSL is a bare, stable, steel spring with a ribbed neoprene pad under the base plate. Bolt holes shall be provided in the baseplate to permit attachment to the building structure. Limit stops shall be provided to prohibit spring extension if the load is removed. These stops may also serve as rigid blocking during erection so that the installed and operating heights shall be the same. Clearance shall be maintained around restraining bolts and between the limit stops and the housing so as not to interfere with the spring action.
3. Type HMN is a neoprene isolator incorporating a steel housing capable of resisting a seismic load of 1.0 G in all directions. The mount shall consist of a captive steel insert embedded into a neoprene element which is enclosed by a steel housing which also includes floor mounting holes. The isolator shall have a rated deflection of 0.15 inches compression, 0.12 inches in tension and 0.09 inches in shear.

MANUFACTURER'S COMPARISON

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
<th>Manufacturer's Code - Isolator Type</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>A</td>
</tr>
<tr>
<td>HN</td>
<td>Neoprene Hanger</td>
<td>BR</td>
</tr>
<tr>
<td>MSL</td>
<td>Spring Mount with Limit Stop</td>
<td>CT</td>
</tr>
<tr>
<td>HMN</td>
<td>Housed Neoprene Mount</td>
<td>BRD</td>
</tr>
</tbody>
</table>

Notes:

1. Availability - contact manufacturer

2. Notwithstanding this table, the manufacturer's isolator must meet all the requirements of this specification.

Manufacturer's Code:

A) Amber/Booth.

B) California Dynamics.

C) Mason Industries.

D) Sausse (Vibrex).

2.02 FLEXIBLE CONNECTIONS

A. Conduit 1 inch ID or over: Make electrical connections to vibrating equipment via flexible expansion/deflection conduit coupling sized as required. Coupling shall have a flexible and watertight outer jacket, an internal grounding strap, plastic inner sleeve to maintain smooth wireway, and end hubs with threads to fit standard threaded metal conduit. Acceptable units include:

1. XD Expansion Deflection Coupling by Crouse-Hinds of Syracuse, NY.

2. Type DF Expansion and Deflection fitting by Spring City Electrical Mfg. Co. of Spring City, PA.

B. Conduit under 1 inch ID: Use flexible conduit with slack at least 3 feet or 15 diameters long, whichever is the longer or provide a flexible coupling as defined above.
2.03 ELECTRICAL BOX PADS

A. Equal to Lowry's Outlet Box Pads as manufactured by Harry A. Lowry Associates, Sun Valley, California.

2.04 ENGINE GENERATOR MUFFLER: CRITICAL TYPE

A. Equal to Nelson 400.

2.05 EQUIPMENT FRAMES

A. General

Mounting frames and/or brackets shall be provided to carry the load of the equipment without causing mechanical distortion or stress to the equipment.

B. Frame Types

1. Type A frame is a wide flange structural steel frame with brackets. The maximum allowable deflection of any point on the loaded frame relative to the unloaded frame shall be 0.005 inch. A wide flange section depth greater than 1/10th the length of the longest frame member will be accepted as satisfying the deflection requirement.

2. Type B frame is a channel steel structural frame with brackets. The section depth shall be greater than 1/10th the length of the longest frame member.

3. Type C frame is a steel bracket or gusset welded or bolted directly to the machine frame in order to accommodate the isolator.

2.06 SEISMIC RESTRAINTS

A. Suspended Transformers:

1. Utilize a slack cable restraint system.

2. The cable size and attachment shall be approved with calculations signed by a Structural Engineer licensed in the State of Texas.

3. Submittal drawing shall indicate proposed method of vertical restraint.

4. Cables shall be installed with sufficient slack to avoid short circuiting the vibration isolation.

PART 3 - EXECUTION

3.01 INSTALLATION OF VIBRATION ISOLATION DEVICES

A. Transmission of perceptible vibration or structure borne noise to occupied areas by equipment installed under this Contract will not be permitted.

B. Install vibration isolators per manufacturer's directions.

C. Flexible electrical connections.
1. Installation of flexible electrical connections to vibration isolated equipment shall in no way impair or restrain the function of the aforementioned vibration isolation.

2. Option 1: Install the flexible conduit in a grossly slack loop form or shallow "U" form. Install stranded conductors with sufficient slack to accommodate maximum possible movement.

3. Option 2: The flexible coupling shall be free and not in contact with any nearby building construction and shall be installed slack and free of strain in any direction. Install stranded conductors as above.

D. All vibration isolation devices, including auxiliary steel bases shall be designed and furnished by a single manufacturer or supplier, who will be responsible for adequate coordination of all phases of this work.

E. The vibration isolation manufacturer, or his representative, shall be responsible for providing such supervision as may be necessary to assure correct installation and adjustment of the isolators. Upon completion of the installation and after the system is put into operation, the manufacturer, or his representative, shall make a final inspection and submit his report to the Architect in writing, certifying the correctness of installation and compliance with approved submittal data.

F. Vibration Isolation Hangers:

1. The isolators shall be installed with the isolator hanger box as close as possible to the structure.

2. Hanger rods shall be aligned to clear the hanger box and be plumb.

3.02 OUTLET BOX PADS

A. All holes in outlet boxes in sound rated walls shall be completely covered with electrical box pads molded and pressed to the back side of the box.

3.03 COORDINATION

A. The Contractor shall coordinate his Work with other trades to avoid rigid contact between isolated equipment and raceways with the building. He shall inform other trades following his Work to avoid any contact which would reduce the vibration isolation.

\textit{END OF SECTION}
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring and for mechanical Facility Management System (FMS). (Addendum 5)

1. Raceways include the following:
   a. RMC.
   b. EMT.
   c. FMC.
   d. LFMC.
   e. RNC.
   f. ENT.
   g. IMC.
   h. Wireways.
   i. Surface raceways.

2. Boxes, enclosures, and cabinets include the following:
   a. Device boxes.
   b. Floor boxes.
   c. Outlet boxes.
   d. Pull and junction boxes.
   e. Cabinets and hinged-cover enclosures.

B. Related Sections include the following:

1. Section 07841, "Firestopping."

2. Section 16190, "Supporting Devices" for raceways and box supports.
3. Section 16140, "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

4. Section 15950 – Control Systems for FMS. (Addendum 5)

1.03 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. ENT: Electrical nonmetallic tubing.

C. FMC: Flexible metal conduit.

D. IMC: Intermediate metal conduit.

E. LFMC: Liquid tight flexible metal conduit.

F. RMC: Rigid metal conduit.

G. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

A. Submit under the provisions of Section 01330.

B. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

C. Shop Drawings: Include layout drawings showing components and wiring for nonstandard boxes, enclosures, and cabinets.

D. Special Requests: Submit separate request to use exposed wiring methods in other than indicated spaces for review by the Owner. Each request shall explain the reason why exposed methods are requested and a cost credit for the use of exposed methods.

1.05 QUALITY ASSURANCE

A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.


B. Comply with NECA's "Standard of Installation."

C. Comply with NFPA 70.

1.06 COORDINATION

A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS
2.01 MANUFACTURERS

A. Available Manufacturers: Furnish products in compliance with these Specifications.

1. Anaconda. 4. Triangle PWC Inc.
2. Allied Tube & Conduit Corp. 5. Colby Plastics.

2.02 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.
B. Intermediate Metal Conduit (IMC): May be used where rigid steel conduit is specified except where prohibited by NFPA 70.
C. EMT and Fittings: ANSI C80.3.
   1. Fittings: Set-screw or compression type.
D. FMC: Zinc-coated steel.
E. LFMC: Flexible steel conduit with PVC jacket.
F. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

2.03 NONMETALLIC CONDUIT AND TUBING

B. RNC: NEMA TC 2, Schedule 40 or 80 PVC.
C. ENT and RNC Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.

2.04 METAL WIREWAYS

A. Material: Sheet metal sized and shaped as indicated.
B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
D. Wireway Covers: Screw-cover type.
E. Finish: Manufacturer's standard enamel finish.

2.05 SURFACE RACEWAYS

A. Surface Metal Raceways: Galvanized steel with snap-on covers. Finish with manufacturer's standard prime coating.
B. Types, sizes, and channels as indicated and required for each application, with fittings that match and mate with raceways.

2.06 OUTLET AND DEVICE BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized steel. Outlet boxes and covers shall be pressed steel and plugged holes, and shall be hot dipped galvanized or sherardized. For boxes concealed in walls or ceiling, provide the solid gang, galvanized or sherardized pressed steel knockout type. Outlet boxes shall be used as pullboxes wherever possible and junction boxes or pullboxes shall be installed only as required by the drawings or specification. Sectional boxes shall not be used. Light outlet boxes shall be equipped with fixture-supporting device, as required by the unit to be installed.

B. Exposed boxes in mechanical areas in concrete walls, auto garage areas, etc., and exposed to weather shall be cast metal weatherproof, with grounding terminal, threaded hubs and gaskets. Type FS or FD series.

C. Voice/data outlets shall be two gang 4-11/16 square by 2 1/2 inches deep minimum or as indicated on drawings. All boxes for communications require a two-gang plaster ring. Voice/data outlets with 1 ½” conduit feed shall be four gang, wiremold WSA42-4 complete with device mounting bracket and trim ring.

D. Switch Outlets: Use solid gang boxes 2-1/8 inches deep for three or more switches for mounting behind a common single plate.

E. Fire alarm boxes shall be 4 inches square 2-1/8 inches deep with plaster rings to suit type of device. Special boxes shall be as specified under the “Fire Alarm” section.

F. Cast Boxes: NEMA FB 1, Type FD, aluminum, cast feralloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.

2.07 FLOOR BOXES

A. Floor boxes shall be Wiremold 880 series, or approved equal.

1. Two-gang steel floor box, fully adjustable for combination power and voice/data outlet, above grade. Wiremold 880 S2 or approved equal.

2. Two-gang cast iron floor box, fully adjustable for combination power and voice/data outlet, on grade. Wiremold 880CS2-1 or approved equal.

3. Accessories shall include two-gang brass flanges and corresponding cover plates. Flanges shall be Wiremold 827T or approved equal. Cover plates shall be 828R for power and 828 GFITC for voice/data.

B. Boxes shall have integral, internal steel barriers for full separation of power and telecommunications/data compartments.

C. Wiring boxes shall be designed for feed-thru wiring, and shall accept up to eight (8) conduit entries for conduits sizes ¾” through 1-1/2” diameter.

D. Boxes shall accept full size power and telecommunications devices.

E. Power receptacles shall be NEMA5-20R, except where otherwise indicated on the drawings.
F. Telecommunications boxes shall be capable of accepting owner’s standard multi-purpose telecommunications device cover plate.

G. Floor boxes shall be provided complete with all internal brackets, devices, barriers, covers, trim plates and miscellaneous hardware and accessories.

2.08 PULL AND JUNCTION BOXES

A. Small Sheet Metal Boxes: NEMA OS 1.

B. Cast-Metal Boxes: NEMA FB 1, cast metal box with integral threaded conduit hubs and with gasketed cover.

2.09 ENCLOSURES AND CABINETS

A. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.

1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.

B. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 WIRING METHODS

A. Exposed Wiring Methods:

1. Exposed wiring methods are allowed in Electrical Rooms, Utility Vault, Telecomm Rooms, Security Electronics Rooms, Elevator Machine Rooms, Shafts, Utility Chases, and where indicated on the Drawings.

2. Exposed wiring methods will be allowed only in a limited number of applications, other than those indicated above. Each application of exposed methods shall be submitted as a special request. Each request shall explain the reason why exposed methods are requested and a cost credit for the use of exposed methods.

B. Outdoors: Use the following wiring methods:

1. Exposed: Rigid steel conduit.

2. Concealed: Rigid steel conduit.
3. Underground, Concrete Encased: RNC.

4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.

5. Boxes and Enclosures: NEMA 250, Type 3R.

C. Indoors: Use the following wiring methods:

1. Exposed in inmate accessible areas: Rigid steel conduit.

2. Concealed:
   a. Within concrete or masonry walls or floor: RNC.
   b. Within gypsum wallboard partitions: EMT.
   c. Above ceilings: EMT.

3. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.

4. Damp or Wet Locations: Rigid steel conduit.

5. Boxes and Enclosures: NEMA 250, Type 1.
   a. Damp and wet locations such as kitchen and laundry: NEMA 250, Type 4, stainless steel.

6. Below On-Grade Concrete Slab: RNC.

7. Embedded in Concrete: RNC.

3.03 PROJECT REQUIREMENTS

A. Exposed electrical conduit, of any kind, shall not be installed in unsupervised inmate areas such as: Housing unit cells, holding cells, dormitory/dayrooms.

B. Provide rigid metal conduit where conduit is exposed in inmate accessible areas. Examples of instances where rigid metal conduit is required, whether exposed or concealed, are at floor and security wall penetrations and electrical supply for Division 17 equipment.

C. Provide a protective coating at the crossing line for rigid metallic conduit when conduit runs directly from concrete encasement to direct soil burial to prevent corrosive effects.

D. Electrical metallic tubing may be exposed within such secure locations as electrical rooms, mechanical rooms, and electronic rooms.

E. Rigid nonmetallic conduit is limited to rigid polyvinyl chloride (PVC). PVC is limited to use in concrete slabs, concrete encased ductbanks, and direct burial. PVC shall not be used exposed above ground in any area of the institution.
F. Flexible metal conduit used in wet locations (mechanical rooms, plumbing rooms, exterior locations, etc.), shall be liquid tight.

3.04 INSTALLATION

A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

B. Minimum Raceway Size: 1/2-inch trade size.

C. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors, and concrete slabs. (Addendum 5)

D. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

E. Install raceways level and square and at proper elevations. Provide adequate headroom.

F. Complete raceway installation before starting conductor installation.

G. Support raceways as specified in Division 16 Section "Supporting Devices."

H. Use temporary closures to prevent foreign matter from entering raceways.

I. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

J. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

K. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.

L. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.

M. Raceways Embedded in Slabs: Install in middle third of slab thickness where practical, and leave at least 2-1/2-inch concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.

2. Space raceways laterally to prevent voids in concrete.

3. Run conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.

4. Transition from rigid nonmetallic conduit (RNC) to rigid steel conduit before rising above floor.
5. Electrical nonmetallic tubing (ENT) may be used where the lightning protection down lead conductor is routed through the structural footing. Transition from ENT to Schedule 80 rigid nonmetallic conduit (RNC), before rising above floor.

N. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
   1. Run parallel or banked raceways together, on common supports where practical.

O. Join raceways with fittings designed and approved for the purpose and make joints tight.
   1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
   2. Use insulating bushings to protect conductors.

P. Tighten set screws of threadless fittings with suitable tools.

Q. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.

R. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

S. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of the pull wire.

T. Telephone and Signal System Raceways, 2-Inch Trade Size and Smaller: In addition to the above requirements, install raceways in maximum lengths of 100 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

U. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
   1. Where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces.
   2. Fuel storage tanks.
   3. Where indicated on Drawings.
   4. Where otherwise required by NFPA 70.
V. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.

W. Flexible Connections: Use maximum of 4-feet of flexible metal conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible metal conduit in wet or damp locations. Install separate ground conductor inside flexible connections.

X. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying the raceways to receptacle or fixture ground terminals. Provide surface metal raceway outlet box, and the backplate and canopy, at the feed-in location.

Y. Set floor boxes level and adjust to finished floor surface.

Z. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

3.05 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.06 CLEANING

A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION
PART 1 - GENERAL

1.01 SECTION INCLUDES
   A. Cable trays and accessories.

1.02 REFERENCES
   B. NEMA VE 1 - Metallic Cable Tray Systems.

1.03 SUBMITTALS
   A. Submit under provisions of Section 01330.
   B. Shop Drawings: Indicate tray type, dimensions, support points, accessories, finishes and load and deflection tables.
   C. Product Data: Provide data for fittings and accessories.
   D. Manufacturer’s Instructions: Indicate application conditions and limitations of use stipulated by Product testing agency specified under Regulatory Requirements. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of Product.

1.04 PROJECT RECORD DOCUMENTS
   A. Submit under provisions of Section 01783.
   B. Record actual routing of cable tray and locations of supports.

1.05 QUALIFICATIONS
   A. Manufacturer: Company specializing in manufacturing Products specified in this Section with minimum five years documented experience.

1.06 REGULATORY REQUIREMENTS
   A. Conform to requirements of ANSI/NFPA 70.
   B. Furnish products listed and classified by Underwriters Laboratories, Inc. or testing firm acceptable to authority having jurisdiction as suitable for purpose specified and shown.

PART 2 – PRODUCTS

2.01 MANUFACTURERS
   A. B-Line
2.02 LADDER-TYPE CABLE TRAY

A. Description: NEMA, Class 8A ladder type tray.
B. Material: 6063-T6 extruded aluminum.
C. Sections: 12 foot long
D. Inside Width: 12 inches.
E. Inside Depth: 4 inches.
F. Straight Section Rung Spacing: 12 inches on center.
G. Inside Radius of Fittings: 24 inches
H. Loading: 50 pounds per linear feet (uniformly distributed)
I. Safety Factor: 1.65 based upon guaranteed yield strength or 2.0 based upon ultimate or buckling strength of material.
J. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.

2.03 SOLID-BOTTOM-TYPE CABLE TRAY

A. Description: NEMA, Class 8A solid bottom cable tray.
   1. Minimum thickness:
   2. Longitudinal side members: 0.105 inch
   3. Bottom: 0.080 inch
C. Sections: 12 foot long
D. Inside Width: 12 inches
E. Inside Depth: 6 inches
F. Inside Radius of Fittings: 24 inches or as indicated on drawings.
G. Provide manufacturer's standard clamps, hangers, brackets, splice plates, reducer plates, blind ends, barrier strips, connectors, and grounding straps.
H. Loading: 50 pounds per linear feet (uniformly distributed)
I. Safety factors: 1.65 based upon guaranteed yield strength or 2.0 based upon ultimate or buckling strength of material.
2.04 WARNING SIGNS

A. Engraved Nameplates: 3/4 inch high black letters on yellow laminated plastic nameplate, engraved with the following wording:

WARNING! DO NOT USE CABLE TRAY AS WALKWAY, LADDER, OR SUPPORT. USE ONLY AS MECHANICAL SUPPORT FOR CABLES AND TUBING!

PART 3 – EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install metallic cable tray in accordance with NEMA VE 1.

C. Install solid bottom trays for horizontal cable distribution system at all floors where shown on the drawings.

D. Install ladder type cable trays inside the main, telecommunication, and RF rooms.

E. Support trays in accordance with Section 16190. Provide supports at each connection point, at the end of each run, and at other points to maintain spacing between supports of 8 feet maximum.

F. Use expansion connectors where required.

G. Ground and bond cable tray under provisions of Section 16170.

1. Provide continuity between tray components. Provide bonding jumpers. The maximum resistance across any splice connections shall be 50 micro ohms.

2. Provide 2 AWG bare copper equipment grounding conductor through entire length of tray; bond to each component; bond to building ground.

3. Connections to tray may be made using mechanical or exothermic connectors.

H. Install warning signs at 20 ft centers along cable tray, located to be visible.

I. Arrange to permit accessible lay-in of cable over entire length of tray assembly using cantilever support except trapeze hangers where cantilever supports are not practicable.

J. Support trays directly to ceiling slabs.

K. Installation shall be coordinated with other trades and shall maintain cable installation access space around trays as follows:

1. Top and Bottom: 6 inches clear.

2. Sides: 6 inches clear.
L. Penetrations through fire walls shall be made via tray-to-box connectors and sealed by Contractor following installation of all cables. Firestop assembly shall be UL listed and shall have approved fire rating equal to the wall being penetrated.

M. Clearance from water, steam or other piping: minimum 12 inches separation from parallel runs of steam and hot water pipes, except 3 inches from pipe cover at crossings. Cable installation access space clearance may be part of the piping clearance.

N. Allow for expansion at building expansion joints if applicable.

END OF SECTION
PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Duct.

B. Pre-cast concrete manholes.

1.02 RELATED SECTIONS

A. Section 02222 Excavation

B. Section 02260 Excavation Support and Protection

C. Section 03100 - Concrete Formwork.

D. Section 03200 - Concrete Reinforcement.

E. Section 03300 - Concrete Materials and Proportioning.

F. Section 07141 – Cold Fluid – applied water proofing.

1.03 REFERENCES


B. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated.

C. ANSI/ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.

D. ANSI/ASTM A569 - Steel, Sheet and Strip, Carbon (0.15 Maximum Percent), Hot-Rolled, Commercial Quality.

E. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

F. ASTM A48 - Gray Iron Castings.

G. ASTM A123 - Zinc (Hot-Galvanized) Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars, and Strips.

H. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

I. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.04 PROJECT RECORD DOCUMENTS

A. Submit under provisions of Section 01783 Record Drawings and Records Project Manual.

B. Accurately record actual locations of exact routing of ductbank.
C. Accurately record actual locations of each pullbox.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect, and handle Products to site under provisions of Section 01600 Product Requirements.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

1.06 PROJECT CONDITIONS

A. Verify that field measurements are as shown on Drawings.

B. Verify routing and termination locations of duct bank prior to excavation for rough-in.

C. Verify locations of manholes prior to excavating for installation.

D. Duct bank routing is shown on Drawings in approximate locations unless dimensions are indicated. Route as required to complete duct system.

E. Manhole locations are shown on Drawings in approximate locations unless dimensions are indicated. Locate as required to complete ductbank system.

PART 2 - PRODUCTS

2.01 PLASTIC CONDUIT

A. Description: NEMA TC 2; Schedule 40 PVC.

B. Fittings and Conduit Bodies: NEMA TC 3.

2.02 PRECAST CONCRETE MANHOLES

A. Manufacturers:
   1. Jensen Precast
   2. Brooks.

B. Material: Reinforced precast concrete as specified in Section 03200.

C. Construction: Modular sections with tongue-and-groove joints.

D. Reinforcing: AASHTO Classification H-20.

E. Shape: As indicated.

F. Nominal Inside Dimensions: As indicated.
G. Inside Depth: As indicated.

H. Frames and Covers: ASTM A48; Class 30B gray cast iron, 30 inch size, machine finished with flat bearing surfaces. Provide cover marked to indicate utility.


J. Duct Entry Locations: As indicated.

K. Cable Pulling Irons: Use galvanized rod and hardware. Locate opposite each duct entry. Provide watertight seal.

L. Cable Rack Inserts: Minimum load rating of 800 pounds.

M. Sump Covers: ASTM A48; Class 30B gray cast iron.

2.03 ACCESSORIES

A. Underground Warning Tape: 4 inch wide plastic tape, detectable type, colored yellow with suitable warning legend describing buried electrical lines.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that excavation, base material installation, and compaction is completed.

3.02 PREPARATION

A. Prepare excavation in accordance with pullbox manufacturer's instructions.

3.03 DUCT BANK INSTALLATION

A. Install duct in accordance with manufacturer's instructions.

B. Install duct to locate top of ductbank at depths as indicated on drawings.

C. Install duct with minimum slope of 4 inches per 100 feet. Slope duct away from building entrances.

D. Cut duct square using saw or pipe cutter; de-burr cut ends.

E. Insert duct to shoulder of fittings; fasten securely.

F. Join nonmetallic duct using adhesive as recommended by manufacturer.

G. Wipe nonmetallic duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.

H. Install no more than equivalent of two 90-degree bends between pull points.

I. Provide suitable fittings to accommodate expansion and deflection where required.

J. Terminate duct at manhole entries using end bell.

K. Stagger duct joints vertically in concrete encasement 6 inches minimum.
L. Use suitable separators and chairs installed not greater than 4 feet on centers.

M. Band ducts together before placing concrete.

N. Securely anchor duct to prevent movement during concrete placement.

O. Place concrete under provisions of Section 03300.

P. Provide minimum 3 inch concrete cover at bottom, top, and sides of ductbank.

Q. Provide two No. 4 steel reinforcing bars in top of bank under paved areas.

R. Connect to existing concrete encasement using dowels.

S. Connect to pullbox wall using dowels.

T. Provide suitable pull string in each empty duct except sleeves and nipples.

U. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.

V. Backfill trenches.

W. Interface installation of underground warning tape with backfilling. Install tape 6 inches below finished surface.

3.04 PRECAST MANHOLE INSTALLATION

A. Install and seal precast sections in accordance with manufacturer's instructions.

B. Install pullboxes plumb. Install pullboxes on 6 inches compacted rock.

C. Dampproof exterior surfaces, joints, and interruptions of pullboxes after concrete have cured 28 days, under provisions of Section 07141.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary
Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and
terminations for wiring systems rated 600 V and less.

1.03 SUBMITTALS

A. Submit under the provision of Section 01330.

B. Field Test Reports: Indicate and interpret test results for compliance with performance
requirements.

1.04 QUALITY ASSURANCE

A. Listing and Labeling: Provide wires and cables specified in this Section that are listed
and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing
Laboratory" as defined in OSHA Regulation 1910.7.

B. Comply with NFPA 70.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver wires and cables according to NEMA WC 26.

1.06 COORDINATION

A. Coordinate layout and installation of cables with other installations.

B. Revise locations and elevations from those indicated, as required to suit field conditions
and as approved by Architect.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers
offering products that may be incorporated into the Work include, but are not limited to,
the following:
1. Wires and Cables:
   a. Alcan Aluminum Corporation; Alcan Cable Div.
   b. American Insulated Wire Corp.; Leviton Manufacturing Co.
   c. BICC Brand-Rex Company.
   d. Southwire.

2. Connectors for Wires and Cables:
   a. AMP Incorporated.
   b. General Signal; O-Z/Gedney Unit.

2.02 BUILDING WIRES AND CABLES
A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.
B. Thermoplastic Insulation Material: Comply with NEMA WC 5.
C. Cross-Linked Polyethylene Insulation Material: Comply with NEMA WC 7.
D. Conductor Material: Copper, except feeders and service entrances larger than No. 1/0 AWG and not greater than 600 volts may be AA-8000 electrical grade aluminum.
E. Stranding: Solid conductor for No. 10 AWG and smaller; stranded conductor for larger than No. 10 AWG; compact stranded for aluminum conductors.
F. Provide conductor sized as indicated. In no case shall the conductor be sized smaller than the following:
   1. Power: 12 AWG.
   2. Control: 14 AWG.
   3. Analog/Digital signals and instrumentation: 16 AWG.
   4. Current Transformer Secondary: 10 AWG.
G. Temperature rating of wires shall be 90 degrees C.
H. Conductors up to #6 AWG shall be factory color coded.

2.03 CONNECTORS AND SPLICES
A. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 "Wire and Insulation Applications" Article.
PART 3 - EXECUTION

3.01 EXAMINATION
A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 WIRE AND INSULATION APPLICATIONS
A. Service entrance from pad mounted transformer to service disconnect: Type RHW-2 or USE-2 in raceway.
B. Feeders: Type THHN/THWN, THHW, or XHHW 600 volt, in raceway.
C. Indoor Branch Circuits: Type THHN/THWN, THHW, or XHHW 600 volt, in raceway.
D. Outdoor Branch Circuits: Type RHW-2, in raceways.

3.03 INSTALLATION
A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."
B. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
D. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
E. Support cables according to Section 16190, "Supporting Devices."
F. Seal around cables penetrating fire-rated elements according to Section 07841, "Through Penetration Firestop Systems."
G. Identify wires and cables according to Section 16195, "Electrical Identification."

3.04 CONNECTIONS
A. Conductor Splices: Keep to minimum.
B. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
C. Use splice and tap connectors compatible with conductor material.
D. Use oxide inhibitor in each splice and tap connector for aluminum conductors.
E. Wiring at Outlets: Install conductor at each outlet, with at least 6-inches of slack.
F. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.

G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

H. Cables shall be terminated (where possible) with compression type lugs.

3.05 FIELD QUALITY CONTROL

A. Testing: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.

B. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY
A. This Section includes receptacles, cord and plug sets, switches, wall box dimmers, occupancy sensors, wall plates, floor service fittings, and multi-outlet assemblies.

1.03 DEFINITIONS
A. GFCI: Ground-fault circuit interrupter.

1.04 SUBMITTALS
A. Submit under the provision of Section 01330.
B. Product Data: For each product specified.
C. Shop Drawings: Legends for receptacles and switch plates.
D. Samples: For devices and device plates for color selection and evaluation of technical features.
E. Maintenance Data: For materials and products to include in maintenance manuals specified in Division 1.

1.05 QUALITY ASSURANCE
A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.
B. Comply with NEMA WD 1.
C. Comply with NFPA 70.

1.06 COORDINATION
A. Receptacles for Owner-Furnished Equipment: Match plug configurations.
   1. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Wiring Devices:
   a. Eagle Electric Manufacturing Co., Inc.
   c. Leviton Manufacturing Co., Inc.
   d. Pass & Seymour/Legrand; Wiring Devices Div.

2. Wallbox Dimmers Dimming Systems:
   a. Leviton.
   b. Lithonia Lighting
   c. Lutron Electronics Co., Inc.

3. Security Grade Wall Plates:
   a. Appleton
   b. Crouse-Hinds
   c. Fail Safe
   d. Holcor
   e. Kenall

4. Floor Service Outlets:
   c. Pass & Seymour/Legrand; Wiring Devices Div.
   d. Square D Co.
   e. Wiremold.

5. Multioutlet Assemblies:
   a. Airey-Thompson Co.
   b. Wiremold.

2.02 RECEPTACLES

A. Straight-Blade and Locking Receptacles: General-Duty grade, side and back wired (not back stab).

B. Straight-Blade Receptacles in Medical Area: Hospital grade.
C. GFCI Receptacles: Feed-through type, with integral NEMA WD 6, Configuration 5-20R duplex receptacle arranged to protect connected downstream receptacles on same circuit. Design units for installation in a 2-3/4-inch deep outlet box without an adapter.

D. Isolated-Ground Receptacles: Equipment grounding contacts connected only to the green grounding screw terminal of the device with inherent electrical isolation from mounting strap.

1. Devices: Listed and labeled as isolated-ground receptacles, orange color.

2. Isolation Method: Integral to receptacle construction and not dependent on removable parts.

E. Receptacle Frame Color:


2. UPS Powered Receptacle: Orange.

3. Others: Match to Architect’s finish.

2.03 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with type SOW-A jacket. Green-insulated grounding conductor, and equipment-rating ampacity plus a minimum of 30 percent.


2.04 SWITCHES

A. Snap Switches: General-duty, quiet type, 20 A, 120/277-V ac, with mounting yoke insulated from mechanism, side wired.

B. Combination Switch and Receptacle: Both devices in a single gang unit with plaster ears and removable tab connector that permit separate or common feed connection.

2.05 WALL BOX DIMMERS

A. Include line-voltage surge protection in all solid-state equipment. Comply with UL 1449 and ANSI C62.41.

B. Load Compatibility: Components compatible with each other and with controlled loads.

C. Dimmers:

1. Comply with UL 508.
2. Noise and Radio Frequency Interface (RFI) Suppression: Solid-state dimmers operate smoothly over their operating ranges without audible lamp noise or RFI at any setting. Modules include integral or external filters that provide audible noise and RFI suppression.

3. Dimmer Rating: As indicated, but not less than 125 percent of connected load.

4. Fluorescent Dimmers: Control lights smoothly over a minimum range of 100 to 10 percent of full brightness. Shall be listed by the ballast manufacturer as being compatible with the ballast. Integrated linear slide control. Rotary control is not acceptable. Provide integrated positive OFF position.

2.06 OCCUPANCY SENSORS

A. Wall-mounted, passive infrared sensors, Watt Stopper Type WA 200 and WI 300 or equal by UNENCO.

B. Ceiling mounted combination, passive infrared and ultra sonic, “Watt Stopper” type DT-200 or equal by “UNENCO”.

2.07 WALL PLATES

A. Single and combination types match corresponding wiring devices.

   1. Plate-Securing Screws: Metal with head color to match plate finish.

   2. Material for Finished Spaces: 0.04-inch thick, Type 302, satin-finished stainless steel.

B. Security Grade Plates:

   1. Material and Finish:
      
      a. Public areas: #302 stainless steel, brush finish.

      b. Inmate accessible areas: Die formed prime 10 gauge cold rolled steel cover plates, continuous welded and ground smooth edges with security screws. 10 gauge prime cold rolled steel back plates with four (4) threaded bushings. Baked white enamel finish. Fail Safe series SSB/SPC or Kenall Series WSP/WPP, or equal by HOLCOR.

2.08 FLOOR SERVICE FITTINGS

A. Type: Modular, flush-type, dual-service units suitable for wiring method used.

B. Compartmentation: Barrier separates power and signal compartments. Coordinate with Section 17 for signal outlet combination.

C. Housing Material: Die-cast aluminum, satin finished.

D. Power Receptacle: As specified herein.

E. Signal Outlet: Blank cover with bushed cable opening, unless otherwise indicated.
2.09 MULTIOUTLET ASSEMBLIES

A. Components of Assemblies: Products from a single manufacturer designed for use as a complete, matching assembly of raceways and receptacles.

B. Raceway Material: Metal, with manufacturer's standard finish.

C. Wire: No. 12 AWG.

2.10 FINISHES

A. Color: White, unless otherwise indicated or required by Code.

B. Color: Red, for emergency power wiring devices.

C. Color: Orange, for isolated ground wiring devices.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive wiring devices for compliance with installation tolerances and other conditions affecting performance of wiring devices installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Refer to the Drawings for mounting heights.

B. Install devices and assemblies plumb and secure.

C. Install wall plates when painting is complete.

D. Install wall box dimmers to achieve indicated rating after derating for ganging as instructed by manufacturer.

E. Do not share neutral conductor on load side of dimmers.

F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical, and grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.

G. Protect devices and assemblies during painting.

H. Install security grade wall plates on wiring devices in Housing Cells, Inmate Toilets, Holding Cells, Dormitory/Dayrooms and where indicated on the Drawings.

I. Install isolated-ground receptacles on circuits fed from Security Electronics panelboards and on circuits fed from panelboards with isolated grounds.

J. Orient the toggle handles of three-way and four-way switches such that the lights are off when all toggle handles are down.
K. Install occupancy sensors as per manufacturer’s recommendations to achieve optimum coverage.

3.03 IDENTIFICATION

A. Comply with Division 16 Section "Electrical Identification."

1. Switches: Where three or more switches are ganged, and elsewhere as indicated, identify each switch with approved legend engraved on wall plate.

2. Receptacles:
   a. Panelboard and circuit numbers shall be identified on receptacle plates with engraved or etched designations with 3/16" high block letters filled with black enamel.
   b. Emergency power - Same as above except lettering shall be filled with red enamel.

3.04 CONNECTIONS

A. Connect wiring device grounding terminal to branch-circuit equipment grounding conductor.

B. Isolated-Ground Receptacles: Connect to isolated-ground conductor routed to designated isolated equipment ground terminal of electrical system.

C. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

3.05 FIELD QUALITY CONTROL

A. Test wiring devices for proper polarity and ground continuity. Operate each device at least six times.

B. Test GFCI operation with both local and remote fault simulations according to manufacturer’s written instructions.

C. Replace damaged or defective components.

D. Log tests on each device, and submit logs as part of project record documents.

3.06 CLEANING

A. Internally clean devices, device outlet boxes, and enclosures. Replace stained or improperly painted wall plates or devices.

END OF SECTION
SECTION 16190
SUPPORTING DEVICES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including General Conditions and Division-1 Specification Sections, apply to the Work of this Section.

1.02 DESCRIPTION OF WORK

A. Extent of supporting devices, sleeves, seals, telephone backboards, and access doors is specified in other Division-16 Sections, and is indicated by Drawings and by the requirements of this Section.

B. Refer to Division-3 Sections for concrete and the following related items which are not Work of Division 16 Sections:

1. Concrete housekeeping bases and reinforcing steel work related to all floor or pad mounted equipment furnished as part of the work of Division 16.

2. Placement and sizing of bases to extend minimum of 6 inches beyond equipment base in any direction (except 2 inches in the front of motor control centers and panelboards), and 4 inches above finished floor elevation.

3. Construction of reinforced concrete pads, roughening of floor slab beneath base for bond and providing steel rod anchors between floor and base, locating anchor bolts using equipment manufacturer's templates, and chamfering top and edge corners.

C. Access panels shall be supplied as part of the Work of Division-16 and in compliance with Section 08310, Access Doors and Frames. Access panels will be installed by the General Contractor.

D. Fire stops shall be supplied and installed as part of the Work of Division-16 and in compliance with Section 07840, Firestopping. Provide fire seals in all telephone/data conduit riser and sleeves after Owner has installed cables.

E. Supporting devices, sleeves, seals, and access doors furnished as part of factory-fabricated equipment, and specified as part of equipment assembly in other Division-16 Sections.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of supporting devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical supporting devices.

C. ANSI/NEMA Compliance: Comply with applicable requirements of ANSI/NEMA Std. Pub. No. FB 1, "Fittings and Supports for Conduit and Cable Assemblies".
D. NECA Compliance: Comply with National Electrical Contractors Association's “Standard of Installation” pertaining to anchors, fasteners, hangers, supports, and equipment mounting.

E. UL Compliance: Provide electrical components which are UL-listed and labeled.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's data including specifications, installation instructions, and general recommendations for each type of supporting device, sleeve, seal, telephone backboard, access door, etc. required. Include data substantiating that materials comply with requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURED SUPPORTING DEVICES

A. General: Provide supporting devices, sleeves, seals, telephone backboards, and access doors complying with manufacturer's standard materials, design and construction in accordance with published product information, and as required for a complete installation; and as herein specified.

B. Supports:

1. Provide supporting devices such as channels, cradles, saddles, gratings, hangers, clamps, steel rods, straps, anchors, bolts, nuts, inserts, etc. for a complete installation.

2. Manufacturer: Subject to compliance with requirements, provide anchors of the following:

   a. Ackerman Johnson Fastening System Inc.
   b. Elcen Metal Products Co.
   c. Ideal Industries, Inc.
   d. Joslyn Mfg. and Supply Co.
   e. McGraw Edison Co.
   f. Rawlplug Co., Inc.
   g. Star Expansion Co.
   h. U.S. Expansion Bolt Co.

C. Sleeves and Seals: Provide seals in accordance with Section 07841, “FIRESTOPPING.”

D. U-Channel Strut System:
1. Provide U-channel strut system for supporting electrical equipment, 16-gage hot dip galvanized steel, of types and sizes indicated; construct with 9/16” dia. holes, 8” o.c. on top surface, with standard green finish, and with the following fittings which mate and match with U-channel:
   a. Fixture hangers.
   b. Channel hangers.
   c. End caps.
   d. Beam clamps.
   e. Wiring Stud.
   f. Conduit clamps.
   g. Conduit hangers.
   h. U-bolts.

2. Manufacturer: Subject to compliance with requirements, provide channel systems of one of the following:
   a. B-Line Systems, Inc.
   b. Elcen Metal Products Co.
   c. Power-Strut Div.; Van Huffel Tube Corp.
   d. Unistrut Div.; GTE Products Corp.

PART 3 - EXECUTION

3.01 INSTALLATION OF SUPPORTING DEVICES

   A. Install supporting devices, sleeves, seals and access doors as indicated, in accordance with manufacturer’s written instructions and with recognized industry practices to insure compliance with requirements. Comply with requirements of NECA, NEC and ANSI/NEMA.

   B. Opening in walls, partitions, ceilings and floors shall be made with care to avoid piping, equipment and unnecessary damages. Workholes shall be a practicable minimum in size and number. Patch repair and paint in a workmanlike and approved manner.

   C. Seal all floors, walls and ceiling openings to prevent air and liquid movement and noise transmission from floor to floor and from room to room. Openings in fire rated surfaces shall be sealed with a UL classified intumescent compound, device or sheet to restore original fire rated integrity.

   D. Coordinate with other electrical Work, including raceway and wiring Work, as necessary to interface installation of supporting devices with other Work.
E. Install supporting devices dedicated to electrical Work to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install raceway supports with spacings not exceeding the maximum spacings allowed by the NEC.

F. In metal stud and lath construction, raceways may be securely wired to structural members.

G. Tighten sleeve seal nuts until sealing grommets have expanded to form watertight seal.

H. Seal gaps between lighting fixtures, outlet boxes, etc. and concrete ceilings and walls with high strength security grout.

I. Wood backing shall be provided as may be necessary for proper and substantial installation of equipment and shall be finish painted in a manner satisfactory to the Owner.

1. Comply with material requirements of Section 06105, “Miscellaneous Carpentry.”

J. Metallic sleeves through foundation wall shall be long enough to reach undisturbed earth to eliminate shear.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY
A. This Section includes identification of electrical materials, equipment, and installations.

1.03 SUBMITTALS
A. Submit under the provision of Section 01330.
B. Product Data for each type of product specified.
B. Schedule of identification nomenclature to be used for identification signs and labels.
C. Samples for each color, lettering style, and other graphic representation required for identification materials; samples of labels and signs.

1.04 QUALITY ASSURANCE
A. Comply with NFPA 70.
B. Comply with ANSI C2.

1.05 SEQUENCING AND SCHEDULING
A. Coordinate installing electrical identification after completion of finishing where identification is applied to field-finished surfaces.
B. Coordinate installing electrical identifying devices and markings prior to installing acoustical ceilings and similar finishes that conceal such items.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
   1. Brady USA, Inc.; Industrial Products Div.
   2. D&G Sign and Label.
   3. Ideal Industries, Inc.
4. Panduit Corp.

5. Seton Name Plate Co.

2.02 RACEWAY AND CABLE LABELS

A. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Conform to ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway or cable size.

1. Color: Black legend on orange field.

2. Legend: Indicates voltage.

C. Adhesive Labels: Preprinted, flexible, self-adhesive vinyl. Legend is overlaminated with a clear, weather- and chemical-resistant coating.

D. Colored Adhesive Tape: Self-adhesive vinyl tape not less than 3-mils thick by 1 to 2-inches wide. Use the following Color Code for Conduit:

- Pink: 120/208V Emergency Power.
- Red: Fire Alarm.
- Orange: 277/480V UPS Lighting System.
- White: Telephone/Data.
- Blue: 120/208V Normal Power.

E. Underground Line Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:

1. Size: Not less than 6-inches wide by 4-mils thick.

2. Compounded for permanent direct-burial service.

3. Embedded continuous metallic strip or core.

4. Printed Legend: Indicates type of underground line.

F. Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

G. Plasticized Card-Stock Tags: Vinyl cloth with preprinted and field-printed legends. Orange background, except as otherwise indicated, with eyelet for fastener.

H. Aluminum-Faced Card-Stock Tags: Weather-resistant, 18-point minimum card stock faced on both sides with embossable aluminum sheet, 0.002-inch thick, laminated with moisture-resistant acrylic adhesive, and punched for the fastener. Preprinted legends suit each application.
I. Brass or Aluminum Tags: Metal tags with stamped legend, punched for fastener. Dimensions: 2 by 2-inches by 0.05-inch thick.

2.03 ENGRAVED NAMEPLATES AND SIGNS

A. Manufacturer's Standard Products: Where more than one type is listed for a specified application, selection is Installer's option, but provide single type for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Engraving stock, melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 sq. in., 1/8 inch thick for larger sizes.
   1. Engraved Legend: White letters on black face.
   2. Punched for mechanical fasteners.

C. Baked-Enamel Signs for Interior Use: Preprinted aluminum signs, punched for fasteners, with colors, legend, and size as indicated or as otherwise required for the application. 1/4-inch grommets in corners for mounting.

D. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose acetate butyrate signs with 0.0396-inch, galvanized steel backing, with colors, legend, and size appropriate to the application. 1/4-inch grommets in corners for mounting.

E. Fasteners for Plastic-Laminated and Metal Signs: Self-tapping stainless-steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2.04 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties with the following features:
   2. Tensile Strength: 50 lb minimum.
   3. Temperature Range: Minus 40 to 185 deg F.
   4. Color: As indicated where used for color coding.

B. Paint: Alkyd-urethane enamel over primer as recommended by enamel manufacturer.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install identification devices according to manufacturer's written instructions.

B. Install labels where indicated and at locations for best convenience of viewing without interference with operation and maintenance of equipment.
C. Lettering, Colors, and Graphics: Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations used in the Contract Documents or required by codes and standards. Use consistent designations throughout the Project.

D. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work.

E. Self-Adhesive Identification Products: Clean surfaces of dust, loose material, and oily films before applying.

F. Install painted identification as follows:
   1. Clean surfaces of dust, loose material, and oily films before painting.
   2. Prime Surfaces: For galvanized metal, use single-component, acrylic vehicle coating formulated for galvanized surfaces. For concrete masonry units, use heavy-duty, acrylic-resin block filler. For concrete surfaces, use clear, alkali-resistant, alkyd binder-type sealer.
   3. Apply one intermediate and one finish coat of silicone alkyd enamel.
   4. Apply primer and finish materials according to manufacturer’s instructions.

G. Identify pullboxes, junction boxes, end of conduit, and the like of certain systems with color coding of the systems listed below for identification:

H. Install Caution Signs for Enclosures Over 250 V: Use pressure-sensitive, self-adhesive label indicating system voltage in black, preprinted on orange field. Install on exterior of door or cover.

I. Install Circuit Identification Labels on Boxes: Label externally as follows:
   1. Exposed Boxes: Pressure-sensitive, self-adhesive plastic label on cover.
   3. Labeling Legend: Permanent, waterproof listing of panel and circuit number or equivalent.

J. Identify Paths of Underground Electrical Lines: During trench backfilling, for exterior underground power, control, signal, and communications lines, install continuous underground plastic line marker located directly above line at 6- to 8-inches below finished grade. Where multiple lines installed in a common trench or concrete envelope do not exceed an overall width of 16-inches, use a single line marker.
   1. Install line marker for underground wiring, direct buried, in raceway, and ductbanks.

K. Color-Code Conductors: Secondary service, feeder, and branch circuit conductors throughout the secondary electrical system.
   1. 208/120-V System: As follows:
a. Phase A: Black.
b. Phase B: Red.
c. Phase C: Blue.
e. Ground: Green.
f. Isolated Ground: Green with Yellow stripe.

2. 480/277-V System: As follows:
   b. Phase B: Orange.
   c. Phase C: Yellow.
   d. Neutral: Gray.
   e. Ground: Green.

3. Factory-apply color the entire length of the conductors, except the following field-applied, color-coding methods may be used in lieu of factory-coded wire for sizes larger than No. 10 AWG.
   a. Colored, pressure-sensitive plastic tape in half-lapped turns for a distance of 6 inches from terminal points and in boxes where splices or taps are made. Apply the last 2 turns of tape with no tension to prevent possible unwinding. Use 1-inch wide tape in colors as specified. Adjust tape bands to avoid obscuring cable identification markings.
   b. Colored cable ties applied in groups of 3 ties of specified color to each wire at each terminal or splice point starting 3 inches from the terminal and spaced 3 inches apart. Apply with a special tool or pliers, tighten to a snug fit, and cut off excess length.

L. Power Circuit Identification: Use metal tags or aluminum wraparound marker bands for cables, feeders, and power circuits in vaults, pull boxes, junction boxes, manholes, and switchboard rooms.
   1. Legend: 1/4-inch steel letter and number stamping or embossing with legend corresponding to indicated circuit designations.
   2. Fasten tags with nylon cable ties; fasten bands using integral ears.

M. Apply identification to conductors as follows:
   1. Conductors to Be Extended in the Future: Indicate source and circuit numbers.
   2. Multiple Power or Lighting Circuits in the Same Enclosure: Identify each conductor with source, voltage, circuit number, and phase. Use color coding for voltage and phase indication of secondary circuit.
3. Multiple Control and Communications Circuits in the Same Enclosure: Identify each conductor by its system and circuit designation. Use a consistent system of tags, color coding, or cable marking tape.

N. Apply warning, caution, and instruction signs and stencils as follows:

1. Install warning, caution, and instruction signs where indicated or required to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved, plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install butyrate signs with metal backing for outdoor items.

2. Emergency-Operating Signs: Install engraved laminate signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

O. Install identification as follows:

1. Apply equipment identification labels of engraved plastic laminate on each major unit of equipment, including central or master unit of each system. This includes communication, signal, and alarm systems, unless units are specified with their own self-explanatory identification. Except as otherwise indicated, provide a single line of text with 1/2-inch high lettering on 1-1/2-inch high label; where 2 lines of text are required, use label 2 inches high; where three lines of text are required use 2-1/2 inches high. Text shall include component identification tag, source of power, and load served. Use white lettering on black field. Apply labels for each unit of the following categories of equipment.

   a. Panelboards, electrical cabinets, and enclosures.

   b. Access doors and panels for concealed electrical items.

   c. Electrical switchgear and switchboards.

   d. Motor control centers.

   e. Motor starters.

   f. Variable frequency drives.

   g. Disconnect switches.

   h. Push-button stations.

   i. Power transfer equipment.

   j. Contactors.

   k. Remote-controlled switches.

   l. Control devices.

   m. Transformers.

   n. Power-generating units.
o. Ground bus bars.

p. Ground bonds at piping systems.

q. Fire-alarm master station or control panels.

2. Apply designation labels of engraved plastic laminate for disconnect switches, breakers, push buttons, pilot lights, motor control centers, and similar items for power distribution and control components above.

3. For panelboards, provide framed, typed circuit schedules with explicit description and identification of items controlled by each individual breaker.

4. Provide red handles on circuit breakers feeding security panelboards, and clearly label as “Security Electronics.”

P. Provide a separate one-line diagram in each of the electrical rooms depicting that building’s electrical distribution system. Mount the diagram on the wall in a metal or wood frame under glass at a location for best convenience of viewing without interference with operation and maintenance of equipment. Diagram shall be “B” size (11” x 17”) or “C” size (17” x 22” or 18” x 24”). Secure to substrate with fasteners, except use adhesive where fasteners should not or cannot penetrate the substrate.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including General Conditions and Division-1 Specification Sections, apply to the Work of this Section.

1.02 DESCRIPTION OF WORK

A. Work included in this Section, but not limited to:

1. Short Circuit Study.
2. Protective device evaluation study.
3. Protective device coordination study.

1.03 GENERAL SCOPE

A. Under this Section, the Contractor shall provide a power system study in accordance with the requirements hereinafter listed. The cost of the study and all subsequent related work such as equipment, selective trips, relays, adjustments, calibration and circuit breaker settings, etc., shall be borne by the Contractor and shall be included in his bid.

B. Short circuit study, protective device evaluation study and protective device coordination study shall be performed by the vendor or a recognized independent electrical testing laboratory. The study shall be stamped and certified by an electrical engineer registered in the State of California. The studies shall be submitted to and received by the Engineer before approval of the distribution equipment shop drawings can be made and/or prior to written release for manufacture of the equipment.

C. The studies shall include all portions of the electrical distribution system from the normal power sources down to and including the branch circuits.

D. The short circuit study shall be in accordance with ANSI C37.5-1969 (R1975), IEEE St’d. 399-1990 and IEEE St’d 141-1993.

A. The short circuit study shall be performed with the aid of a digital computer program.

B. The study input data shall include the power company's short circuit contribution, resistance and reactance components of the branch impedances, the X/R ratios, base quantities selected and other source impedances.

C. Short circuit momentary duty values and interruption duty values shall be calculated on the basis of assumed three-phase bolted short circuits at switchboard, low voltage motor control center, distribution panelboard, pertinent branch circuit panel and other significant locations through the system. The short circuit tabulations shall include location identification, nominal voltage level, current phase angle equivalent Z, in per unit values asymmetrical current based on X/R ratio, symmetrical fault currents in KA and MVA and X/R ratio. For each fault location, the total duty on the bus, as well as the individual contribution from each connected branch, shall be listed in KILO AMPS along with phase angle fault current with its respective X/R ratios.

D. In addition to the tabulation, the symmetrical short circuit currents will be provided on a single line diagram of the system. Total fault current for each location as well as branch contribution shall be plotted.

3.02 PROTECTIVE DEVICE EVALUATION STUDY

A. A protective device evaluation study shall be performed to determine the adequacy of circuit breakers, molded case switches, automatic transfer switches, and fuses by tabulating and comparing the short circuit ratings of these devices with the calculated fault currents. Appropriate multiplying factors based on system X/R ratios and protective device rating standards shall be applied and the percent difference between the two values shall be included. Ensure that all equipment characteristics are in compliance with the study.

3.03 PROTECTIVE DEVICE COORDINATION STUDY

A. A protective device coordination study shall be performed to provide the necessary calculations and logic decisions required to select or to check the selection of protective relay characteristics and settings, ratios and characteristics of associated current transformers and low voltage breaker trip characteristics and settings. The objective of the study is to obtain protective and coordination performance from these devices.

B. The coordination study shall include all high voltage and low voltage classes of equipment from the utility down to and including the largest rated device in the MCC and panelboard. The phase and ground overcurrent protection shall be included as well as settings of all other adjustable protective devices.
C. The time-current characteristics of the specified protective devices shall be drawn on log-log graphs. The plots shall include complete titles, representative on-line diagram and legends, significant motor starting characteristics, complete parameters of transformers, complete operating bands of low voltage circuit breaker trip curves and fuses. The coordination plots shall indicate the type of protective devices selected, proposed relay taps, time dial and instantaneous trip settings, transformer magnetizing inrush and ANSI transformer withstand parameters, cable thermal overcurrent withstand limits and significant symmetrical and asymmetrical fault currents. All restrictions of the National Electric Code shall be adhered to and proper coordination intervals and separation of characteristic curves shall be maintained. The coordination intervals and separation of characteristic curves shall be maintained. The coordination plots for phase and ground protective devices shall be provided on a system basis. A sufficient number of separate curves shall be used to clearly indicate the coordination achieved.

D. The selection and settings of the protective devices shall be provided separately in a tabulated form listing circuit identification, IEEE device number, current transformer ratios and connection, manufacturer and type, range of adjustment and recommended settings.

3.04 STUDY REPORT

A. The results of the power system study shall be summarized in a final report. Five (5) bound copies of the final report shall be submitted.

B. The report shall include the following sections:

1. Description, purpose, basis and scope of the study findings and recommendations and a single line diagram of that portion of the power system which is included within the scope of the study.

2. Tabulations of circuit breaker, fuse and other protective device ratings versus calculated short circuit duties and commentary regarding same.

3. Protective device time versus current coordination curves, tabulations of relay and circuit breaker trip settings, fuse selection and commentary regarding same.

4. Fault current calculations including a definition of terms and guide for interpretation of computer printout.

3.05 PROTECTIVE DEVICE TESTING, CALIBRATION AND ADJUSTMENT

A. The equipment manufacturer shall provide the services of a qualified field engineer and necessary tools and equipment to test, calibrate and adjust the protective relays and circuit breaker trip devices as recommended in the power system study.

END OF SECTION
PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Arrangement with Utility Company for permanent electric service, including payment of Utility Company charges for service.

B. Underground service entrance.

C. Metering equipment.

1.02 REFERENCES


1.03 SYSTEM DESCRIPTION

A. Utility Company: Los Angeles Department Water & Power “DWP”

B. System Characteristics: 277/480 volts, three phase, four-wire, 60 Hertz.

C. Service Entrance: Contractor to coordinate complete requirements with Los Angeles Department of Water and Power “DWP” prior to bid and rough-in.

1.04 SUBMITTALS

A. Submit under provisions of Section 01330 Shop Drawings / Submittals.

B. Submit Utility Company prepared drawings.

1.05 QUALITY ASSURANCE

A. Perform Work in accordance with Utility Company written requirements.

B. Maintain one copy of each document on site.

1.06 REGULATORY REQUIREMENTS

A. Conform to requirements of ANSI/NFPA 70.

B. Furnish products listed and classified by Underwriters Laboratories, Inc. as suitable for purpose specified and shown.

1.07 PRE-INSTALLATION CONFERENCE

A. Convene two weeks prior to commencing work of this Section, under provisions of Section 01310 Administrative Requirements.

1.08 FIELD MEASUREMENTS

A. Verify that field measurements are as indicated on Utility Company drawings.
PART 2 - PRODUCTS

2.01 UTILITY METERS
   A. Meters will be furnished by Utility Company.

2.02 UTILITY METER BASE
   A. Meter base will be furnished as per DWP requirement.

2.03 METERING TRANSFORMER CABINET
   A. Manufacturers:
      1. Substitutions: Under provisions of Section 01630 Substitutions and “Or Equal” Submittal.
      2. Size: As indicated on drawings.
      3. Include provisions for padlocking and sealing.

2.04 TRANSFORMER PAD
   A. Manufacturers:
      1. Substitutions: Under provisions of Section 01630 Substitutions and “Or Equal” Submittal.
      2. Description: Precast concrete transformer pad with cable pit sized as indicated on Drawings and “DWP” requirements.

PART 3 - EXECUTION

3.01 EXAMINATION
   A. Verify conditions under provisions of Section 01330 Administrative Requirements.
   B. Verify that service equipment is ready to be connected and energized.

3.02 PREPARATION
   A. Make arrangements with Utility Company to obtain permanent electric service to the Project.
   B. Coordinate location of Utility Company’s facilities to ensure proper access is available.

3.03 INSTALLATION
   A. Install service entrance conduits in concrete envelope from Utility Company’s pad-mounted transformer to building service entrance equipment. Utility Company will connect service lateral conductors to service entrance conductors.
   B. Provide cast-in-place concrete pad for Utility Company transformer, under the provisions of Section 03300.
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes service and distribution switchboards rated 600 V and less.

B. Related Sections include the following:

1. Section 16195, "Electrical Identification" for identification materials.

2. Section 16452, “Grounding.”


1.03 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. RFI: Radio-frequency interference.

D. RMS: Root mean square.

E. SPDT: Single pole, double throw.

F. TVSS: Transient voltage surge suppressor.

1.04 SUBMITTALS

A. Submit under the provisions of Section 01330.

B. Product Data: For each type of switchboard, overcurrent protective device, TVSS device, ground-fault protector, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

C. Shop Drawings: For each switchboard and related equipment.

1. Dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details for types other than NEMA 250, Type 1.
b. Bus configuration, current, and voltage ratings.

c. Short-circuit current rating of switchboards and overcurrent protective devices.

d. Descriptive documentation of optional barriers specified for electrical insulation and isolation.

e. Utility company's metering provisions with indication of approval by utility company.

f. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

2. Wiring Diagrams: Diagram power, signal, and control wiring and differentiate between manufacturer-installed and field-installed wiring.

D. Manufacturer Seismic Qualification Certification: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Section 16100, “Electrical Equipment Noise Control, Vibration Isolation, and Seismic Restraints.” Include the following:

1. Basis of Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

2. The term "withstand" means "the unit will remain in place without separation of internal and external parts during a seismic event and the unit will be fully operational after the event."

3. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.

4. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

E. Manufacturer's Local Experience: Submit list of projects successfully completed the past 5-years within the Los Angeles, California.

F. Field Test Reports: Submit written test reports and include the following:

1. Test procedures used.

2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

G. Manufacturer's field service report.

H. Maintenance Data: For switchboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Section 01700, "Project Closeout," include the following:

1. Routine maintenance requirements for switchboards and all installed components.
2. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

3. Time-current curves, including selectable ranges for each type of overcurrent protective device.

4. Operating instructions, including those noted in 3.03.E.

1.05 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NEMA PB 2.

C. Comply with NFPA 70.

D. Comply with UL 891.

E. Product Selection for Restricted Space: Drawings indicate maximum dimensions for switchboards, including clearances between switchboards, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver in sections of lengths that can be moved past obstructions in delivery path.

B. Store indoors in clean dry space with uniform temperature to prevent condensation. Protect from exposure to dirt, fumes, water, corrosive substances, and physical damage.

C. If stored in areas subjected to weather, cover switchboards to provide protection from weather, dirt, dust, corrosive substances, and physical damage. Remove loose packing and flammable materials from inside switchboards; install electric heating (250-W per section) to prevent condensation.

D. Handle switchboards according to NEMA PB 2.1.

1.07 PROJECT CONDITIONS

A. Environmental Limitations: Rate equipment for continuous operation under the following, unless otherwise indicated:

   1. Ambient Temperature: Not exceeding 104 deg F.
   2. Altitude: Not exceeding 6600 feet.

B. Service Conditions: NEMA PB2, service conditions, as follows:

   1. Altitude not exceeding 6600 feet.
   2. Ambient temperatures within limits specified.

1.08 COORDINATION
A. Coordinate layout and installation of switchboards and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Section 03300, "Cast-in-Place Concrete."

1.09 EXTRA MATERIALS

A. Spares: For the following:
   1. Control-power fuses.

B. Spare Indicating Lights: Six of each type installed.

PART 2 - PRODUCT

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Square D Co.
   3. Eaton Corp.; Cutler-Hammer Products

2.02 MANUFACTURED UNITS

A. Front- and Rear-Accessible Switchboard: Front and rear aligned, with features as follows:
   1. Main Devices: Fixed, individually mounted.
   2. Branch Devices: Individually compartmented and fixed mounted.

B. Nominal System Voltage: 480Y/277 V.

C. Main-Bus Continuous: 2000 A or as shown on Single Line diagrams.

2.03 FABRICATION AND FEATURES

A. Enclosure: Steel: NEMA 250, Type 1.

B. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.

C. Barriers: Between adjacent switchboard sections.

D. Isolation for main bus of main section and main and vertical buses of feeder sections.
E. Customer Metering: Provided with digital meter.

F. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.

G. Removable, Hinged Rear Doors and Compartment Covers: Secured by captive thumb screws, for access to rear interior of switchboard.

H. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.

I. Buses and Connections: Three phase, four wire, unless otherwise indicated. Include the following features:

      a. If bus is aluminum, use copper or tin-plated aluminum for circuit breaker line connections.
      b. If bus is copper, use copper for feeder circuit breaker line connections.

   2. Load Terminals: Rigidly braced, silver-plated, copper runback bus extensions equipped with compression lugs for outgoing circuit conductors. Provide load terminals for future circuit breaker positions at full ampere rating as indicated.

   3. Ground Bus: 1/4-by-2-inch minimum size, drawn-temper copper of 98 percent conductivity, equipped with pressure connectors for feeder and branch-circuit ground conductors. For busway feeders, extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.


   5. Main Phase Buses, Neutral Buses, and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.


   7. Neutral Buses: 100 percent of the ampacity of the phase buses equipped with pressure connectors for outgoing circuit neutral cables. Bus extensions for busway feeder neutral bus are braced.

J. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit breaker compartment.

2.04 TVSS DEVICES

A. Integral Transient Voltage Surge Suppressors

   1. TVSS devices shall be Listed and Component Recognized in accordance with UL 1449 Second Edition to include Section 37.3 highest fault current category. TVSS devices shall be UL 1283 listed.

   2. TVSS devices shall be installed by and shipped from the electrical distribution equipment manufacturer's factory.
3. TVSS devices shall provide surge current diversion paths for all modes of protection; L-N, L-G and N-G in WYE systems.

4. TVSS devices shall be modular in design. Each mode including N-G shall be fused with a 200kAIR UL recognized surge rated fuse and incorporate a thermal cutout device.

5. Audible diagnostic monitoring shall be by way of audible alarm. This alarm shall activate upon a fault condition. An alarm on/off switch shall be provided to silence the alarm. An alarm push to test switch shall be provided.

6. If a dedicated breaker for the TVSS is not provided, the TVSS shall include a UL Recognized disconnect switch.

7. TVSS devices shall meet or exceed the following criteria:
   a. Minimum surge current capability (single pulse rated) per phase shall be: 240kA per phase.
   b. UL 1449 Suppression Voltage Ratings:

<table>
<thead>
<tr>
<th>VOLTAGE</th>
<th>L-N</th>
<th>L-G</th>
<th>N-G</th>
</tr>
</thead>
<tbody>
<tr>
<td>208Y/120V</td>
<td>400V</td>
<td>400V</td>
<td>400V</td>
</tr>
<tr>
<td>480Y/277V</td>
<td>600V</td>
<td>600V</td>
<td>600V</td>
</tr>
</tbody>
</table>

8. TVSS devices shall have a minimum EMI/RFI filtering of -50dB at 100kHz with an insertion ratio of 50:1 using MIL-STD-220A methodology.

9. TVSS devices shall be provided with one set of NO/NC dry contacts.

10. TVSS devices shall have a warranty for a period of five years, incorporating unlimited replacement of suppressor parts. Warranty shall be the responsibility of the electrical distribution equipment manufacturer and shall be supported by their respective field services organization.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Electronic Circuit Breaker:

B. Features and Accessories:
   1. Circuit breaker(s) shall have power terminals to accommodate either cable or bolted bus connections.
   2. Circuit protective devices shall be two-step stored energy type circuit breaker, they shall be UL Listed for 100% continuous current when applied in switchboards. Sensor (frame) ampere ratings shall be as shown on the drawings
   3. Electronic Trip System:

      a. The entire trip system shall be a microprocessor-based, true rms sensing design.
b. Provide the following time/current curve shaping adjustments to maximize system selective coordination. Each adjustment shall have discrete settings and each function is independent from all other adjustments.

c. [LSI]:

- Adjustable Long Time Ampere Rating and Delay.
- Adjustable Short Time Pickup and Delay (delay includes I²t IN and I²t OUT).
- Adjustable Defeatable Instantaneous Pickup (with OFF position).
- High Level Selective Override

4. Equipment Ground Fault Protection:

a. Circuit breaker(s) shall be provided with integral equipment protection for grounded systems.

b. The ground fault system shall be of the residual type.

c. Circuit breaker(s) shall be provided with zone selective interlocking (ZSI) on the Ground Fault function in order to limit thermal stress caused by a fault, yet permit optimum coordination with all other electronic trip circuit breakers.

2.06 INSTRUMENTATION

A. Instrument Transformers: NEMA EI 21.1, IEEE C57.13, and the following:

1. Current Transformers: Ratios shall be as indicated with accuracy class and burden suitable for connected relays, meters, and instruments.

2. Control-Power Transformers: Dry type, mounted in separate compartments for units larger than 3 kV.


B. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:

1. See Section 16442, “Power Meters.”

2.07 CONTROL POWER

A. Control Circuits: 120 V, supplied through secondary disconnecting devices from control-power transformer.

B. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.

C. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.
PART 3 - EXECUTION

3.01 PROTECTION

A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions.

3.02 EXAMINATION

A. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.03 INSTALLATION

A. Install switchboards and accessories according to NEMA PB 2.1.

B. Support switchboards on concrete bases, 4-inch nominal thickness.

C. Comply with mounting and anchoring requirements specified in Section 16100, “Electrical Equipment Noise Control, Vibration Isolation and Seismic Restraints.”

D. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.

E. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic or glass. Mount on front of switchboards.

3.04 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in 16195, "Electrical Identification."

B. Switchboard Nameplates: Label each switchboard compartment with engraved laminated-plastic nameplate mounted with corrosion-resistant screws.

3.05 CONNECTIONS

A. Install equipment grounding connections for switchboards with ground continuity to main electrical ground bus.

B. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values. If manufacturer’s torque values are not indicated, use those specified in UL 486A and UL 486B.

3.06 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Testing Agency: Engage a qualified independent testing agency to perform specified testing. Submit substantiation of qualifications.

C. Testing: After installing switchboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Sections 7.1, 7.5, 7.6, 7.9, 7.10, 7.11, and 7.14 as appropriate. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.07 ADJUSTING

A. Set field-adjustable switches trip ranges.

3.08 CLEANING

A. On completion of installation, inspect interior and exterior of switchboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS
   A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY
   A. This Section includes Power Metering.
   B. Related sections include the following:
      1. Section 16441 - Switchboards

1.04 SUBMITTALS
   A. Submit under the provisions of Section 01330.
   B. Product Data.
   C. Shop Drawings.
   D. Maintenance Data: For materials and products to include in maintenance manuals specified in Division 1.

1.05 QUALITY ASSURANCE
   A. Electrical Components: Listed and labeled as defined in NFPA 70, Article 100.
   B. Vendor shall be ISO 9000 registered to demonstrate quality compliance.

1.06 REFERENCES
   A. All Power Meters shall be UL 508 Listed, CSA approved, and have CE marking. They shall also have certified revenue accuracy as per ANSI C12.20 0.5 class.
   B. The system shall comply with the applicable portions of NEMA standards. In addition, the control unit shall comply with FCC Emission Standards specified in Part 15, Sub-part J for Class A application.

PART 2 - PRODUCTS

2.01 POWER METERS
   A. The Power Meter shall be accurate to 0.075% of reading plus 0.025% of full scale for voltage and current sensing, and 0.15% of reading plus 0.025% of full scale for power and energy, accurate through the 63rd harmonic.
      1. These accuracies shall be maintained for both light and full loads.
2. No annual recalibration by users shall be required to maintain these accuracies.

3. Voltage and current for all phases shall be sampled simultaneously to assure high accuracy.

B. The meter shall be UL Listed per UL 508, CSA recognized under C22.2, CE compliant, and tested for EMC in accordance with the IEC 1000-2, 1000-4, 1000-5 series of electrical tests (level 4), FCC compliant per FCC Part 15, Class A, and vibration and temperature tested. The meter module shall be rated for an operating temperature range of 0°C to 60°C.

C. The Power Meter metering inputs shall utilize current transformers for the current inputs. It shall be rated 5A nominal and 10A full scale. In addition, it shall be industrially and utility hardened to have an overload withstand rating of 15A continuous and 500A for 1 second.

D. The device shall not require potential transformers or control power transformers when applied at 600V or less. The power meter shall accept control power over a range of 90-600Vac, 50 or 60 Hz, or 100-350Vdc.

E. Each Power Meter shall have built-in RS-485 data communications to allow multipoint communication to multiple computer workstations, programmable controllers, and other host devices, up to a data rate of 38,400 baud.

F. All information shall be available from the display or via RS-485 communications. It shall be possible to perform the setup via the display. No dip switches or other hardware adjustments shall be required for setup.

G. The power meter shall be installed as part of a power monitoring and control system as indicated on the drawings. The RS-485 communications shall provide communications links up to 10,000 feet long.

H. The power meter shall communicate using:
   1. The Modbus RTU and JBus protocol and connect to any host devices with a Modbus-compatible port.
   2. The POWERLOGIC protocol and shall connect to any host devices with a POWERLOGIC compatible port.
   3. The three protocols mentioned above shall reside in the meter from the factory and be field selectable as part of setup.

I. The data communications shall be optically isolated to provide reliable operation.

J. When connected via the network to a POWERLOGIC computer, the power meter shall provide logging, trending, and alarming information.

K. Each Power Meter shall be equipped with a backlit, two-line LCD display as indicated on the project drawings.

L. To facilitate ease in mounting, the display shall be capable of being mounted up to 50 feet (15 meters) from the metering module using RJ-11 terminated communications cable. Regardless of mounting configuration, the display shall always be optically isolated from the power meter module.
M. The display shall scale readings automatically, without the need for multipliers.

N. All setup information and reset commands shall be password protected.

O. The power meter shall provide diagnostics to troubleshoot mis-wired installations.

P. A KYZ pulse initiator for communication of kWh, kVARh, or kVAh information to third party energy management systems shall be provided.

Q. The information and capabilities provided by the Power Meter shall include the following:

1. Power Meter Model 820 shall provide the following metered values:
   a. Current, per-phase
   b. Voltage, phase-to-phase & phase-neutral
   c. Real Power (kW), per phase & three-phase total
   d. Reactive Power (kVAR), per phase & three phase total
   e. Apparent Power (kVA), per phase & three phase total
   f. Power Factor (true), per-phase & three-phase total
   g. Frequency readings
   h. Real Energy (kWh), three phase total
   i. Reactive Energy (kVARh), three phase total
   j. Apparent Energy (kVAh), three phase total
   k. Energy Accumulation modes, signed, absolute, energy in, energy out
   l. Neutral current measurements
   m. Demand Current, per-phase & neutral, present & peak
   n. Real Power Demand (kWd) readings, three phase total, present & peak
   o. Reactive Power Demand (kVARd) readings, three phase total, present & peak
   p. Apparent Power Demand (kVAd) readings, three phase total, present & peak
   q. Total Harmonic Distortion (THD) readings, voltage & current, per phase
   r. Date and Time Stamping, peak demands, power up/restart and resets
   s. Onboard alarms for over/under voltages (per phase L-L, L-N), over/under currents (per phase, neutral), over/under frequency, current unbalance (per phase), and voltage unbalance (per phase L-L, L-N)
   t. Minimum and maximum readings
u. Onboard memory provided

v. Relay output capability provided

2. Power Meter Model 850 includes all of the readings provided by the Model 820 plus:

   a. Advanced demand calculations shall include:

      1) User defined demand intervals

      2) User defined sliding or rolling block demand

      3) Synchronization of demand interval to utility pulse

      4) Predicted power demand for real, reactive and apparent power

   b. Trending and Forecasting

   c. Waveform Capture

3. The Power Meter shall be a PM820 series manufactured by Square D Company or equal.

   END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes grounding of electrical systems and equipment and basic requirements for grounding for protection of life, equipment, circuits, and systems. Grounding requirements specified in this Section may be supplemented in other Sections of these Specifications.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 16120, "Conductor and Cables" for requirements for grounding conductors.

2. Section 17040, “Grounding and Surge Protection.”

1.03 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections 01330.

B. Product Data for grounding rods, connectors and connection materials, and grounding fittings.

C. Qualification data for firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

D. Field tests and observation reports certified by the testing organization and indicating and interpreting the test reports for compliance with performance requirements.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1. Testing Agency Field Supervision: Use persons currently certified by NETA or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Comply with NFPA 70.

C. Comply with UL 467.
D. Listing and Labeling: Provide products specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

1.05 REFERENCE STANDARDS


C. IEEE Std. 142-1982 “Grounding of Industrial and Commercial Power Systems” (Green Book).


PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:


2. Erico Inc.; Electrical Products Group.

3. ILSCO.

4. O-Z/Gedney Co.

5. Thomas & Betts, Electrical.

2.02 GROUNDING AND BONDING PRODUCTS

A. Governing Requirements: Where types, sizes, ratings, and quantities indicated are in excess of National Electrical Code (NEC) requirements, the more stringent requirements and the greater size, rating, and quantity indications govern.

2.03 WIRE AND CABLE GROUNDING CONDUCTORS

A. Comply with Division 16 Section "Conductors and Cables." Conform to NEC Table 8, except as otherwise indicated, for conductor properties, including stranding.

1. Material: Copper. Use only copper wire for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
B. Equipment Grounding Conductors: Insulated with green color insulation.

C. Isolated Grounding Conductor: Insulated with green color insulation and yellow stripe.

D. Grounding-Electrode Conductors: Stranded cable.

E. Bare Copper Conductors: Conform to the following:

2.04 MISCELLANEOUS CONDUCTORS

A. Grounding Bus: Bare, annealed-copper bars of rectangular cross section.

B. Braided Bonding Jumpers: Copper tape, braided No. 30 AWG bare copper wire, terminated with copper ferrules.

C. Bonding Straps: Soft copper, 0.05 inch thick and 2 inches wide, except as indicated.

2.05 CONNECTOR PRODUCTS

A. Pressure Connectors: High-conductivity-plated units.

B. Bolted Clamps: Heavy-duty type.

C. Exothermic-Welded Connections: Provided in kit form and selected per manufacturer's written instructions for specific types, sizes, and combinations of conductors and connected items.

2.06 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel.
   1. Size: 3/4 inch diameter by 10 ft long.

B. Test Wells: Fabricate from 15-inch long, square-cut sections of 8-inch diameter, Schedule 80, PVC pipe, or precast nonmetallic fiber reinforced epoxy enclosure.

PART 3 - EXECUTION

3.01 APPLICATION

A. Equipment Grounding Conductors: Comply with NEC Article 250 for types, sizes, and quantities of equipment grounding conductors, except where specific types, larger sizes, or more conductors than required by NEC are indicated.

   1. Install equipment grounding conductor with feeders and branch circuit conductors.

   2. Isolated Ground- Receptacle Circuits: Install a separate insulated isolated grounding conductor connected to the receptacle grounding terminal. Isolate grounding conductor from raceway and from panelboard grounding terminals. Terminate at the
isolated ground bar terminal of the applicable derived system or service, except as otherwise indicated.

3. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

B. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide a No. 4 AWG minimum insulated grounding conductor in raceway from grounding-electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.


2. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

C. Separately Derived Systems: Where NEC requires grounding, ground according to NEC Article 250.

3.02 INSTALLATION

A. General: Ground electrical systems and equipment according to NEC requirements, except where Drawings or Specifications exceed NEC requirements.

B. Electrical Room Grounding Bus (ERGB): Space 1 inch from wall and 6 inches above finished floor, except as otherwise indicated. Install ERGB in a NEMA 1 enclosure.

C. Ground Rods: Locate a minimum of 1-rod length from each other and at least the same distance from any other grounding electrode.

1. Drive until tops are not less than 2 inches below finished floor or final grade, except as otherwise indicated.

2. Interconnect with grounding-electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make these connections without damaging copper coating or exposing steel.

D. Grounding Conductors: Route along the shortest and straightest paths possible, except as otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

E. Metal Water Service Pipe: Provide insulated copper grounding conductors, sized as indicated, in conduit, from building’s main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding-clamp connectors. Where a dielectric main water fitting is installed, connect grounding conductor to street side of fitting. Do not install a grounding jumper across dielectric fittings. Bond grounding-conductor conduit to conductor at each end.

F. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding-clamp connectors.

G. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.
H. Test Wells: One for each driven grounding electrode, except as otherwise indicated. Set top of well flush with finished grade or floor. Fill with 1-inch maximum-size crushed stone or gravel.

I. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NEC Paragraph 250-81(c), using a minimum of 20 feet of bare copper conductor not smaller than No. 4 AWG. Where base of concrete foundation is less than 20 feet in length, coil excess conductor within base of concrete foundation. Bond grounding conductor to reinforcing steel at least 4 locations, and to anchor bolts.

J. Bond building ground ring to underground metallic piping where they intersect.

K. Equipotential Grounding Plane Between Power System Grounding and Division 17 Grounding System: Provide an equipotential grounding plane between the main electrical electrode system and the grounding system provided for Division 17 under Section 17040 - Grounding and Surge Protection.

3.03 CONNECTIONS

A. General: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to assure high conductivity and to make contact points closer in order of galvanic series.

2. Make connections with clean, bare metal at points of contact.


5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells. Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding-Wire Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: Where metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at both entrances and exits with grounding bushings and bare grounding conductors, except as otherwise indicated.

E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and grounding rods.
F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. Where these requirements are not available, use those specified in UL 486A and UL 486B.

G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by manufacturer of connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

H. Moisture Protection: Where insulated grounding conductors are connected to grounding rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.04 FIELD QUALITY CONTROL

A. Independent Testing Agency: Engage an independent electrical testing organization to perform tests described below.

B. Tests: Subject the completed grounding system to a megger test at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than 2 full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the 2-point method according to IEEE 81 using a Biddle earth resistance test instrument or equal.

C. Maximum grounding to resistance values are as follows:

1. Equipment Rated 1000 kVA and less: 5 ohms.
2. Equipment Rated More than 1000 kVA: 3 ohms.

D. Excessive Ground Resistance: Where resistance to ground exceeds specified values, promptly notify the Contractor and Architect and submit recommendations to reduce the ground resistance. After approval of the Contractor and Architect, perform the recommended procedures and retest the system.

E. Report: Submit five (5) copies of the certified test report which shall bear the seal of the registered test engineer who performed the tests and contain:

1. The project name, date, and location of test.
2. Instruments serial number and type used.
3. Observations of weather and other phenomena that may affect test results.
4. A list of participants which includes their qualifications.
5. Description of testing method.
6. Sketch(es) showing layout of the ground system, including ground rod location and associated resistivity measurement and location of test probes.
7. Extensive and detailed recommendations for the improvement of grounding deficiencies if encountered.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary
   Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes dry-type distribution and specialty transformers rated 1000V and
   less.

1.03 SUBMITTALS

A. Submit under the provisions of Section 01330.

B. Product Data: Include data on features, components, ratings, and performance for each
   type of transformer specified. Include dimensioned plans, sections, and elevation views. Show
   minimum clearances and installed devices and features.

C. Wiring Diagrams: Detail wiring and identify terminals for tap changing and connecting
   field-installed wiring.

D. Product Certificates: Signed by manufacturers of transformers certifying that the
   products furnished comply with requirements.

E. Qualification Data: For firms and persons specified in "Quality Assurance“ Article.

F. Factory Test Reports: Certified copies of manufacturer's design and routine factory tests
   required by referenced standards.

G. Sound-Level Test Reports: Certified copies of manufacturer's sound-level tests
   applicable to equipment for this Project.

H. Field Test Reports: Indicate and interpret test results for tests specified in Part 3.

I. Maintenance Data: For transformers to include in the maintenance manuals specified in
   Division 1.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: In addition to requirements specified in Section 01453,
   “Quality Control,” an independent testing agency shall meet OSHA criteria for
   accreditation of testing laboratories, Title 29, Part 1907; or shall be a full-member
   company of the InterNational Electrical Testing Association.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational
   Electrical Testing Association or the National Institute for Certification in Engineering
   Technologies, to supervise on-site testing specified in Part 3.
B. Listing and Labeling: Provide transformers specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.


C. Comply with IEEE C2.

D. Comply with NFPA 70.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit throughout periods during which equipment is not energized and is not in a space that is continuously under normal control of temperature and humidity.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering transformers that may be incorporated into the Work include, but are not limited to, the following:

1. Square D; Schneider Electric

2. Eaton Corp; Cutler-Hammer Products.


2.02 TRANSFORMERS, GENERAL

A. General: Except as otherwise indicated, provide manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by manufacturer, and as required for complete installation.

B. Low Voltage Dry-Type K-rated

1. Distribution Transformers: Provide factory-assembled, general-purpose, air cooled, ventilated dry-type, distribution transformers of sizes, characteristics, and rated capacities as required; three-phase; 60-hertz, 10 kV BIL, K-13 rated, manufacturers standard impedance, shielded isolation, with 480-volts delta connection primary and 208/120 volts secondary wye connected. Provide primary winding with 6 taps; 2-2 1/2% FCAN and 4-2 1/2% FCBN for de-energized tap-changing operation. Insulate with Class 220 insulation. Rate transformer for continuous operation at rated KVA with 150 degrees C average temperature rise on windings. Limit transformer surface temperature rise to maximum of 65 degrees C. Provide terminal enclosure, with cover, to accommodate primary and secondary coil wiring connections and electrical supply raceway terminal connector. Equip terminal leads with connectors installed. Limit terminal compartment temperature to 90 degree C when transformer is
operating continuously at rated load with ambient temperature of 40 degrees C. Provide wiring connectors suitable for copper wiring. Neutral bars shall be sized for at least 200% ampacity of the secondary phase conductors. Cushion-mount transformers with external vibration isolation supports; sound-level ratings in accordance with ANSI/NEMA standards. Electrically ground core and coils to transformer enclosure by means of flexible metal grounding strap. Provide transformers with fully-enclosed sheet steel enclosure. Apply manufacturer's standard light grey indoor enamel over cleaned and phosphatized steel enclosure.

C. Low Voltage Dry-Type - High Efficiency transformers

1. Rating Information

   a. All insulating materials are to exceed NEMA ST20 standards and be rated for 220°C UL component recognized insulation system.

   b. Transformers 15kVA and larger shall be 150°C temperature rise above 40°C ambient. Transformers 25kVA and larger shall have a minimum of 4-2.5% full capacity primary taps. Exact voltages and taps to be as designed on the plans or the transformer schedule.

   c. The maximum temperature of the top of the enclosure shall not exceed 50°C rise above a 40°C ambient.

2. Transformers shall be low loss type with minimum efficiencies per NEMA TP1 when operated at 35% of full load capacity. Efficiency shall be tested in accord with NEMA TP2.

<table>
<thead>
<tr>
<th>Single Phase</th>
<th>Three Phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>kVA</td>
<td>Efficiency</td>
</tr>
<tr>
<td>15</td>
<td>97.7%</td>
</tr>
<tr>
<td>25</td>
<td>98.0%</td>
</tr>
<tr>
<td>37.5</td>
<td>98.2%</td>
</tr>
<tr>
<td>50</td>
<td>98.3%</td>
</tr>
<tr>
<td>75</td>
<td>98.5%</td>
</tr>
<tr>
<td>100</td>
<td>98.6%</td>
</tr>
<tr>
<td>167</td>
<td>98.7%</td>
</tr>
<tr>
<td>250</td>
<td>98.8%</td>
</tr>
<tr>
<td>333</td>
<td>98.9%</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

D. Equipment/System Identification: Provide equipment/system identification nameplates complying Section 16055 “Electrical Identification”.

E. Finish: Coat interior and exterior surfaces of transformer, including bolted joints, with manufacturer's standard color baked-on enamel.

2.03 CONTROL AND SIGNAL TRANSFORMERS

A. Units comply with NEMA ST 1 and are listed and labeled as complying with UL 506.
B. Ratings: Continuous duty. If rating is not indicated, provide capacity exceeding peak load by 50 percent minimum.

C. Description: Self-cooled, 2 windings.

2.04 FINISHES

A. Indoor Units: Manufacturer's standard paint over corrosion-resistant pretreatment and primer.

2.05 SOURCE QUALITY CONTROL

A. Factory Tests: Design and routine tests comply with referenced standards.

B. Factory Sound-Level Tests: Conduct sound-level tests on equipment for this Project if specified sound levels are below standard ratings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive dry-type transformers for compliance with installation tolerances and other conditions affecting performance of dry-type transformers installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with safety requirements of IEEE C2.

B. Arrange equipment to provide adequate spacing for access and for circulation of cooling air.

C. Identify transformers and install warning signs according to Section 16195, "Electrical Identification."

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.03 GROUNDING

A. Separately Derived Systems: Comply with NFPA 70 requirements for connecting to grounding electrodes and for bonding to metallic piping near the transformer.

B. Comply with Section 16452, "Grounding" for materials and installation requirements.

3.04 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified independent testing agency to perform field quality-control testing.

B. Test Objectives: To ensure transformer is operational within industry and manufacturer's tolerances, is installed according to the Contract Documents, and is suitable for energizing.
C. Test Labeling: On satisfactory completion of tests for each transformer, attach a dated and signed "Satisfactory Test" label to tested component.

D. Schedule tests and provide notification at least 7 days in advance of test commencement.


F. Tests: Include the following minimum inspections and tests according to manufacturer's written instructions. Comply with IEEE C57.12.91 for test methods and data correction factors.

1. Inspect accessible components for cleanliness, mechanical and electrical integrity, and damage or deterioration. Verify that temporary shipping bracing has been removed. Include internal inspection through access panels and covers.

2. Inspect bolted electrical connections for tightness according to manufacturer's published torque values or, if not available, those specified in UL 486A and UL 486B.

3. Insulation Resistance: Perform megohmmeter tests of primary and secondary winding to winding and winding to ground.
   b. Minimum Insulation Resistance: 500 megohms.
   c. Duration of Each Test: 10 minutes.
   d. Temperature Correction: Correct results for test temperature deviation from 20 deg C standard.

G. Test Failures: Compare test results with specified performance or manufacturer's data. Correct deficiencies identified by tests and retest. Verify that transformers meet specified requirements.

3.05 CLEANING

A. On completion of installation, inspect components. Remove paint splatters and other spots, dirt, and debris. Repair scratches and mars on finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

3.06 ADJUSTING

A. After installing and cleaning, touch up scratches and mars on finish to match original finish.

B. Adjust transformer taps to provide optimum voltage conditions at utilization equipment throughout normal operating cycle of facility. Record primary and secondary voltages and tap settings and submit with test results.

C. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in readjusting transformer tap settings to suit
actual occupied conditions. Provide one (1) visit to Project site for this purpose without additional cost.

1. Voltage Recordings: Contractor performed. Provide up to 48 hours of recording on the low-voltage system of each medium-voltage transformer.

2. Point of Measurement: Make voltage recordings at load outlets selected by Owner.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes load centers and panelboards, overcurrent protective devices, and associated auxiliary equipment rated 600 V and less for the following types:

1. Lighting and appliance branch-circuit panelboards.
2. Distribution panelboards with transient voltage surge suppressor.

1.03 DEFINITIONS

A. EMI: Electromagnetic interference.
B. GFCI: Ground-fault circuit interrupter.
C. RFI: Radio-frequency interference.
D. RMS: Root mean square.
E. SPDT: Single pole, double throw.
F. TVSS: Transient voltage surge suppressor.

1.04 SUBMITTALS

A. Submit under the provisions of Section 01330.

B. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

C. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

   a. Enclosure types and details for types other than NEMA 250, Type 1.
   b. Bus configuration, current, and voltage ratings.
   c. Short-circuit current rating of panelboards and overcurrent protective devices.
   d. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
D. Qualification Data: Submit data for testing agencies indicating that they comply with qualifications specified in "Quality Assurance" Article.

E. Field Test Reports: Submit written test reports and include the following:
   1. Test procedures used.
   2. Test results that comply with requirements.
   3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

F. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

G. Maintenance Data: For panelboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Section 01770, "Closeout Procedures," include the following:
   1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
   2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1.05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Testing agency that is a member company of the InterNational Electrical Testing Association or similar organization and that is acceptable to authorities having jurisdiction.

   1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70 and Local Electrical Code.

1.06 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS
A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, TVSS, and Accessories:
   a. Square D Co.

2.02 FABRICATION AND FEATURES

A. Enclosures: Surface-mounted cabinets. NEMA PB 1, Type 1, to meet environmental conditions at installed location.

B. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

C. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

D. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.

E. Bus: Hard-drawn copper, 98 percent conductivity or Tin-plated aluminum.

F. Main and Neutral Lugs: Mechanical type suitable for use with conductor material.

G. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

H. Future Devices: Mounting brackets, bus connections, and necessary appurtenances required for future installation of devices.

I. Isolated Equipment Ground Bus: Adequate for branch-circuit equipment ground conductors; insulated from box, where indicated on the Drawings.

J. Extra-Capacity Neutral Bus: Neutral bus rated 200 percent of phase bus and UL listed as suitable for nonlinear loads, where indicated on the Drawings.

K. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor. Provide back, sides and removable front.

L. Feed-through Lugs: Mechanical type suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device, where indicated on the Drawings.

2.03 PANELBOARD SHORT-CIRCUIT RATING
A. Fully rated to interrupt symmetrical short-circuit current available at terminals. Series ratings of the panelboards are not acceptable, and will be disapproved if submitted.

2.04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

B. Doors: Front mounted with secured with flush latch with tumbler lock; keyed alike.

2.05 DISTRIBUTION PANELBOARDS

A. Doors: Front trim cover without door providing direct access to the circuit breaker handles.

B. Main Overcurrent Protective Devices: Circuit breaker, where indicated on the Drawings.

C. Branch overcurrent protective devices shall be one of the following:

1. For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers, plug-in circuit breakers where individual positive-locking device requires mechanical release for removal

2. For Circuit-Breaker Frame Sizes Larger Than 125 A: Bolt-on circuit breakers; plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.

2.06 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.


2. Circuit Breakers, 250A and Larger: Adjustable magnetic trip setting

3. Electronic Circuit Breakers, 400A and Larger: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:

   a. Instantaneous trip.

   b. Long- and short-time pickup levels.

   c. Long- and short-time time adjustments.

   d. Ground-fault pickup level, time delay, and $I^2t$ response. Where indicated on the drawings.

4. GFCI Circuit Breakers: Single- and two-pole configurations with 5-mA trip sensitivity, where indicated on the lighting and appliance panelboards.

B. Molded-Case Circuit-Breaker Features and Accessories. Standard frame sizes, trip ratings, and number of poles.
1. Lugs: Mechanical style, suitable for number, size, trip ratings, and material of conductors.

2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

2.07 TVSS

A. Surge Suppressor

1. SPD shall be Listed and Component Recognized in accordance with UL 1449 Second Edition to include Section 37.3 highest fault current category. SPD shall be UL 1283 listed.

2. SPD shall be installed by and shipped from the electrical distribution equipment manufacturer’s factory.

3. The TVSS devices in lighting and appliance panelboards shall be bus mounted between the main and branch devices. Panelboards with TVSS will accommodate thru-feed lugs and sub-feed circuit breakers in single section and multi-section panelboards. If TVSS supplied is not manufactured by the panelboard manufacturer, then the TVSS will be mounted remotely to the panelboard using cables with lead lengths less than 3 feet.

4. The TVSS devices in I-LINE power distribution panelboards shall be cable connected.

5. SPD shall provide surge current diversion paths for all modes of protection; L-N, L-G, N-G in WYE systems.

6. SPD shall be modular or block in design. Each mode including N-G shall be fused with a 200kAIR UL recognized surge rated fuse and incorporate a thermal cutout device.

7. Audible diagnostic monitoring shall be by way of audible alarm. This alarm shall activate upon a fault condition. An alarm on/off switch shall be provided to silence the alarm. An alarm push to test switch shall be provided.

8. SPD shall meet or exceed the following criteria:

   a. Minimum surge current capability (single pulse rated) per phase shall be:

      1) Service Entrance Panelboard locations: 240kA per phase
      2) Distribution and lighting and Appliance Panelboard locations: 160kA per phase

   b. UL 1449 Suppression Voltage Ratings:

<table>
<thead>
<tr>
<th>VOLTAGE LOCATION</th>
<th>L-N</th>
<th>L-G</th>
<th>N-G</th>
</tr>
</thead>
<tbody>
<tr>
<td>208Y/120V</td>
<td>330V</td>
<td>330V</td>
<td>330V</td>
</tr>
<tr>
<td>480Y/277V</td>
<td>600V</td>
<td>600V</td>
<td>600V</td>
</tr>
</tbody>
</table>
9. SPD shall have a minimum EMI/RFI filtering of -50dB at 100kHz with an insertion ratio of 50:1 using MIL-STD-220A methodology.

10. SPD shall be provided with one set of NO/NC dry contacts.

11. SPD shall have a warranty for a period of five years, incorporating unlimited replacement of suppressor parts. Warranty shall be the responsibility of the electrical distribution equipment manufacturer and shall be supported by their respective field service division.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Comply with mounting and anchoring requirements specified in Section 16100, “Electrical Equipment Noise Control, Vibration Isolation, and Seismic Restraints.”

C. Mounting Heights: Top of trim 74 inches above finished floor, unless otherwise indicated.

D. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

E. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

F. Install filler plates in unused spaces.

G. Provision for Future Circuits at Flush Panelboards: Stub four 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch empty conduits into raised floor space or below slab not on grade.

H. Wiring in Panelboard Gutters: Arrange conductors into groups and bundle and wrap with wire ties after completing load balancing.

3.02 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."

B. Panelboard Nameplates: Label each panelboard with engraved laminated-plastic nameplate mounted with corrosion-resistant screws.

3.03 CONNECTIONS

A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.

B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
3.04 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.

2. Test continuity of each circuit.

B. Testing Agency: Engage a qualified independent testing agency to perform specified testing.

C. Testing: After installing panelboards and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Balancing Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:

1. Measure as directed during period of normal system loading.

2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data-processing, computing, transmitting, and receiving equipment.

3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.

4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

3.05 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3.06 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes the following:
   1. Fuses.

1.03 SUBMITTALS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for each fuse type specified.

C. Product Data for each fuse type specified. Include the following:
   1. Descriptive data and time-current curves.
   2. Let-through current curves for fuses with current-limiting characteristics.
   3. Coordination charts and tables and related data.
   4. Fuse size for elevator feeder and disconnect applications.

D. Field test reports indicating and interpreting test results.

1.04 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses from one source and by a single manufacturer.

B. Comply with NFPA 70 for components and installation.

C. Listing and Labeling: Provide fuses specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.
   2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

D. Comply with NEMA FU-1, nonrenewable cartridge fuses.
1.05 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Spare Fuses: Furnish quantity equal to 10 percent of each fuse type and size installed, but not less than 1 set of 3 of each type and size.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering fuses that may be incorporated into the Work include, but are not limited to, the following:

2. Gould Shawmut.

2.02 FUSES

A. 601 Amperes Through 6000 Amperes, (current rating as indicated):

1. UL Class L.
2. 200,000 RMS symmetrical amperes interrupting rating.
3. Bussmann KRP-C, Littlefuse KLP-C, or Gould Shawmut A4QB.

B. 600 Amperes and below, (current rating as indicated):

1. UL Class J.
2. 200,000 RMS symmetrical amperes interrupting rating.

2.03 SPARE FUSES

A. Provide 10 percent (minimum of 3) spare power and control fuses of each type and rating utilized.

B. Provide spare fuse cabinets in the main switchgear room and rooms with equipment utilizing 15 or more fuses.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions to verify proper fuse locations, sizes, and characteristics.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.
3.02 FUSE APPLICATIONS

A. Disconnect Switches.

B. Other Control Circuits.

3.03 INSTALLATION

A. Fuses shall not be installed until equipment is ready to be energized.

B. Install fuses in fusible devices as indicated. Arrange fuses so fuse ratings are readable without removing fuse.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes individually mounted switches and circuit breakers used for the following:

1. Feeder and equipment disconnect switches.
2. Feeder and branch-circuit protection.

B. Related Sections: The following Sections contain requirements that relate to this Section:

1. Section 16475, "Fuses" for fuses in fusible disconnect switches.

1.03 SUBMITTEDS

A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product Data for switches, circuit breakers, and accessories specified in this Section. Include the following:

1. Descriptive data and time-current curves.
2. Let-through current curves for circuit breakers with current-limiting characteristics.
3. Coordination charts and tables and related data.
4. Short-circuit rating.

C. Wiring diagrams detailing wiring for power and control systems and differentiating between manufacturer-installed and field-installed wiring.

D. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

E. Field test reports indicating and interpreting test results.
F. Maintenance data for tripping devices to include in the operation and maintenance manual specified in Division 1.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: In addition to the requirements specified in Division 1 Section "Quality Control," an independent testing agency shall meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907, or shall be a full member company of the InterNational Electrical Testing Association (NETA).

1. Testing Agency's Field Supervisor: Person currently certified by NETA or the National Institute for Certification in Engineering Technologies, to supervise on-site testing specified in Part 3.

B. Source Limitations: Obtain disconnect switches and circuit breakers from one source and by a single manufacturer.

C. Comply with NFPA 70 for components and installation.

D. Listing and Labeling: Provide disconnect switches and circuit breakers specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" (NRTL) as defined in OSHA Regulation 1910.7.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering disconnect switches and circuit breakers that may be incorporated into the Work include, but are not limited to, the following:

1. Fusible Switches:
   a. Square D Co
   b. General Electric Co.; Electrical Distribution and Control Division.

2. Molded-Case Circuit Breakers:
   a. Square D Co
   b. General Electric Co.; Electrical Distribution and Control Division.

3. Combination Circuit Breaker and Ground Fault Trip:
   a. Square D Co
b. General Electric Co.; Electrical Distribution and Control Division.

c. Eaton Corp.; Cutler-Hammer Products/ Westinghouse

2.02 DISCONNECT SWITCHES

A. Enclosed, Nonfusible Switch: NEMA KS 1, Type HD, with lockable handle.

B. Enclosed, Fusible Switch, 800 A and Smaller: NEMA KS 1, Type HD, clips to accommodate specified fuses, enclosure consistent with environment where located, handle lockable with 2 padlocks, and interlocked with cover in CLOSED position.

C. Enclosure: NEMA KS 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.
   1. Outdoor Locations: Type 3R.
   2. Wet or Damp Indoor Locations: Type 4.

2.03 ENCLOSED CIRCUIT BREAKERS

A. Enclosed, Molded-Case Circuit Breaker: NEMA AB 1, with lockable handle.

B. Characteristics: Frame size, trip rating, number of poles, and auxiliary devices as indicated and interrupting rating to meet available fault current.

C. Application Listing: Appropriate for application, including switching fluorescent lighting loads or heating, air-conditioning, and refrigerating equipment.

D. Circuit Breakers, 200 A and Larger: Trip units interchangeable within frame size.

E. Lugs: Mechanical lugs and power-distribution connectors for number, size, and material of conductors indicated.

F. Shunt Trip: Where indicated.

G. Accessories: As indicated.

H. Enclosure: NEMA AB 1, Type 1, unless otherwise specified or required to meet environmental conditions of installed location.
   1. Outdoor Locations: Type 3R.
   2. Wet or Damp Indoor Locations: Type 4.

2.04 SHORT-CIRCUIT RATING

A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install disconnect switches and circuit breakers in locations as indicated, according to manufacturer's written instructions.
B. Install disconnect switches and circuit breakers level and plumb.

C. Install wiring between disconnect switches, circuit breakers, control, and indication devices.

D. Connect disconnect switches and circuit breakers and components to wiring system and to ground as indicated and instructed by manufacturer.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

E. Identify each disconnect switch and circuit breaker according to requirements specified in Division 16 Section "Electrical Identification."

3.02 FIELD QUALITY CONTROL

A. Testing Agency: Provide the services of a qualified independent testing agency to perform specified field quality-control testing.

B. Testing: After installing disconnect switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.5 for disconnect switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

C. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

3.03 ADJUSTING

A. Set field-adjustable disconnect switches and circuit-breaker trip ranges as indicated.

3.04 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish including chips, scratches, and abrasions.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes ac motor-control devices rated 600 V and less that are supplied as enclosed units.

B. Related Sections include the following:

1. Section 16050, "Basic Electrical Materials and Methods" for general materials and installation methods.

2. Section 16195, "Electrical Identification" for labeling materials.

3. Section 16475, "Fuses."

1.03 SUBMITTALS

A. Product Data: For products specified in this Section. Include dimensions, ratings, short-circuit rating, and data on features and components.

B. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

C. Maintenance Data: For products to include in the maintenance manuals specified in Division 1.

D. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

E. Qualification Data for Field Testing Agency: Certificates, signed by Contractor, certifying that agency complies with requirements specified in "Quality Assurance" Article below.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.

B. Field Testing Agency Qualifications: An independent testing agency with experience and capability to satisfactorily conduct testing indicated without delaying the Work. Evaluation criteria shall be according to ASTM E 699.

C. Source Limitations: Obtain similar motor-control devices through one source from a single manufacturer.
D. Comply with NFPA 70 and Local Electrical Code.

E. Listing and Labeling: Provide motor controllers specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

1.05 COORDINATION

A. Coordinate features of controllers and accessory devices with pilot devices and control circuits to which they connect.

B. Coordinate features, accessories, and functions of each motor controller with the ratings and characteristics of the supply circuit, the motor, the required control sequence, and the duty cycle of the motor and load.

1.06 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Spare Fuses and Incandescent Indicating Lamps: Furnish 1 spare for every 5 installed units, but not less than 1 set of 3 of each kind.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:


3. Square D Co.

2.02 MANUAL MOTOR CONTROLLERS

A. Description: NEMA ICS 2, general purpose, Class A with toggle action and overload element.

2.03 MAGNETIC MOTOR CONTROLLERS

A. Description: NEMA ICS 2, Class A, full voltage, nonreversing, across the line, unless otherwise indicated.

B. Control Circuit: 120 V; obtained from integral control power transformer, unless otherwise indicated. Include a control power transformer with adequate capacity to
operate connected pilot, indicating and control devices, plus 100 percent spare capacity. Provide primary and secondary fuses.

C. Combination Controller: Factory-assembled combination controller and disconnect switch with overcurrent protection as indicated.


2. Minimum size starter shall be NEMA Size 1.

D. Overload Relay: Ambient-compensated type with inverse-time-current characteristic. Provide with heaters or sensors in each phase matched to nameplate full-load current of specific motor to which they connect, and with appropriate adjustment for duty cycle.

E. Multispeed-Motor Controller: Match controller to motor type, application, and number of speeds; include the following accessories:

1. Compelling relay ensures motor will start only at low speed.

2. Accelerating relay ensures properly timed acceleration through speeds lower than that selected.

3. Decelerating relay ensures automatically timed deceleration through each speed.

F. Star-Delta Controller: NEMA ICS 2, closed transition with adjustable time delay.


2.04 ENCLOSURES

A. Description: Flush or surface-mounted cabinets as indicated. NEMA 250, Type 1, unless otherwise indicated to meet environmental conditions at installed location.

1. Outdoor Locations: NEMA 250, Type 3R.

2. Wet or Damp Indoor Locations: NEMA 250, Type 4.

2.05 ACCESSORIES

A. Devices are factory installed in controller enclosure, unless otherwise indicated.

B. Provide Hand-Off-Automatic (HOA) selector switch, unless otherwise indicated.


D. Control Relays: Auxiliary and adjustable time-delay relays.

E. Factory mounted with Nationally Recognized Testing Laboratory listed and labeled mounting device.

2.06 SHORT-CIRCUIT RATING
A. Fully rated to interrupt symmetrical short-circuit current available at terminals.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive motor controllers for compliance with installation tolerances and other conditions affecting performance of motor controllers installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

A. Select features of each motor controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.

B. Select horsepower rating of controllers to suit motor controlled.

C. Use fractional-horsepower manual controllers for single-phase motors, unless otherwise indicated.

3.03 INSTALLATION

A. Install independently mounted motor-control devices according to manufacturer's written instructions.

B. Location: Locate controllers within sight of motors controlled, unless otherwise indicated.

C. For control equipment at walls, bolt units to wall or mount on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks conforming to Section 16050, "Basic Electrical Materials and Methods."

D. Install freestanding equipment on concrete housekeeping bases conforming to Section 03300, "Cast-in-Place Concrete."

E. Motor-Controller Fuses: Install indicated fuses in each fusible switch.

3.04 IDENTIFICATION

A. Identify motor-control components and control wiring according to Section 16195, "Electrical Identification."

3.05 CONTROL WIRING INSTALLATION

A. Install wiring between motor-control devices according to Section 16120, "Conductors and Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect Hand-Off-Automatic switch and other automatic control devices where available.

1. Connect selector switches to bypass only the manual and automatic control devices that have no safety functions when switch is in the hand position.
2. Connect selector switches with motor-control circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor overload protectors.

3.06 CONNECTIONS

A. Tighten connectors, terminals, bus joints, and mountings. Tighten field-connected connectors and terminals, including screws and bolts, according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.07 FIELD QUALITY CONTROL

A. Testing Agency: Provide services of a qualified independent testing agency to perform specified testing.

B. Testing: After installing motor controllers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Sections 7.5, 7.6, and 7.16. Certify compliance with test parameters.

2. Remove and replace malfunctioning units with new units, and retest.

3.08 CLEANING

A. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally, using methods and materials recommended by manufacturer.

3.09 DEMONSTRATION

A. Training:

1. Conduct a minimum of 4 hours of training in operation and maintenance as specified in Section 01770, "Closeout Procedures." Include training relating to equipment operation and maintenance procedures.

2. Schedule training with at least 7 days' advance notice. Deliver maintenance manuals to Owner before training commences.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes motor-control centers for use on AC circuits rated 600 V and less.

B. Related Sections include the following:

1. Section 16195, "Electrical Identification" for labeling materials.

2. Section 16475, "Fuses."

3. Section 16481, “Motor Controllers”.

4. Section 16476, “Disconnect Switches and Circuit Breakers”.

1.03 SUBMITTALS

A. Submit under the provisions of Section 01330.

B. Product Data: For products specified in this Section. Include dimensions, ratings, short-circuit rating, and data on features and components.

C. Shop Drawings: For each motor-control center specified in this Section. Include dimensioned plans, elevations, and component lists. Show ratings, including short-time and short-circuit ratings, and horizontal and vertical bus ampacities.

1. Schedule of features, characteristics, ratings, and factory settings of individual motor-control center units.

2. Wiring Diagrams: Interconnecting wiring diagrams pertinent to class and type specified for motor-control center. Schematic diagram of each type of controller unit indicated.

D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

E. Maintenance Data: For products to include in the maintenance manuals specified in Division 1. Include operating instructions required per 3.04.B.

F. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.

G. Qualification Data for Field Testing Agency: Certificates, signed by Contractor, certifying that agency complies with requirements specified in "Quality Assurance" Article below.
1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Maintain, within 100 miles of Project site, a service center capable of providing training, parts, and emergency maintenance and repairs.

B. Field Testing Agency Qualifications: An independent testing agency with experience and capability to satisfactorily conduct testing indicated without delaying the Work. Evaluation criteria shall be according to ASTM E 699.

C. Source Limitations: Obtain similar motor-control devices through one source from a single manufacturer.

D. Comply with NFPA 70 and City of Phoenix Electrical Code.

E. Listing and Labeling: Provide motor-control centers and components specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.


F. Product Selection for Restricted Space: Drawings indicate maximum dimensions for motor-control centers, including clearances between motor-control centers and adjacent surfaces and items, and are based on types and models indicated. Other manufacturers' motor-control centers with equal performance characteristics and complying with indicated maximum dimensions may be considered. Refer to Section 01630, "Prior Approval and Substitutions."

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver in shipping splits of lengths that can be moved past obstructions in delivery path as indicated.

B. Store so condensation will not occur on or in motor-control centers. Provide temporary heaters as required to prevent condensation.

C. Handle motor-control centers according to NEMA ICS 2.3, "Instructions for the Handling, Installation, Operation, and Maintenance of Motor Control Centers." Use factory-installed lifting provisions.

1.06 COORDINATION

A. Coordinate features of controllers and accessory devices with pilot devices and control circuits to which they connect.

B. Coordinate features, accessories, and functions of each motor controller with the ratings and characteristics of the supply circuit, the motor, the required control sequence, and the duty cycle of the motor and load.
1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents.

1. Spare Indicating Lights: Furnish 6 of each type required.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

3. Square D Co.

2.02 MOTOR-CONTROL CENTERS

A. Wiring: NEMA ICS 3, Class I, Type B.

B. Enclosures: Free-standing structure as indicated. NEMA 250, Type 2, unless otherwise indicated to meet environmental conditions at installed location.

1. Outdoor Locations: NEMA 250, Type 3R.
2. Compartments: Modular; individual doors have concealed hinges and quick-captive screw fasteners. Interlocks on combination controller units require disconnect means in off position before door can be opened or closed, except by consciously operating a permissive release device.
3. Interchangeability: Compartments are constructed to remove units without opening adjacent doors, disconnecting adjacent compartments, or disturbing the operation of other units in control center. Units requiring the same size compartment are interchangeable, and compartments are constructed to permit ready rearrangement of units, such as replacing 3 single units with one unit requiring 3 spaces, without cutting or welding.
4. Wiring Spaces: Each vertical section of structure with horizontal and vertical wiring has spaces for wiring to each unit compartment in each section, with supports holding wiring in place.

C. Short-Circuit Current Rating for Each Section: Minimum 42,000 amps symmetrical RMS.

2.03 BUSES

A. Material: Plated copper or plated aluminum.

B. Ampacity Ratings: As indicated for horizontal and vertical main buses.
C. Equipment Ground Bus: Noninsulated, horizontal copper bus 2 by 1/4 inch, minimum.

D. Horizontal Bus Arrangement: Main phase, and ground buses extended with same capacity the entire length of motor-control center, with provision for future extension at both ends by bolt holes and captive bus splice sections or approved equivalent.

E. Short-Circuit Withstand Rating: Minimum 42,000 amps symmetrical rms.

2.04 FUNCTIONAL FEATURES

A. Description: Modular arrangement of motor controllers, control devices, overcurrent protective devices, transformers, panelboards, instruments, indicating panels, blank panels, and other items mounted in compartments of motor-control center as indicated.

B. Motor-Controller Units: Combination controller units of types and with features, ratings, and circuit assignments indicated.

1. Units with full-voltage, across-the-line, magnetic controllers up to and including Size 3 are installed on drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.

2. Units have short-circuit current ratings equal to or greater than short-circuit current rating of motor-control center section.

3. Units in motor-control centers with Type B wiring shall be equipped with pull-apart terminal strips or drawout terminal boards for external control connections.

C. Overcurrent Protective Devices: Types of devices with features, ratings, and circuit assignments indicated. Individual feeder-tap units through 225-A rating shall be installed on drawout mountings with connectors that automatically line up and connect with vertical-section buses while being racked into their normal, energized positions.

D. Spaces and Blank Units: Compartments fully bused and equipped with guide rails or equivalent, ready for insertion of drawout units. Provide bus barrier and compartment door.

E. Spare Units: Type, sizes, and ratings as indicated, and installed in compartments indicated "spare."

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive motor control centers for compliance with installation tolerances and other conditions affecting performance of motor control centers installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 APPLICATIONS

A. Select features of each motor controller to coordinate with ratings and characteristics of supply circuit and motor; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.
B. Select horsepower rating of controllers to suit motor controlled.

C. Push-Button Stations: In covers of magnetic controllers for manually started motors where indicated, start contact connected in parallel with sealing auxiliary contact for low-voltage protection.

D. Hand-Off-Automatic Selector Switches: In covers of manual and magnetic controllers of motors started and stopped by automatic controls or interlocks with other equipment.

3.03 INSTALLATION

A. Install motor-control centers according to NEMA ICS 2.3 and manufacturer's written instructions.

B. Anchor each motor-control center assembly to steel-channel sills arranged and sized according to manufacturer's written instructions. Attach by tack welding or bolting. Level and grout sills flush with motor-control center mounting surface.

C. Install motor-control centers on concrete housekeeping bases conforming to Section 03300, "Cast-in-Place Concrete."

D. Fuses: Install fuses in each fusible switch as indicated, oriented for label readability.

3.04 IDENTIFICATION

A. Identify field-installed wiring and components and provide warning signs according to Section 16195, "Electrical Identification."

B. Operating Instructions: Frame printed operating instructions for motor-control centers, including control sequences, and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of motor-control centers.

3.05 CONTROL WIRING INSTALLATION

A. Install wiring between motor-control devices according to Section 16120, "Conductors and Cables."

B. Bundle, train, and support wiring in enclosures.

C. Connect hand-off-automatic switch and other automatic control devices according to an indicated wiring diagram or one that is manufacturer approved, where available.

   1. Connect selector switches to bypass only the manual and automatic control devices that have no safety functions when switch is in the hand position.

   2. Connect selector switches with motor-control circuit in both hand and automatic positions for safety-type control devices such as low- and high-pressure cutouts, high-temperature cutouts, and motor-overload protectors.

3.06 CONNECTIONS

A. Tighten motor-control center bus joint, electrical connector, and terminal bolts according to manufacturer's published torque-tightening values. Where manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
3.07 FIELD QUALITY CONTROL

A. Testing Agency: Provide services of a qualified independent testing agency to perform specified testing.

B. Testing: After installing motor-control center and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Sections 7.5, 7.6, and 7.16. Certify compliance with test parameters.

2. Remove and replace malfunctioning units with new units, and retest.

3.08 CLEANING

A. Inspect interior and exterior of motor-control centers. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean devices internally, using methods and materials recommended by manufacturer.

3.09 DEMONSTRATION

A. Training:

1. Conduct a minimum of 4 hours of training in operation and maintenance as specified in Division 1 Section 01770, "Project Closeout." Include training relating to equipment operation and maintenance procedures.

2. Schedule training with at least 7 days’ advance notice. Deliver maintenance manuals to Owner before training commences.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes interior lighting fixtures, lighting fixtures mounted on exterior building surfaces, lamps, ballasts, emergency lighting units, and accessories.

B. Related Sections include the following:

1. Section 16520, "Lighting Control Equipment" for power relays, and contactors.

1.03 SUBMITTALS

A. Submit under the provisions of Section 01330.

B. Product Data: For each type of lighting fixture indicated, arranged in order of fixture designation. Include data on features, accessories, and the following:

1. Dimensions of fixtures.

2. Certified results of independent laboratory tests for fixtures and lamps for electrical ratings and photometric data.

3. Certified results of laboratory tests for fixtures and lamps for photometric performance.

4. Fluorescent and high-intensity-discharge ballasts.

5. Types of lamps.

6. Color samples for Owner selection.

C. Shop Drawings: Show details of nonstandard or custom fixtures. Indicate dimensions, weights, method of field assembly, components, features, and accessories.

1. Wiring Diagrams: Detail wiring for fixtures and differentiate between manufacturer-installed and field-installed wiring.

D. Coordination Drawings: Reflected ceiling plans and sections drawn to scale and coordinating fixture installation with ceiling grid, ceiling-mounted items, and other components in the vicinity. Include work of all trades that is to be installed near lighting equipment.

E. Product Certificates: Signed by manufacturers of lighting fixtures certifying that products comply with requirements.
F. Dimming Ballast Compatibility Certificates: Signed by manufacturer of ballast certifying that ballasts are compatible with dimming systems and equipment with which they are used.

G. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

H. Maintenance Data: For lighting fixtures to include in maintenance manuals specified in Division 1.

1.04 QUALITY ASSURANCE

A. Fixtures, Emergency Lighting Units, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction.

B. Comply with NFPA 70.

C. NFPA 101 Compliance: Comply with visibility and luminance requirements for exit signs.

1.05 COORDINATION

A. Fixtures, Mounting Hardware, and Trim: Coordinate layout and installation of lighting fixtures with ceiling system and other construction.

1.06 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Special Warranty for Batteries: Written warranty, executed by manufacturer agreeing to replace rechargeable batteries that fail in materials or workmanship within specified warranty period.

   1. Special Warranty Period for Batteries: Manufacturer's standard, but not less than 10 years from date of Substantial Completion. Full warranty shall apply for first year, and prorated warranty for last nine years.

C. Special Warranties for Fluorescent Ballasts: Written warranty, executed by manufacturer agreeing to replace fluorescent ballasts that fail in materials or workmanship within specified warranty period.

   1. Special Warranty Period for Electronic Ballasts: Five years from date of manufacture, but not less than four years from date of Substantial Completion.

   2. Special Warranty Period for Electromagnetic Ballasts: Manufacturers' standard warranty, but not less than two years from date of Substantial Completion.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Lamps: 10 for every 100 of each type and rating installed. Furnish at least one of each type.

2. Plastic Diffusers and Lenses: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

3. Ballasts: 1 for every 100 of each type and rating installed. Furnish at least one of each type.

4. Globes and Guards: 1 for every 20 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, are limited to, the products indicated in the Luminaire Schedule.

2.02 FIXTURES AND FIXTURE COMPONENTS, GENERAL

A. Metal Parts: Free from burrs, sharp corners, and edges.

B. Sheet Metal Components: Steel, unless otherwise indicated. Form and support to prevent warping and sagging.

C. Doors, Frames, and Other Internal Access: Smooth operating, free from light leakage under operating conditions, and arranged to permit relamping without use of tools. Arrange doors, frames, lenses, diffusers, and other pieces to prevent accidental falling during relamping and when secured in operating position.

D. Reflecting Surfaces: Minimum reflectance as follows, unless otherwise indicated:
   1. White Surfaces: 85 percent.
   2. Specular Surfaces: 83 percent.
   3. Diffusing Specular Surfaces: 75 percent.
   4. Laminated Silver Metallized Film: 90 percent.

E. Lenses, Diffusers, Covers, and Globes: 100 percent virgin acrylic plastic or annealed crystal glass, unless otherwise indicated.
   1. Plastic: High resistance to yellowing and other changes due to aging, exposure to heat, and ultraviolet radiation.
   2. Lens Thickness: 0.125 inch minimum, unless greater thickness is indicated.

F. Fasteners:
   1. Non-Secure Areas: Provide manufacturer’s standard fasteners, unless otherwise indicated.
2. Minimum Security Areas: Provide manufacturer’s standard fasteners, unless otherwise indicated.


4. Maximum Security Areas: Provide snap-off type unless otherwise indicated.

2.03 FLUORESCENT LAMP BALLASTS

A. General Requirements: Unless otherwise indicated, features include the following:
   1. Designed for type and quantity of lamps indicated at full light output.
   2. Total Harmonic Distortion Rating: Less than 20 percent.
   3. Inrush Current: Less than 15 times operating current.
   4. Sound Rating: A.
   5. Listing: UL Class P.

B. Electronic Ballasts for Linear Lamps: Unless otherwise indicated, features include the following, besides those in "General Requirements" Paragraph above:
   1. Power Factor: Not less than 95 percent.
   2. Ballast Factor: nominally 0.88, unless indicated otherwise.
   3. Lamps Starting: programmed rapid start, unless indicated otherwise.
   4. Operating Frequency: not less than 25 KHz.
   5. Lamp Current Crest Factor: Less than 1.7.
   6. Transient Protection: Comply with IEEE C62.41 for location Category A1 in common mode and location Category A3 in normal mode.
   7. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.
   8. In-Rush Current: Not greater than 15 times operating current.
   9. Weight: Not greater than 3-pounds.
   10. Dimming ballasts: Compatible with dimmer controls.

C. Ballasts for Compact Fluorescent Lamps: Unless otherwise indicated, additional features include the following:
   1. Type: Electronic.
   2. Power Factor: 95 percent, minimum.
3. Operating Frequency: 20 kHz or higher.

4. Flicker: Less than 5 percent.

5. Lamp Current Crest Factor: Less than 1.7.


7. Interference: Comply with 47 CFR, Chapter 1, Part 18, Subpart C for limitations on electromagnetic and radio-frequency interference for nonconsumer equipment.

2.04 HIGH-INTENSITY-DISCHARGE LAMP BALLASTS

A. General: Comply with ANSI C82.4. Unless otherwise indicated, features include the following:

1. Type: Constant wattage autotransformer or regulating high-power-factor type, unless otherwise indicated.

2. Operating Voltage: Match system voltage.


4. Normal Ambient Operating Temperature: 104 deg F.

5. Open-circuit operation that will not reduce average life.

B. Encapsulation: Manufacturer’s standard epoxy-encapsulated model designed to minimize audible fixture noise.

C. High-Pressure Sodium Ballasts: Equip with a solid-state igniter/starter having an average life in pulsing mode of 10,000 hours at an igniter/starter case temperature of 90 deg C.

1. Lamp Turn-Off Device: Device to prevent lamp on/off cycling at end of lamp life.

2. Instant Restrike Device: Solid-state, potted module, mounted inside high-pressure sodium fixture and compatible with high-pressure sodium lamps, ballasts, and sockets up to 150 W.

   a. Restrike Range: 105- to 130-V ac.

   b. Maximum Voltage: 250-V peak or 150-V ac RMS.

D. Metal-Halide Ballasts: Provide ballasts designed for pulse-start lamps up to 400 watt.

2.05 EXIT SIGNS

A. General Requirements: Comply with UL 924 and the following:

1. Sign Colors and Lettering Size: Comply with authorities having jurisdiction.

2. Lamps for Self-Luminous Operation: Light-emitting diodes (LEDs) 70,000 hours minimum rated lamp life.
2.06 LAMPS

A. Fluorescent Color Temperature and Minimum Color-Rendering Index: 3500 K and 75 CRI, unless otherwise indicated.

B. Noncompact Fluorescent Lamp Life: Rated average is 20,000 hours at 3 hours per start when used on rapid-start circuits.

C. Metal-Halide Color Temperature and Minimum Color-Rendering Index: 3600 K and 70 CRI, pulse-start, unless otherwise indicated.

2.07 FIXTURE SUPPORT COMPONENTS

A. Comply with Section 16190, "Supporting Devices," for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fitting and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy arranged to mount a single fixture. Finish same as fixture.

D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

2.08 FINISHES

A. Fixtures: Manufacturer's standard, unless otherwise indicated.

1. Paint Finish: Applied over corrosion-resistant treatment or primer, free of defects.


PART 3 - EXECUTION

3.01 INSTALLATION

A. Fixtures: Set level, plumb, and square with ceiling and walls, and secure according to manufacturer's written instructions and approved submittal materials. Install lamps in each fixture.

B. Support for Fixtures in or on Grid-Type Suspended Ceilings:

1. Install a minimum of four ceiling support system rods or wires for each fixture. Locate not more than 6 inches from fixture corners.

2. Support Clips: Fasten to fixtures and to ceiling grid members at or near each fixture corner.

3. Fixtures of Sizes Less Than Ceiling Grid: Arrange as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees.

C. Suspended Fixture Support: As follows:

1. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.

3. Continuous Rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

### 3.02 CONNECTIONS

A. Ground equipment.

1. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

### 3.03 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Advance Notice: Give dates and times for field tests.

C. Provide instruments to make and record test results.

D. Tests: As follows:

1. Verify normal operation of each fixture after installation.

2. Emergency Lighting: Interrupt electrical supply to demonstrate proper operation.

3. Verify normal transfer to battery source and retransfer to normal.

4. Verify actuation and termination on photocell, timer, or other control function, as applicable, and in coordination with required testing per Section 16520.

5. Report results in writing.

E. Malfunctioning Fixtures and Components: Replace or repair, then retest. Repeat procedure until units operate properly.

F. Corrosive Fixtures: Replace during warranty period.

### 3.04 CLEANING AND ADJUSTING

A. Clean fixtures internally and externally after installation. Use methods and materials recommended by manufacturer.

B. Adjust aimable fixtures to provide required light intensities.

*END OF SECTION*
SECTION 16520
LIGHTING CONTROL SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes manual and programmable, low-voltage lighting controls.

B. Related Sections include the following:


2. Section 01810, Fundamental Commissioning Requirements.


4. Section 01813, Prefunctional Checklist.

5. Section 01814, Functional Performance Test.

6. Section 17860, Utility Control Interfaces.

1.03 SUBMITTALS

A. Submit under the provisions of Section 01330.

B. Product Data: Submit manufacturer's data sheet for the lighting control system and specified components. Include dimensions and data on features, components, and ratings for lighting controls.

C. Shop Drawings: Detail assemblies of standard components, custom assembled for specific application on Project. Indicate dimensions, weights, arrangement of components, and clearance and access requirements.

1. Wiring Diagrams: Detail specific systems tailored to this Project and differentiate between manufacturer-installed and field-installed wiring.

2. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

D. Operational Documentation: For software and firmware.

E. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

F. Maintenance Data: For lighting control equipment and system components to include in maintenance manuals specified in Division 1.
G. Warranties: Special warranties specified in this Section.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An experienced installer who is an authorized representative of the programmable lighting system manufacturer for both installation and maintenance of units required for this Project.

B. Manufacturer Qualifications: A firm experienced in manufacturing programmable lighting controls similar to those indicated for this Project and with a record of successful in-service performance.

C. Source Limitations: Obtain low-voltage lighting control system components from a single manufacturer.

1. Provide total responsibility for compatibility of system components, including those provided in this Section.

D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, for their indicated use and installation conditions by a testing agency acceptable to authorities having jurisdiction.

E. Comply with 47 CFR, Subparts A and B, for Class A digital devices.

F. NFPA 70 Compliance: Comply with applicable portions of the NEC including Articles 110-10 and 725.

G. Comply with Local Electrical Code.

1.05 COORDINATION

A. Coordinate features of equipment and system components to form an integrated system of compatible components. Match components and interconnections for optimum performance of specified functions.

B. Coordinate lighting controls specified in this Section with work specified in other Sections.

1.06 WARRANTY

A. General Warranty: Special warranty specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Manufacturer shall warrant specified equipment to be free from defects in materials and workmanship for one year from the date of Substantial Completion.

1.07 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.
1. Modular Single-Pole Relays: 1 for every 10 installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include the following:

1. GE Lighting Controls
2. Wattstopper
3. MicroLite

2.02 GENERAL REQUIREMENTS

A. Expansion Capability of System: Adequate to increase the number of control functions in the future by 25 percent more than those indicated. This applies to equipment ratings, housing volumes, spare relays, terminals, and control cable conductor quantities.

B. Line-Voltage Surge Protection: Include in all solid-state equipment. Comply with UL 1449 and with ANSI C62.41 for Category A locations.

C. Comply with UL 916.

2.03 FUNCTIONAL SYSTEM DESCRIPTION

A. A control signal from a manual switch, an internal timing and control unit, or an external sensor or other control signal source is routed to the system control module. This module processes signal according to its programming and routes an "open" or "close" command to one or more relays in the power-supply circuits to groups of lighting fixtures or other loads.

2.04 SYSTEM COMPONENTS

A. Control Module Description: Programmable, microprocessor-based control unit mounted in preassembled modular relay panel. Low-voltage-controlled, latching-type, single-pole lighting circuit relays are prime output circuit devices. Where indicated, a limited number of digital or analog, low-voltage control circuit outputs are supported by control unit and circuit boards associated with relays. Control unit receives inputs from indicated sensors and other sources. Line-voltage components and wiring are separated from low-voltage components and wiring by barriers. Control module is locally programmable. Modules and their associated control panels include the following features:

1. System Memory: Nonvolatile. Reboots program and resets time automatically without errors after power outages up to 90 days' duration.

2. Automatic Time Adjustment: System automatically adjusts for leap year and daylight saving time and provides weekly routine and annual holiday scheduling.

3. Astronomic Control: Automatic adjustment of dawn and dusk switching.
4. Confirmation: Light-emitting diode at control module identifies on or off status of each controlled circuit.

5. Remote Communications Capability: Allows programming, data-gathering interrogation, status display, and controlled command override from an IBM-compatible microcomputer at a remote location over telephone or data lines. System includes modem, communications and control software, and remote computer compatibility verification for this purpose. Microcomputer is not in this Contract.

6. Local Override Capability: Manual, low-voltage control devices override programmed shutdown of lighting and override other programmed control for intervals that may be duration programmed.

7. Automatic battery backup provides power to maintain program and system clock operation for 90 days' minimum duration when power is off.

8. Compatibility with dimmer controls permits commands that change preset scenes and dimmer settings according to programmed time signals.

9. Daylight Compensating Switch Control: Control module interprets a preset threshold illumination-level signal from a photoelectric relay and activates relays controlling power to selected groups of lighting fixtures to turn them on and off to maintain adjustable minimum illumination level as daylight contribution varies.

10. Flick Warning: Programmable momentary turnoff of lights warns that programmed shutoff will occur after a preset interval. Warning is repeated after a second preset interval before end of programmed override period.

11. Diagnostics: When system operates improperly, software initiates factory-programmed diagnosis of failure and displays messages identifying problem and possible causes.

B. Mechanically Held, Modular Single-Pole Relays: Split-coil, momentary-pulsed type.

1. Low-Voltage Leads: Five-pin plug connector.


3. Rated Capacity (Mounted in Relay Panel): 20 A, 125-V ac for tungsten filaments; and 20 A, 277-V ac for ballasts.

4. Endurance: 50,000 cycles at rated capacity.

5. Mounting: Knockout in modular relay panel, unless otherwise indicated.

C. Electrically Held, Modular Single-Pole Relays: As follows:

1. Rated Capacity (Mounted in Relay Panel): 20 A, 120- and 277-V ac for all types of fluorescent and HID ballasts; and 15 A, 120-V ac for tungsten filaments.

2. Operating Coil: DC.

3. Mounting: Modular printed circuit board. Board is held in place in modular relay panel by quick-release spring pins, unless otherwise indicated.
4. Pilot Device: Provides positive relay position indication.

5. Special Warranty: See Part 1 of this Section.

D. Modular Relay Panels: Steel cabinets, preassembled with modular single-pole relays, power supplies, and accessory components required for specified performance.

1. Barriers separate low-voltage and line-voltage components.

2. Cover: Hinged, lockable type.

3. Directory: Mounted on back of door. Identifies each relay as to bunch loads controlled, and each programmed pilot device, if any.


2.05 MANUAL SWITCHES AND PLATES

A. Switches: Specification-grade, modular, momentary contact, low-voltage type.

1. Color: White, unless otherwise indicated.

2. Integral Pilot Light: Indicates when circuit is on.

3. Wall Plates: Match those specified in Section 16140, "Wiring Devices" to materials, finish, and color. Use multigang plates if more than one switch is indicated at a location.

4. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

2.06 PHOTOCELLS

A. Exterior Photocells:

1. Photocell shall be designed for exterior application.

2. Photocell shall be compatible with the lighting control system with dry contact output.

3. Photocell shall have delayed operation to prevent nuisance operation.

B. Interior Photocells:

1. Photocell shall be designed for interior ceiling mount application.

2. Photocell shall be compatible with the lighting control system with dry contact output.

3. Photocell shall have delayed operation to prevent nuisance operation.

2.07 LOW-VOLTAGE WIRING


B. Low-Voltage Control Cable: Multiple conductor, color-coded, No. 20 AWG copper, minimum.
1. Sheath: Listed for plenums.

2. Ordinary Switch Circuits: Three conductors, unless otherwise indicated.

3. Switch Circuits with Pilot Lights: Five conductors, unless otherwise indicated.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install equipment level and plumb and according to manufacturer's written instructions.

B. Mount control equipment according to manufacturer's written instructions and requirements in Section 16050, "Basic Electrical Materials and Methods."

C. Adjust photocells to turn on the exterior lights at dusk and to turn off the exterior lights at dawn.

D. Install interior photocells in the ceiling. The unit shall "see" the floor and not "see" any windows. Adjust the photocells to turn off the interior lights when there is sufficient ambient daylight in the space and to turn on the interior lights when there is insufficient ambient daylight in the space. The time-of-day control function shall have priority over the ambient-daylight function.

3.02 CONTROL WIRING INSTALLATION

A. Wiring Method: Install all wiring in raceway as specified in Section 16110, "Raceways and Boxes," unless run in accessible ceiling space and gypsum board partitions.

B. Bundle, train, and support wiring in enclosures and in ceiling space.

C. Ground equipment.

D. Connections: Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3.03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."

B. Label each system control module with a unique designation.

3.04 FIELD QUALITY CONTROL

A. Manufacturer's Field Services: Engage a factory-authorized service representative to test, adjust, and program lighting control system.

B. Schedule visual and mechanical inspections and electrical tests with at least seven days' advance notice.
C. Inspect control components for defects and physical damage, testing laboratory labeling, and nameplate compliance with the Contract Documents.

D. Check tightness of electrical connections with torque wrench calibrated within previous six months. Use manufacturer's recommended torque values.

E. Electrical Tests: Use particular caution when testing devices containing solid-state components. Perform the following according to manufacturer's written instructions:

1. Continuity tests of circuits.

2. Operational Tests: Set and operate controls to demonstrate their functions and capabilities in a methodical sequence that cues and reproduces actual operating functions.
   a. Where light balancing or other control involving equipment provided under other Sections is indicated, combine testing required by this Section with that required by Sections specifying other equipment. Test programmable control related to light balancing, occupancy sensing, and other controls under conditions that simulate actual operational conditions. Record control settings, operations, cues, and functional observations.

F. Correct deficiencies, make necessary adjustments, and retest. Verify that specified requirements are met.

G. Reports: Written reports of tests and observations. Record defective materials and workmanship and unsatisfactory test results. Record repairs and adjustments.

3.06 CLEANING

A. Cleaning: Clean equipment and devices internally and externally using methods and materials recommended by manufacturers, and repair damaged finishes.

B. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

3.07 ON-SITE ASSISTANCE

A. Occupancy Adjustments: Within one year of date of Substantial Completion, provide up to three Project site visits, when requested, to adjust light levels, make program changes, and adjust sensors and controls to suit actual conditions.

B. Programming revisions may be accomplished from the manufacturer's location via the telephone modem.

3.08 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:

1. Train Owner's maintenance personnel on troubleshooting, servicing, adjusting, and maintaining equipment and schedules. Provide two training sessions of two hours each.
2. Training Aid: Use the approved final version of maintenance manuals as a training aid.

3. Schedule training with Owner, through Architect, with at least seven days’ advance notice. Deliver maintenance manuals to Owner before training commences.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The Drawings and provisions of the Contract, including General Conditions and Division-1 Specification Sections, apply to the Work of this Section.

1.02 DESCRIPTION OF WORK

A. Extent of automatic transfer switches Work is indicated by Drawings and by the requirements of this Section.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in the manufacture of automatic transfer switches, of types, ratings and characteristics required, whose products have been in satisfactory use in similar services for not less than 15 years.

B. NEC Compliance: Comply with the applicable requirements of NEC including, but not limited to, automatic transfer switches.

C. NFPA Compliance: Comply with the applicable requirements of NFPA "Installation and Use of Automatic Transfer Switches," and "Emergency and Standby Power Systems".

D. UL Compliance: Comply with the applicable requirements of UL508 "Industrial Control Equipment" and UL 1008 "Automatic Transfer Switches". Provide automatic transfer switches which are UL 1008 listed and labeled.

E. ANSI/NEMA Compliance: Comply with the applicable requirements of ANSI/NEMA including ICS10-1993 "AC Automatic Transfer Switches".

F. IEEE Compliance: Comply with applicable portions of IEEE STD 446, "IEEE Recommended Practice for Electric Power Systems" pertaining to emergency power.

G. IEC Compliance: Comply with IEC 947-6-1 applicable to "Automatic Transfer Switch Equipment."

1.04 SUBMITTALS

A. Submit under the provisions of Section 01330.

B. Product Data: Submit manufacturer's data with withstand and close on current rating on automatic transfer switches. Include manufacturer's product warranty for replacement of materials and equipment.

C. Shop Drawings: Submit dimensioned drawings of automatic transfer switches with complete accessories and connections to associated equipment.
PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide automatic transfer switches of one of the following. Any alternate shall be submitted for approval to the consulting engineer at least 10 days prior to the bids. Alternate bids must list any deviations for this specification. Acceptable manufacturers:

1. ASCO
2. Russelectric.
3. GE/Zenith.

2.02 AUTOMATIC TRANSFER SWITCHES

A. General:

1. Provide automatic transfer switches products of types, sizes, and capacities indicated, which comply with manufacturer's standard design, materials, and components. The switches shall be designed and constructed in accordance with published product information and as required for a complete installation. Provide automatic transfer switches for application intended and with the following operational, functional and construction features. Switch rating shall be 480Y/277V, three phase, four wire with minimum symmetrical withstand and closing current rating as required. Each switch shall be completely constructed and wired to provide the operation as described. All devices shall be accessible from the front of the equipment. All wirings and buses shall be copper. Provide lugs for equipment grounding conductors.

2. The switches shall be designed for automatically switching electrical loads from an original utility source to an alternate utility source upon the loss of the original source. The switches shall be double throw, mechanically held, electrically operated, and incapable of stops in intermediate positions during normal operation. The electrical operator shall be a momentarily operated single-solenoid mechanism. Main operators which include overcurrent disconnect devices, linear motors or gears are not acceptable. The switches shall be three poles for 480V system and four poles (or three poles with overlapping neutral) for 480Y/277V system. The main contacts shall be protected against arcing. The switch operating time shall not exceed 0.17 seconds in either direction.

3. Provide mechanically interlocked bypass isolation switch and automatic transfer switch drawout feature.

B. Bypass Isolation Switch

1. A two-way bypass-isolation switch shall provide manual bypass of the load to either source and permit isolation of the automatic transfer switch from all source and load power conductors. All main contacts shall be manually driven.

2. Power interconnections shall be silver-plated copper bus bar. The only field installed power connections shall be at the service and load terminals of the bypass-isolation switch. All control interwiring shall be provided with disconnect plugs.
3. Separate bypass and isolation handles shall be utilized to provide clear distinction between the functions. Handles shall be permanently affixed and operable without opening the enclosure door. Designs requiring insertion of loose operating handles or opening of the enclosure door to operate are not acceptable.

4. Bypass to the load-carrying source shall be accomplished with no interruption of power to the load (make before break contacts). Designs which disconnect the load when bypassing are not acceptable. The bypass handle shall have three operating modes: "Bypass to Normal," "Automatic," and "Bypass to Emergency." The operating speed of the bypass contacts shall be the same as the associated transfer switch and shall be independent of the speed at which the manual handle is operated. In the "Automatic" mode, the bypass contacts shall be out of the power circuit so that they will not be subjected to fault currents to which the system may be subjected.

5. The isolation handle shall provide three operating modes: "Closed," "Test," and "Open." The "Test" mode shall permit testing of the entire emergency power system, including the automatic transfer switches with no interruption of power to the load. The "Open" mode shall completely isolate the automatic transfer switch from all source and load power conductors. When in the "Open" mode, it shall be possible to completely withdraw the automatic transfer switch for inspection or maintenance to conform to code requirements without removal of power conductors or the use of any tools.

6. When the isolation switch is in the "Test" or "Open" mode, the bypass switch shall function as a manual transfer switch.

7. Designs requiring operation of key interlocks for bypass isolation or ATSs which cannot be completely withdrawn when isolated are not acceptable.

C. Automatic transfer switch control panel:

1. A solid state sensing and logic control panel shall be provided and mounted on the front of the switch enclosure. The controller shall have the ability to communicate serially through an optional serial communications module. Connections between the switch and the control panel shall be by a wiring harness and a keyed disconnect plug. The control panel shall provide the following control and operational characteristics:

   a. A four line, 20 character LCD displays with keypad shall be an integral part of the controller for viewing all available data and setting desired operational parameters.

   b. Continuously monitor the voltage and frequency of the normal and emergency sources with the following pickup, dropout and trip setting capabilities (values shown as % of nominal unless otherwise specified):

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Sources</th>
<th>Dropout/Trip</th>
<th>Pickup/Reset</th>
</tr>
</thead>
<tbody>
<tr>
<td>Undervoltage</td>
<td>N&amp;E 3ph.</td>
<td>79-98%</td>
<td>85-100%</td>
</tr>
<tr>
<td>Overvoltage</td>
<td>N&amp;E 3ph.</td>
<td>102-115%</td>
<td>2% below trip</td>
</tr>
<tr>
<td>Underfrequency</td>
<td>N&amp;E</td>
<td>85-98%</td>
<td>90-100%</td>
</tr>
<tr>
<td>Overfrequency</td>
<td>N&amp;E</td>
<td>102-110%</td>
<td>2% below trip</td>
</tr>
<tr>
<td>Voltage Unbalance</td>
<td>N&amp;E</td>
<td>5-20%</td>
<td>1% below trip</td>
</tr>
</tbody>
</table>
c. Voltage and frequency settings shall be field adjustable in 1% increments either locally with the display and keypad or serially via the optional serial communications port access.

d. Source status screens shall be provided for both sources to provide digital readout of voltage on all three phases, frequency and phase rotation.

e. Time delay on momentary dips of original source shall be adjustable from 0.5 to 6 seconds and set at one second.

f. Time delay on transfer to the alternate source shall be adjustable from zero to 60 minutes and set at zero seconds.

g. Time delay on retransfer to original source shall be adjustable from 0.5 to 60 minutes and set at five minutes. Time delay shall be automatically bypassed if the alternate source fails and original source is available.

h. All time delay functions shall be readily field adjustable over the ranges indicated in 1 second increments.

i. An in-phase monitor shall be provided to control the transfer and retransfer operation between live sources when the sources are sufficiently close to a zero phase angle difference so as to avoid excess in-rush current and shall not require external control of power sources. The inphase monitor shall be specifically designed for and be a product of the ATS manufacturer.

j. Four auxiliary contacts, rated 10 amps, 250VAC closed when the transfer switch is connected to the original source.

k. Four auxiliary contacts, rated 10 amps, 250VAC closed when the transfer switch is connected to the alternate source.

l. Selective load disconnect circuit contacts (two provided) which operate with time delay to provide a warning signal to the elevator controller prior to and/or after load transfer or retransfer between live sources.

m. Front panel pilot lights to indicate switch position.

n. Front panel three position momentary type test switch to simulate the original source outage.

o. Provision for remote control (maintained contacts) to simulate original source outage.

p. Engine exercise timer seven day, 24 hours, in 30 minute intervals that can be adjusted for a particular time and day of the week. The timer shall be capable of being bypassed if the normal service fails during exercise. The controller shall allow the user to program up to seven different exercise routines.

q. Provide the ability to select "commit/no commit to transfer" to determine whether the load should be transferred to the emergency generator if the normal source restores before the generator is ready to accept the load.
r. The controller shall have the ability to log data and to maintain the last 99 events, even in the event of total power loss. Each event shall be time and date stamped.

C. Enclosure:

1. Shall be UL Type 1 for indoor applications. Refer to Section 16441, “Switchboards.”

2.03 WITHSTAND AND CLOSING RATING

A. The ATS shall be rated to close on and withstand the available RMS symmetrical short-circuit current available at terminals with the type of overcurrent protection shown on the plans.

B. The ATS shall be UL listed in accordance with UL1008 and be labeled in accordance with the standard’s 1 ½ and 3 cycle long-time ratings. ATS’s which are not tested and labeled with 1 ½ and 3 cycle (any breaker) ratings and have series, or specific breaker ratings, only are not acceptable.

2.04 TESTS AND CERTIFICATION

A. The complete ATS/BPS shall be factory tested to ensure proper operation of the individual components and correct overall sequence of operation and to ensure that the operating transfer time, voltage, frequency and time delay settings are in compliance with the specification requirements.

B. Upon request, the manufacturer shall provide a notarized letter certifying compliance with all of the requirements of this specification including compliance with the above codes and standards, and withstand and closing ratings. The certification shall identify, by serial number(s), the equipment involved. No exceptions to the specifications, other than those stipulated at the time of the submittal, shall be included in the certification.

C. The ATS/BPS manufacturer shall be certified to ISO 9001 International Quality Standard and the manufacturer shall have third party certification verifying quality assurance in design/development, production, installation and servicing in accordance with ISO 9001.

2.05 SERVICE REPRESENTATION

A. The ATS/BPS manufacturer shall maintain a national service organization of company-employed personnel located throughout the contiguous United States. The service center's personnel must be factory trained and must be on call 24 hours a day, 365 days a year.

B. The manufacturer shall maintain records of each switch, by serial number, for a minimum of 20 years.

PART 3 - EXECUTION

3.01 INSTALLATION OF AUTOMATIC TRANSFER SWITCHES

A. Install automatic transfer switches as indicated, in accordance with the manufacturer's written instructions and with recognized industry practices to ensure that automatic transfer switches comply with requirements of NEMA and NEC standards and applicable portions of NECA's "Standard of Installation". Comply with NFPA and NEMA standards pertaining to installation of automatic transfer switches and accessories.
B. Coordinate with other Work, as necessary, to interface installation of automatic transfer switches Work with other Work.

C. Provide signal from associated transfer switch to elevator controllers for sequential operation mode.

3.02 GROUNDING

A. Provide equipment grounding connections, sufficiently tight to assure a permanent and effective ground, for system components as indicated.

3.03 QUALITY INSURANCE INSPECTION

A. All equipment herein specified shall be inspected by the manufacturer's quality assurance inspector and any defects corrected before delivery.

3.04 FIELD QUALITY CONTROL


B. Subsequent to wire and cable hook-ups, energize automatic transfer switches and demonstrate functioning in accordance with requirements.

C. Tests shall be made in the presence of the Owner. Costs of test shall be borne by Contractor and Contractor shall provide all instruments, equipment, labor and materials to complete tests. Should these tests develop any defective materials or poor workmanship or variance with requirements of specifications, then Contractor shall make any changes necessary and remedy any defects at his own expense. Submit test reports in accordance with NETA Acceptance Testing Specifications to the Owner.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes packaged engine generator set with the following features and accessories:

3. Day tank. 9. Starting battery.
4. Fuel supply system. 10. Engine fluids
6. Control and power panel.

B. Related Sections include the following:

1. Section 16100, "Electrical Equipment Noise Control, Vibration Isolation and Seismic Restraints."
2. Section 16600, "Automatic Transfer Switches", including sensors and relays to initiate automatic-starting and -stopping signals for engine generator sets.

1.03 DEFINITIONS

A. Standby Rating: Power output rating equal to the power the generator set delivers continuously for the duration of a power outage.

B. Operational Bandwidth: The total variation from the lowest to the highest value of a parameter over the range of conditions indicated, expressed as a percentage of the nominal value of the parameter.

C. Power Output Rating: Gross electrical power output of generator set minus total power requirements of electric motor-driven cooling fan and pump.

D. Steady-State Voltage Modulation: The uniform cyclical variation of voltage within the operational bandwidth, expressed in Hz or cycles per second.
1.04 GENERATOR-SET PERFORMANCE, NOMINAL

A. Steady-State Voltage Operational Bandwidth: 4 percent of rated output voltage from no load to full load.

B. Steady-State Voltage Modulation Frequency: Less than one Hz.

C. Transient Voltage Performance: Not more than 10 percent variation for 50 percent step-load increase or decrease. Voltage recovers to remain within the steady-state operating band within 2 seconds.

D. Steady-State Frequency Operational Bandwidth: 0.5 percent of rated frequency from no load to full load.

E. Steady-State Frequency Stability: When system is operating at any constant load within the rated load, there are no random speed variations outside the steady-state operational band and no hunting or surging of speed.

F. Transient Frequency Performance: Less than 2-Hz variation for a 50 percent step-load increase or decrease. Frequency recovers to remain within the steady-state operating band within 3 seconds.

G. Output Waveform: At no load, harmonic content measured line-to-line or line-to-neutral does not exceed 5 percent total and 3 percent for single harmonics. The telephone influence factor, determined according to NEMA MG 1, does not exceed 50.

H. Sustained Short-Circuit Current: For a 3-phase, bolted short circuit at the system output terminals, the system will supply a minimum of 250 percent of rated full-load current for not less than 10 seconds and then clear the fault automatically, without damage to any generator system component.

I. Temperature Rise of Generator: Within limits permitted by NEMA MG 1 when operating continuously at full-rated load, including 2 hours per 24 hours at 110 percent of rated capacity.

J. Starting Time: Maximum total time period for a cold start, with ambient temperature at the low end of the specified range, is 10 seconds. Time period includes output voltage and frequency settlement within specified steady-state bands.

1.05 SUBMITTALS

A. Submit under the provisions of Section 01330.

B. Product Data: For each component. Include data on features, components, ratings, and performance. Include dimensioned outline plan and elevation drawings of engine generator set and other system components.

C. Shop Drawings: Show details of fabrication, piping, wiring, and installation of field-installed portions of system. Include general arrangement drawings showing locations of auxiliary components in relation to engine generator set and duct, piping, and wiring connections between generator set and auxiliary equipment. Show connections, mounting, and support provisions and access and workspace requirements.

1. Wiring Diagrams: Show details of power and control connections and differentiating between factory-installed and field-installed wiring.
2. Narrative Description: Narrative with functional description of generator control and power panel.

D. Qualification Data: For firms and persons specified in the "Quality Assurance" Article.

E. Field Test and Observation Reports: Indicate and interpret test results for compliance with performance requirements.

F. Certified summary of prototype-unit test report.

G. Certified Test Reports of Components and Accessories: For devices that are equivalent, but not identical, to those tested on prototype unit.

H. Certified Summary of Performance Tests: Demonstrate compliance with specified requirement to meet critical performance criteria.

I. Factory Test Reports: For units to be shipped for this Project showing evidence of compliance with specified requirements.

J. Exhaust Emissions Test Report: To show compliance with applicable regulations.

K. Sound measurement test report.

L. Certification of Torsional Vibration Compatibility: Comply with NFPA 110.

M. Field test report of tests specified in Part 3.

N. Maintenance data for system and components to include in the maintenance manuals specified in Division 1. Include the following:

1. List of tools and replacement items recommended shall be stored at the site for ready access. Include part and drawing numbers, current unit prices, and source of supply.

2. Detail operating instructions for both normal and abnormal conditions.

O. Extended Warranty and Service Agreement as specified herein.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Engage a firm experienced in manufacturing equipment of types and capacities similar to those indicated for this Project and with a service center maintained by engine generator set manufacturer capable of providing training, parts, and emergency maintenance and repairs at the Project site with 4 hours' maximum response time.

B. Source Limitations: Obtain engine generator set and auxiliary components from a single manufacturer with responsibility for entire system. Complete engine generator set shall be a product of an ISO9001 Certified facility. Furnish a representative product built from components that have proven reliable and compatible with each other and are coordinated to operate as a unit as evidenced by records of prototype testing.

C. Listing and Labeling: Provide system components of types and ratings for which listing or labeling service is established and components specified in this Section that are listed and labeled.
1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.


D. Comply with NFPA 70.

E. Engine Exhaust Emissions: Comply with applicable state and local government requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver engine generator set and system components to their final locations in protective wrappings, containers, and other protection that will exclude dirt and moisture and prevent damage from construction operations. Remove protection only after equipment is safe from such hazards.

1.08 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. Special Warranty: Submit a written warranty signed by Contractor and manufacturer, with single-source responsibility for engine generator and auxiliary components, agreeing to repair or replace items that do not meet requirements or that deteriorate as defined in this Section within the specified warranty period.

C. Warranty Period: 5 years from date of Substantial Completion.

1.09 MAINTENANCE SERVICE

A. Maintenance: Beginning at Substantial Completion, provide 12 months' full maintenance by skilled employees of the manufacturer's designated service organization. Include quarterly exercising to check for proper, starting, load transfer, and running under load. Include routine preventive maintenance as recommended by manufacturer and adjusting as required for proper operation. Provide parts and supplies as used in the manufacture and installation of original equipment.

1.10 EXTENDED WARRANTY AND SERVICE

A. Extended Warranty and Service Agreement: Submit proposal to provide intended warranty and service agreement (parts and labor) for a five (5) year period after the date of Final Completion for the emergency generator. This five year period includes mandatory period as required under Maintenance Service. Service shall be available on a 4-hour notice, 24 hours per day, every day.

1.11 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed, are packaged with protective covering for storage, and are identified with labels describing contents. Deliver extra materials to Owner.
1. Fuses: 1 for every 10 of each type and rating, but not less than 1 of each.

2. Indicator Lamps: 2 for every 6 of each type used, but not less than 2 of each.

3. Filters: One set each of lubricating oil, fuel, and combustion air filters.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Caterpillar, Inc.; Engine Division.

2. Cummins/Onan, Inc.

3. Detroit Diesel.

4. Kohler Co.

2.02 SERVICE CONDITIONS

A. Environmental Conditions: Engine generator system withstands the following environmental conditions without mechanical or electrical damage or degradation of performance capability:

1. Ambient Temperature: Minus 7 deg C to plus 50 deg C.

2. Relative Humidity: 0 to 95 percent.

3. Altitude: Sea level to 1000-feet.

B. Unusual Service Conditions: Engine generator equipment and installation is required to operate in the following conditions:

1. Seismic Risk Zone 4 location as defined in the Uniform Building Code.

2.03 ENGINE GENERATOR

A. Furnish a coordinated assembly of compatible components.

B. Ratings: Voltage, frequency, and power output ratings of system are as indicated.

C. Output Connections: 3 phase, 4 wire.

D. Safety Standard: Comply with ASME B15.1.

E. Nameplates: Each major system component is equipped with a conspicuous nameplate of component manufacturer. Nameplate identifies manufacturer of origin and address, and model and serial number of item.

F. Resistance to Seismic Forces: Supports for internal and external components, and fastenings for batteries, wiring, and piping are designed to withstand static or anticipated
seismic forces, or both, in any direction. For each item, use a minimum force value equal
to weight of item.

G. Limiting dimensions indicated for system components are not exceeded.

H. Power Output Rating: Nominal ratings as indicated, with capacity as required to operate
as a unit as evidenced by records of prototype testing.

I. Skid: Adequate strength and rigidity to maintain alignment of mounted components
without dependence on a concrete foundation. Skid is free from sharp edges and
corners. Lifting attachments are arranged to facilitate lifting with slings without damaging
any components.

J. Rigging Diagram: Inscribed on a metal plate permanently attached to skid. Diagram
indicates location and lifting capacity of each lifting attachment and location of center of
gravity.

2.04 ENGINE

A. Comply with NFPA 37.

B. Fuel: Diesel fuel oil grade DF-2, low sulfur (0.05% or less by weight).

C. Maximum Engine Speed: 1800 rpm.

D. Maximum Piston Speed for 4-Cycle Engines: 2250 fpm.

E. Lubrication System: Pressurized by a positive-displacement pump driven from engine
crankshaft. The following items are mounted on the engine or skid:

1. Filter and Strainer: Rated to remove 90 percent of particles 2 microns and larger
while passing full flow.

2. Oil Cooler: Maintains lubricating oil at manufacturer’s recommended optimum
temperature throughout operation of generator set at 100 percent of system power
output rating.

3. Thermostatic Control Valve: Controls flow in system to maintain optimum oil
temperature. Unit is capable of full flow and is designed to be fail-safe.

4. Crankcase Drain: Arranged for complete gravity drainage to an easily removable
container with no disassembly and without the use of pumps or siphons or special
tools or appliances.

F. Engine Fuel System: Comply with NFPA 30. System includes the following:

1. Integral Injection Pumps: Driven by engine camshaft, or electronically controlled as
per manufacturer’s standard.

2. Main Fuel Pump: Mounted on engine. Pump ensures adequate primary fuel flow
under starting and load conditions.

3. Fuel Oil Filters: Primary filter/water separator ahead of fuel transfer pump and
secondary filter ahead of injection pumps.
4. Relief/Bypass Valve: Automatically regulates pressure in fuel line and returns excess fuel to source.


G. Jacket Coolant Heater: Electric-immersion type, factory installed in jacket coolant system. Unit is rated and thermostatically controlled to maintain an engine temperature of 25 deg C at the low end of the ambient temperature range specified in "Environmental Conditions" Paragraph above.

H. Air Pollution:
   1. Provide positive crankcase ventilation.
   2. Provide turbocharger with intercooler (or aftercooler) plus 4° retarded fuel injection timing, or emissions not greater than 7.2 grams of NOₓ per brake horsepower hour.

2.05 GOVERNOR

A. Type: Adjustable isochronous type, with speed sensing, plus or minus 0.02 Hertz maximum variation.

2.06 ENGINE COOLING SYSTEM

A. Description: Closed loop, liquid cooled, with radiator factory mounted on engine generator-set skid and integral engine-driven coolant pumping.

B. Coolant: Solution of 50 percent ethylene glycol and 50 percent water.

C. Expansion Tank: Constructed of welded steel plate and equipped with gage glass and petcock. Capacity is as required.

D. Temperature Control: Self-contained, thermostatic-control valve modulates coolant flow automatically to maintain optimum constant coolant temperature as recommended by engine manufacturer. Features include the following:
   1. Thermostatic Elements: Interchangeable and nonadjustable.
   2. Actuator Design: Normally open valves to return to open position when actuator fails.

E. Coolant Hose: 4-ply fabric reinforced silicone rubber.
   1. Rating: 50-psig maximum working pressure with 120 deg C coolant, and noncollapsible under vacuum.
   2. End Fittings: Flanges or steel pipe nipples with clamps to suit piping and equipment connections.

2.07 FUEL SUPPLY SYSTEM

A. Comply with NFPA 30 and NFPA 37.
B. Fuel Tank: Mounted above grade, factory-fabricated assembly of a Nationally Recognized Testing Laboratory listed fuel tank with integral, float-controlled transfer pump and the following features:

1. Containment: Integral rupture basin with a capacity of 110 to 120 percent of nominal capacity of day tank.
   a. Leak Detector: Locate in rupture basin and connect to provide audible and visual alarm in the event of a day-tank leak.

2. Tank Capacity: 72-hours at full load.

3. Pump Capacity: Exceeds maximum flow of fuel drawn by engine-mounted fuel supply pump at 110 percent of rated capacity, including fuel returned from engine.

4. Unit, Including Alarm Contacts: Complies with UL 142.

5. Low-Level Warning Sensor: Separate device operates alarm contacts at 75 percent of maximum fuel level.

6. Low-Level Alarm Sensor: Separate device operates alarm contacts at 50 percent of maximum fuel level.

7. High-Level Alarm Sensor: Separate device operates alarm and redundant fuel shutoff contacts at 98 percent of maximum fuel level.

8. Piping Connection: Include fuel suction and return lines to fuel storage tank, fuel supply and return lines to engine, local fuel fill, vent line, overflow line and tank drain line complete with shut-off valve.


10. Prove a 2-inch threaded opening in the top of the day tank to accommodate a fuel oil pump control probe.

11. Prove a 2-inch threaded opening in the top of the day tank to accommodate a float for the mechanical shut-off of the supply fuel upon high level.

2.08 ENGINE EXHAUST SYSTEM

A. Muffler: Industrial type, sized as recommended by engine manufacturer.

B. Connections from Engine to Exhaust System: Flexible section of corrugated stainless-steel flexible hose.

C. Connection from Exhaust Pipe to Muffler: Stainless-steel expansion joint with liners.

2.09 COMBUSTION AIR-INTAKE SYSTEM

A. Air-Intake Silencer: Filter type providing filtration as recommended by engine manufacturer.

1. Mounting: Factory installed on engine generator set at a location readily accessible for servicing.
2.10 STARTING SYSTEM

A. Description: 24-V electric, with negative ground and including the following items:

1. Components: Sized so they will not be damaged during a full engine-cranking cycle with ambient temperature at maximum specified in "Environmental Conditions" Paragraph above.

2. Cranking Motor: Heavy-duty unit that automatically engages and releases from engine flywheel without binding.


4. Battery complies with SAE J537 and has adequate capacity within ambient temperature range specified in "Environmental Conditions" Paragraph above to provide specified cranking cycle at least twice without recharging.

5. Battery Cable: Size as recommended by generator set manufacturer for cable length indicated. Include required interconnecting conductors and connection accessories.

6. Battery Compartment: Factory fabricated of fiber reinforced acid-resistant plastic. Thermostatically controlled heater is arranged to maintain battery above 10 deg C regardless of external ambient temperature within range specified in "Environmental Conditions" Paragraph above. Include accessories required to support and fasten batteries in place.


8. Battery Charger: Current-limiting, automatic-equalizing and float-charging type. Unit complies with UL 508 and includes the following features:
   a. Operation: Equalizing-charging rate of 10 A is initiated automatically after battery has lost charge until an adjustable equalizing voltage is achieved at battery terminals. Unit then automatically switches to a lower float-charging mode and continues operating in that mode until battery is discharged again.
   b. Automatic Temperature Compensation: Adjusts float and equalizes voltages for variations in ambient temperature from minus 40 deg C to plus 60 deg C to prevent overcharging at high temperatures and undercharging at low temperatures.
   c. Automatic Voltage Regulation: Maintains output voltage constant regardless of input voltage variations up to plus or minus 10 percent.
   e. Safety Functions: Include sensing of abnormally low battery voltage arranged to close contacts providing low battery voltage indication on control and monitoring panel. Also include sensing of high battery voltage and loss of ac input or dc output of battery charger. Either of these conditions closes contacts that provide a battery charger malfunction indication at system control and monitoring panel.
   f. Enclosure and Mounting: NEMA 250, Type 1, wall-mounted cabinet.
2.11 GENERATOR, EXCITER, AND VOLTAGE REGULATOR

A. Comply with NEMA MG 1 and specified performance requirements.

B. Drive: Generator shaft is directly connected to engine shaft. Exciter is rotated integrally with generator rotor.

C. Electrical Insulation: Class H.

D. Stator-Winding Leads: Brought out to terminal box.

E. Construction prevents mechanical, electrical, and thermal damage due to vibration, overspeed up to 125 percent of rating, and heat during operation at 110 percent of rated capacity.

F. Excitation uses no slip or collector rings, or brushes, and is arranged to sustain generator output under short-circuit conditions as specified.

G. Enclosure: Dripproof.

H. Instrument Transformers: Mounted within generator enclosure.

I. Voltage Regulator: Solid-state type, separate from exciter, providing performance as specified.
   1. Adjusting rheostat on control and monitoring panel provides plus or minus 5 percent adjustment of output voltage operating band.

J. Strip Heater: Thermostatically controlled unit arranged to maintain stator windings above dew point.

K. Windings: Two-thirds pitch stator winding and fully linked amortisseur winding.

L. Subtransient Reactance: 20 percent, maximum.

2.12 CONTROL AND POWER PANEL

A. Functional Description:

   1. Mode Selector Switch:
      a. When the mode-selector switch on the control panel is in the Automatic position, closing of remote contacts in any of the automatic transfer switches shall start the generator set without delay and pick up active load, and opening of the contacts shall stop the generator set after an appropriate cool-down delay.
      b. When the mode-selector switch is in the On position, the generator set shall start without picking up load. If the remote contact in any of the automatic transfer switches closes, then the controls shall operate as if the mode-selector switch were in the Automatic position.
      c. When the mode-selector switch is in the Off position, the generator set shall stop without delay.
2. When the generator is running, specified system or equipment failures or derangement shall automatically shut down the generator set and initiate alarms.

3. Operation of a remote Generator Emergency Stop switch shall shut down the generator set without intentional delay.

B. Configuration: Operating and safety indications, protective devices, basic system controls, engine gages, instrument transformers, generator circuit breaker, and other indicated components are grouped in a combination control and power panel. Control and monitoring section of panel is isolated from power sections by steel barriers. Panel features include the following:

1. Generator Circuit Breaker: Low-voltage, fixed mounted, insulated case with LSIG functions, and conforms to Division 16 Section "Switchboards."

2. Shunt Trip Device: For generator circuit breaker, connected to trip circuit breaker when generator set is shut down by protective devices.


C. Indicating and Protective Devices, and Controls: Include the following:

1. Ac voltmeter.

2. Ac ammeter.

3. Ac frequency meter.

4. Ac kilowatt meter.

5. Dc voltmeter (alternator battery charging).


7. Engine lubricating-oil pressure gage.

8. Running-time meter.

9. Ammeter-voltmeter, phase-selector switch or switches.

10. Generator-voltage adjusting rheostat.

11. Start-stop switch.

12. Overspeed shutdown device.

13. Coolant high-temperature shutdown device.


15. Oil low-pressure shutdown device.

16. Battery low voltage alarm.

17. Battery charger malfunction alarm.
18. Day tank low-level warning.
17. Day tank low-level alarm.
18. Day tank high-level shutdown of fuel supply alarm.
19. Main fuel tank low-level alarm.
20. Controls not in automatic status.

D. Supporting Items: Include sensors, transducers, terminals, relays, and other devices, and wiring required to support specified items. Locate sensors and other supporting items on engine, generator, or elsewhere as indicated. Where not indicated, locate to suit manufacturer's standard.

2.13 REMOTE GENERATOR ANNUNCIATOR PANEL

A. Provide remote generator annunciator panel in the Watch Commander Operations Room 1B.22 to signal the occurrence of any of the events listed below without differentiating between different event types. Locate audible device and silencing means where indicated. Connect so that after an alarm is silenced, clearing of initiating condition will reactivate alarm until silencing switch is reset. Panel may be solid-state. Include the following:

1. Engine high-temperature shutdown.
2. Lube-oil low-pressure shutdown.
3. Overspeed shutdown.
5. Engine high-temperature prealarm.
6. Lube-oil low-pressure prealarm.
7. Fuel tank low level.
8. Overcrank shutdown.
12. Controls not in automatic status.
15. Day tank high-level shutdown.
Provide all necessary interconnecting wiring.

B. Remote Emergency-Stop Switch: Flush wall-mounted (in Room E188) unless otherwise indicated and prominently labeled. Pushbutton shall be protected from accidental operation.

C. Generator Running: Dry contact for connection to the Building Management System. Contact closure means generator is running.

D. Digital Multifunction Meter: Provide space for and install a digital multifunction meter.

2.14 WEATHERPROOF HOUSING

A. The engine generator set and related equipment shall be housed in a factory fabricated outdoor weatherproof enclosure. The design and placement shall be such that the generator will function properly without overheating in the ambient conditions specified.

B. Enclosure shall be floorless type secured to the skid. The enclosure shall be of sufficient size and volume to accommodate acoustical attenuation and vibration isolation equipment.

C. Roof shall be pitched for drainage and overlapping on all sides. Exhaust pipe opening shall be fitted watertight sealing material. Provide a drip shield around the exhaust pipe opening.

D. Doors shall be gasketed and mounted on piano type hinges. Provide a key lock for each door. Locate doors to allow easy access for maintenance of engine and access to control panel.

E. Fixed storm proof louvers shall be provided to allow the engine generator set to operate at the project location at rated conditions with all enclosure doors closed.

F. Provide an internal 120 volt incandescent lighting system with on/off switch. Connect lighting circuit to an emergency power system panelboard.

G. Provide internally mounted GFI duplex receptacle.

H. Enclosure shall be of sufficient size to allow for code required clearances and maintenance.

I. Exhaust silencer shall be mounted within enclosure. Silencer shall be painted with heat and weather resistant paint.

J. All surfaces shall be factory painted. Color of exterior to be selected by the Architect.

K. Unit shall have sufficient guards to prevent entrance by small animals.

L. Batteries to fit inside enclosure and along side the engine (batteries shall not be installed under the generator).

M. Unit shall have coolant and oil drains outside the unit to facilitate maintenance. Provide a valve located near the fluid source.
N. Fuel filter shall be mounted inside the base perimeter and located so that spilled fuel cannot fall on hot parts of the engine or generator. Provide a cleanable primary fuel strainer to collect water and sediment between tank and main engine fuel filter.

O. Crankcase fumes disposal shall terminate in front of the radiator to prevent oil from collecting on the radiator core and reducing cooling capacity.

P. Total Exhaust and Mechanical Noise level shall not exceed 65 dBA at 30 feet for any normal operating condition.

2.15 ACCESSORIES

A. Provide all required accessories to interface with the 72-hour main fuel tank.

2.16 SOURCE QUALITY CONTROL

A. Factory Tests: Include prototype testing and Project-specific equipment testing (testing of equipment manufactured specifically for this Project).

B. Prototype Testing: Performed on a separate engine generator set using same engine model, constructed of identical or equivalent components and equipped with identical or equivalent accessories.

1. Tests: Conform to those required for Level 1 energy converters as required by NFPA 110.

2. Components and Accessories: Items furnished with installed unit that are not identical to those on tested prototype have been tested to demonstrate compatibility and reliability.

C. Project-Specific Equipment Tests: Factory test engine generator set and other system components and accessories before shipment. Test items individually and assembled and connected as a complete system the same as specified in "Field Quality Control" Article below. Record and report test data. Conform to the following:

1. Test Equipment: Use instruments calibrated within the previous 12 months and with accuracy directly traceable to the National Institute of Standards and Technology.

2. Hydrostatic Test: Perform on radiator and engine water jacket.


4. Complete-System, Continuous-Operation Test: Include nonstop operation for a minimum of 8 hours, including at least 1 hour each at one-half, three-fourths, and full load, and 2 hours at 110 percent of full load. If unit stops during the 8-hour test, repeat the complete test. Record the following minimum data at start and end of each load run, at 15-minute intervals between those times, and at 15-minute intervals during balance of test:

   a. Fuel consumption.

   b. Exhaust temperature.

   c. Jacket water temperature.
d. Lubricating oil temperature and pressure.

e. Generator load current and voltage, each phase.

f. Generator system gross and net output kW.

5. Complete-System Performance Tests: Include the following to demonstrate conformance to specified performance requirements:


b. Transient and steady-state governing.

c. Transient and steady-state voltage performance.

d. Safety shutdown devices.

6. Observation of Test: Provide 14 days' advance notice of tests and opportunity for observation of test by Owner's representatives.

7. Report test results within 10 days of completion of test.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Anchor generator set and other system components on concrete housekeeping bases conforming to Division 3 Section "Cast-in-Place Concrete" and as indicated. Provide anchorage according to manufacturer's written instructions, unless otherwise indicated.

B. Maintain minimum workspace around components according to manufacturer's Shop Drawings and National Electrical Code.

3.02 IDENTIFICATION

A. Identify system components according to Division 16 Section "Electrical Identification."

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Provide services of an authorized service representative who is factory-trained by the engine-generator manufacturer to supervise installation and connection of unit and to report results in writing.

B. Supervised Adjusting and Pretesting: Under supervision of an authorized service representative who is factory-trained by the engine-generator manufacturer, pretest all system functions, operations, and protective features. Provide all instruments and equipment required for tests. Adjust to ensure operation is according to Specifications. Load system using a portable reactive load bank simulating kW, and power factor of loads for which unit is rated.

C. Tests: Provide services of a technician who is factory-trained by the engine-generator manufacturer to perform tests on completion of installation of system. Use instruments bearing records of calibration within the last 12 months, traceable to National Institute for Standards and Technology standards, and adequate for making positive observation of test results. Include the following:
1. InterNational Electrical Testing Association Tests: Perform each visual and mechanical inspection and electrical and mechanical test stated in InterNational Electrical Testing Association's NETA ATS for emergency engine generator sets. Certify compliance with test parameters.

2. Battery Tests: Measure charging voltage and voltages between available battery terminals for full-charging and float-charging conditions. Check electrolyte level and specific gravity under both conditions. Test for contact integrity of all connectors. Perform an integrity load test and a capacity load test for the battery. Verify acceptance of charge for each element of battery after discharge. Verify measurements are within manufacturer's specifications.

3. Battery-Charger Tests: Verify specified rates of charge for both equalizing and float-charging conditions.

4. System Integrity Tests: Methodically verify proper installation, connection, and integrity of each element of engine generator system before and during system operation. Check for air, exhaust, and fluid leaks.

5. Exhaust System Back-Pressure Test: Use a manometer with a scale exceeding 40-inches of water. Connect to exhaust line close to engine exhaust manifold. Verify that back pressure at full-rated load is within manufacturer's written allowable limits for the engine.


7. Voltage and Frequency Transient Stability Tests: Use recording oscilloscope to measure voltage and frequency transients for 50 and 100 percent step-load increases and decreases and verify that performance is as specified.

8. Harmonic-Content Tests: Measure harmonic content of output voltage under 25 percent and at 100 percent of rated linear load. Verify that harmonic content is within specified limits.

9. Control and Power Panel Tests:
   a. Test each function of the generator control and power panel.
   b. Set the LSIG functions of the circuit breakers.

D. Retest: Correct deficiencies identified by tests and observations and retest until specified requirements are met.

3.04 CLEANING

A. Upon completion of installation, inspect system components. Remove paint splatters and other spots, dirt, and debris. Touch up scratches and mars of finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

3.05 DEMONSTRATION

A. Training: Engage a factory-authorized service representative to demonstrate adjustment, operation, and maintenance of system and to train Owner's maintenance personnel as specified below.
1. Conduct a minimum of 8 hours of training as specified in Division 1 Section "Contract Closeout."

2. Schedule training with at least 7 days' advance notice.

B. Demonstrate Remote Generator Annunciator Panel.

C. Battery Equalization: Equalize charging of battery cells according to manufacturer's written instructions. Record individual cell voltages.

END OF SECTION
PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. This Section includes single-phase, on-line, Central Lighting Inverter system.

1.03 SUBMITTALS

A. Submit under the provisions of Section 01330.

B. Product Data: Include data on features, components, ratings, and performance for each product specified in this Section.

C. Shop Drawings: Detail fabrication, internal and interconnecting wiring, and installation of central lighting inverter system. Include dimensioned plan, elevation views, and details of control panels. Show access and clearance requirements. Differentiate between field-installed and factory-installed wiring and components.

D. Product Certificates: Signed by manufacturers of central lighting inverter systems certifying that the products furnished comply with requirements.

E. Qualification Data: For firms and persons specified in the "Quality Assurance" Article.

F. Factory Test Reports: Comply with specified requirements.

G. Field Test Reports: For tests specified in Part 3.

H. Maintenance Data: For system and products to include in the maintenance manuals specified in Division 1. Include the following:

1. Lists of spare parts and replacement components recommended to be stored at the Project site for ready access.

2. Detailed operating instructions covering operation under both normal and abnormal conditions.

I. Warranties: Special warranties specified in this Section.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications: An independent testing agency with the experience and capability to conduct the testing indicated without delaying the Work, as documented according to OSHA criteria for accreditation of testing laboratories, Title 29, Part 1907; or a full member company of the InterNational Electrical Testing Association.
1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies, to supervise on-site testing specified in Part 3.

B. Comply with NFPA 70.

C. Source Limitations: Obtain central lighting inverter system, including components, from a single manufacturer with responsibility for entire system.

D. Listing and Labeling: Provide central lighting inverter system specified in this Section that are listed and labeled as a factory-assembled unit.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.


E. Comply with UL 1778 and UL 924.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver equipment in fully enclosed vehicles after specified environmental conditions have been permanently established in spaces where equipment is to be placed.

B. Store equipment in spaces with environments that are controlled within manufacturer's ambient temperature and humidity tolerances for nonoperating equipment.

1.06 WARRANTY

A. General Warranty: The special warranty specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Crucial Power Products

2. United Power

2.02 MANUFACTURED UNITS

A. Description: Factory fabricated in one cabinet. Automatic system operating functions include the following:

1. Normal Conditions: Supply the lighting load with power conditioned and regulated by the inverter's solid state electronics. The solid state electronics regulates inverter's
output voltage to within specified limits. The rectifier maintains the batteries in a fully charged state.

2. Emergency Conditions: Upon loss of input power or when power exceeds the specified input limits, the control logic shall transfer to battery operation and disconnect the input line. The transfer to battery shall be an uninterrupted or “no break” power transfer. The inverter shall supply power from the batteries and through the solid state electronics to the lighting loads. The output shall be sinusoidal and within specified limits. If power is not restored before the batteries become discharged, the inverter shall completely shut down, protecting the batteries from possible damage.

3. Recharge: Upon restoration of input power and before the batteries are completely discharged, the inverter shall automatically return to normal operation. This retransfer to normal operation shall be uninterrupted. The battery charger shall automatically recharge the batteries to full capacity. The battery charger shall recharge the batteries as set forth in UL 924.

B. Load Description: Supply power without noise, vibration, pulsation of load, or abnormal output or visual appearance for the following loads types, in any combination and at any percentage of unit capacity.

1. Incandescent lights.
2. Fluorescent lights with magnetic ballasts.
3. Fluorescent lights with electronic ballasts.
4. HID lights with magnetic ballasts.
5. HID lights with electronic ballasts.

2.03 SYSTEM SERVICE CONDITIONS

A. Environmental Conditions: Operate continuously in the following environmental conditions without mechanical or electrical damage or degradation of operating capability:

1. Ambient Temperature: 0 to 40 deg C.
2. Relative Humidity: 0 to 95 percent, noncondensing.
4. Altitude: Sea level to 6000 feet (1829 m).

2.04 SYSTEM CHARACTERISTICS

A. Minimum Duration of Supply: 90 minutes, if rated full load is being supplied solely from the battery.

B. System Performance When Supplied from Battery: Performance under steady-state and transient-load conditions remains within specified tolerances throughout minimum duration of supply from battery specified.

C. Input Voltage and Frequency Tolerance: System steady-state and transient output performance remains within specified tolerances when steady-state ac input voltage
varies plus or minus 10 percent from nominal voltage; when steady-state input frequency
varies plus or minus 5 percent from nominal voltage; and when the THD of input voltage
is 15 percent, and the largest single harmonic component is a minimum of 5 percent of
the fundamental value.

2.05 PERFORMANCE EFFICIENCIES

A. Minimum overall system efficiency, when operated within indicated nominal input- and
output-voltage and frequency limits, shall be 70 percent.

B. Maximum Acoustical Noise: 58 dB, "A" weighting, emanating from the system under any
condition of normal operation, measured 1 meter from the nearest surface of the
enclosure.

C. Maximum Output-Voltage Regulation for No Load to Full Load: Plus or minus 4 percent
of the full range of battery voltage.

D. Output Frequency: 60 Hz, plus or minus 0.5 Hz when on Inverter.

E. Maximum Harmonic Distortion of Output-Voltage Waveform: 10 percent THD with Linear
Load.

2.06 SYSTEM COMPONENTS, GENERAL

A. Solid State Electronics: The Solid State Electronics shall provide regulation and
conditioning from incoming power aberrations. Power to the critical lighting load shall be
supplied by the Solid State Electronics whether the Inverter is in normal mode or
emergency mode. The output wave shape shall be sinusoidal for all modes of operation.

B. Battery Subsystem: Sealed, maintenance-free batteries shall be provided. The batteries
shall have an expected life of ten (10) years. The batteries shall be fully wired and
contained within a freestanding battery cabinet. Battery run time at 100% full load shall
be no less than ninety (90) minutes.

C. Inverter: The Inverter shall convert DC power supplied from the batteries into AC power.

D. Charger: A battery charger shall be provided. The battery charger shall maintain the
batteries at full charge. The battery charger shall be sized such that it recharges the
batteries as set forth in UL 924.

E. Power Connections: The Inverter input and output shall be hardwired. A main output
circuit breaker shall be provided. This circuit breaker provides overcurrent protection and
a means to easily disconnect power from the lighting system.

F. Monitoring Subsystem: The Inverter shall be furnished with a system status indicator
panel. This panel shall have the following enunciators:

1. Green LED for AC Line Present
2. Green LED Battery Charger Charging in 20% increments
3. Green LED for Inverter Output Status
4. Amber LED for Inverter on Battery Operation
5. Red LED Low Battery Condition in 20% increments
6. Red LED for Alarm

2.07 SOURCE QUALITY CONTROL

A. Factory test complete CBI, including battery, before shipment. Include the following tests:

1. Functional test and demonstration of all functions, controls, indicators, sensors, and protective devices.
2. Full-load test.
4. Overload test.
5. Power failure test.
6. Efficiency test at 50, 75, and 100 percent loads.

B. Report test results. Include the following data:

1. Description of input source and output loads to be used. Describe actions required to simulate source load variation and various operating conditions and malfunctions.
2. List of indications, parameter values, and system responses considered satisfactory for each test action. Include tabulation of actual observations during test.
3. List of instruments and equipment required to duplicate factory tests in the field for those tests required to be repeated there.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Maintain minimum workspace at equipment according to manufacturer's written instructions and NFPA 70.

B. Connections: Interconnect system components. Make connections to supply and load circuits according to manufacturer's wiring diagrams, unless otherwise indicated.

3.02 IDENTIFICATION

A. Identify components according to Division 16 Section "Electrical Identification."

3.03 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Supervision of unit installation, connections, pretests, and adjustments by a factory-authorized service representative. Report results in writing.

B. Supervised Adjusting and Pretesting: Under supervision of a factory-authorized service representative, pretest system functions, operations, and protective features. Adjust to
ensure operation complies with specifications. Load the system using a variable-load bank simulating kVA, kW, and power factor of loads for which unit is rated.

C. Tests: Perform tests listed below by an independent testing agency meeting the qualifications specified in the “Quality Assurance” Article. Perform tests according to the manufacturer's written instructions. Load the system using a variable-load bank to simulate kVA, kW, and power factor of loads for the unit's rating. Use instruments calibrated, within the previous 6 months, according to NIST standards.

1. Simulate malfunctions to verify protective device operation.

2. Test duration of supply on emergency, low-battery voltage shutdown, and transfers and restoration due to normal source failure.

3. Test harmonic content of input and output current less than 25, 50, and 100 percent of rated loads.

4. Test output voltage under specified transient-load conditions.

5. Test efficiency at 50, 75, and 100 percent rated loads.

6. Test alarm panel functions.

E. Retest: Correct deficiencies and retest until specified requirements are met.

3.04 CLEANING

A. On completion of installation, inspect system components. Remove paint splatters and other spots, dirt, and debris. Repair scratches and mars of finish to match original finish. Clean components internally using methods and materials recommended by manufacturer.

3.05 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:

1. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

2. Review data in the operation and maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."

3. Schedule training with Owner, through Architect, with at least 7 days' advance notice.

END OF SECTION
PART 1 – GENERAL

1.01 REQUIREMENTS

A. Summary

1. This performance specification provides the minimum requirements for the Fire Alarm System. The work provided shall include, but not limited to furnishing all permits, equipment, materials, delivery, labor, documentation, testing and services necessary to design and furnish and install a complete, operational system Fire Alarm System for:

   Name of Facility
   Address.

2. At the time of bid, all exceptions taken to these Specifications, all variances from these Specification and all substitutions of operating capabilities or equipment called for in these Specification shall be listed in writing and forwarded to the Architect. Any such exception, variances or substitutions that were not listed at the time of bid and are identified in the submittal, shall be grounds for immediate disapproval without comment.

1.02 RELATED SECTIONS

Section 13930: Wet-Pipe Fire Suppression System

Section 15800: Air Handling and Conditioning

Section 15950 Control Systems

Section 16050: Basic Electrical Materials and Methods

Section 16110: Raceways and Boxes

Section 16120: Conductors and Cables

Section 16140: Wiring Devices

Section 16190: Supporting Devices

Section 16195: Electrical Identification

Section 16452: Grounding

1.03 REFERENCES

A. NFPA 72 – National Fire Code

B. 2001 CBC, 2001 CFC, 2001 CEC

C. L.A. City Fire Department Requirements
D. California State Fire Marshal

E. UL Listings and UL 1971

F. All applicable Local Codes

1.04 CONTRACTOR QUALIFICATIONS

A. All work specified in this Section shall be performed (furnished, installed and connected) by a qualified fire alarm contractor. The fire alarm contractor shall provide the following documentation to show compliance with contractor qualifications within 14 days after notice of award of contract.

1. Contractor’s License: A copy of the electronics contractor’s valid State of California License.

2. Proof of Experience: Proof that the fire alarm contractor has been regularly engaged in the business of fire alarm contracting consisting of, but not limited to, engineering, fabrication, installation, and servicing of fire alarm systems of the type specified herein for at least the past ten (10) consecutive years. Provide a statement summarizing any pending litigation involving an officer or principal of/or the company, the nature of the litigation and what effect the litigation may carry as it relates to this work in the worst case scenario. Non-disclosure of this item, if later discovered, may result, at the owner’s discretion, in the contractor bearing all costs and any cost related to associated delays in the progress of the work.

3. Insurance Certificates: Copy of fire alarm contractor’s current liability insurance and state industrial insurance certificates in conformance with the contract documents.

4. Project List: A List containing at least ten (10) California installations completed within the last five (5) years by the fire alarm contractor that are comparable in scope and nature to that specified in the contract document.

5. Service Capability: Documentation indicating in detail that the fire alarm contractor has competent engineering, installation, service personnel and facilities with reasonable stock of service parts within 50 air miles of the job site.

6. Authorization Letters: Letters from the fire alarm equipment manufacturer stating that the fire alarm contractor is the Factory Authorized Distributor, and is trained and certified for the equipment he proposes to use on this project, and is licensed to purchase and install that software required to provide the specified functions.

7. Certification:

   a. Proof that the fire alarm contractor is Underwriters Laboratories, Inc. (UL) listed under the classification of “PROTECTIVE SIGNALING SERVICES-LOCAL, AUXILIARY, REMOTE STATION AND PROPRIETARY (UUJS).

   b. Copy of the National Institute for Certification in Technologies (NICET) Certificate. Proof that the Technician Level 2 certificate holders are a part of the fire alarm contractor’s local facility servicing this project and will be actively involved in this project.
8. Proof of Trained Personnel: Documentation that the fire alarm contractor has on staff personnel factory-trained and certified for the equipment proposed for this project. Also, a statement that personnel meeting these qualifications are in the local facility, and will be maintained at that facility throughout the project and the warranty period.

1.05 INSTALLATION COMPANY

A. The fire alarm contractor shall be UL listed company under the UL classification of (UUJS). The installation company shall UL certify this installation.

B. The fire alarm contractor shall have a NICET Certified Engineering Technologist and Technicians on staff in their facility directly involved with this project to ensure technical expertise to this project and adherence with these specifications.

C. The fire alarm contractor shall maintain sufficient stock on hand and have a fully equipped service organization capable of guaranteeing response time within 8 hours of service calls, 24 hours a day, 7 days a week to service completed systems.

D. Equipment, wire and materials shall only be installed by the fire alarm contractor. An installation company other than the fire alarm contractor shall not be acceptable.

E. The fire alarm contractor shall provide, install and test all equipment related to this section.

1.06 SCOPE OF WORK

A. General

1. This performance specification provides the minimum requirements for the Fire Alarm System. The work provided shall include, but not limited to furnishing all equipment, materials, delivery, labor, documentation, testing and services necessary to design and furnish and install a complete, operational system.

2. The system supplied under this specification shall be a microprocessor-based direct wired, multi-priority peer-to-peer networked system. The system shall utilize independently addressed, microprocessor-based smoke detectors, heat detectors, and modules as described in this specification. It shall be complete with all necessary hardware, software and memory specifically tailored for this installation. It shall be possible to permanently modify the software on site by using a plug-in programmer.

3. The system shall consist of, but not be limited to, the following:

   a. Fire alarm control panel and related remote data gathering panels.

   b. Remote Annunciators with enclosures.

   c. Graphic Annunciator with enclosure located in Fire Control Room.

   d. Addressable manual fire alarm stations.

      (i) Each entrance to stairs or at guard desk in housing areas.

   e. Addressable analog area smoke detectors with detector guards as needed.
(i) Both sides of automatic closing doors

(ii) Elevator equipment rooms

(iii) Within 5 feet of stairway entrance doors

(iv) Elevator landings

(v) Dayrooms and holding rooms

(vi) Corridors, hallways, sally ports, intake booking, medical and other I-3 areas.

(vii) R-1 overnight rooms.

f. Addressable analog duct smoke detectors.

   (i) Downstream of filters on supply fans over 2000cfm

   (ii) Fire / smoke dampers except those in systems serving areas with complete detector coverage.

 g. Addressable analog heat detectors.

   (i) Elevator equipment rooms within 12 inches of sprinklers for elevator shunt trip.

   (ii) Vehicle sally port

   (iii) Food preparation area

h. Audible notification appliances; Speakers.

   (i) Throughout building in order to notify staff

   (ii) Zoned per cell complex, vertically by floor and by elevator cabs and stairwells.

i. Visual notification appliances; low profile strobes.

   (i) General use areas (lobbies, meeting rooms, offices, corridors, bath rooms, etc.)

   (ii) 15 feet from the end of each corridor and within a visual distance of 150 feet.

   (iii) Candela sized per NFPA.

   (iv) Synchronized per floor or within individual rooms and corridors.

j. Central station alarm connection control.

   (i) Type of Device Fire Alarm Signal

      (a) Sprinkler waterflow

      (b) Manual pull station
(c) Heat Detectors
(d) Smoke Detectors
(e) Duct Smoke Detector
(i) Common Supervisor Signal
(ii) Common Trouble Signal
(iii) Monitor Signal
(a) Fire Pump
(b) Generator

k. Air handling systems shutdown control.
l. Magnetic door / card access release override control, where required.
m. Dry pipe sprinkler release valve / deluge valve control.
   (i) At each floor, downstream of standpipe / riser connection
n. Sprinkler supervisory switches and tamper switch supervision
   (i) All control valves
o. Battery standby.
p. Fire Pump Status
   (i) Pump Run
   (ii) Fail to start
   (iii) Loss of line power
   (iv) Phase reversal
   (v) Transfer switch position
q. Emergency Generator Status
   Generator Run
   (i) Fail to start

1.07 SEQUENCE OF OPERATION

A. General Alarm Operation: Upon alarm activation of any area smoke detector, duct smoke detector, heat detector, manual pull station, sprinkler waterflow, the following functions shall automatically occur:

1. The internal audible device shall sound at the control panel or command center.
2. The LCD Display shall indicate all applicable information associated with the alarm condition including zone, device type, device location and time / date.

3. All system activity events shall be documented on the system printer.

4. Any remote or local annunciator LCD / LED’s associated with the alarm zone shall be illuminated. The internal audible device shall sound.

5. The following audio messages and actions shall occur simultaneously:
   a. An evacuation message shall be sounded on fire floors (zones). The signal shall be a Temporal 3 tone.
   b. Activate visual strobes on the fire floors (zones). The visual strobe shall continue to flash until the system has been reset. The visual strobe shall not stop operating when the “Alarm Silence” is pressed.

6. Provide selective paging to each individual floor (zone). In addition to the message / channels detailed above, a dedicated page channel shall be capable of simultaneously providing live voice channel shall be capable of simultaneously providing live voice instructions without interrupting any of the messages listed above shall be provided.

7. Transmit signal to the building automation system (if applicable) and / or shutdown all HVAC units serving the floor of alarm.

8. Transmit signal to the central station with point identification.

9. Activate automatic smoke control sequences (if applicable).

10. All stairwell / exit doors shall unlock throughout the building except holding cells and secure areas as required.

11. All self-closing fire / smoke doors held open shall be released (if applicable).

12. All automatic events programmed to the alarm point shall be executed and the associated outputs activated.

B. Elevator Lobby / Equipment Room Detectors: Upon alarm activation of any elevator lobby smoke detector or equipment room detector the following functions shall automatically occur:

1. Perform general alarm sequence above.

2. Elevator Lobby smoke detectors shall recall the elevators to primary floor.

3. Elevator Lobby smoke detectors located on the primary recall floor shall recall the elevator the alternate floor.

4. Equipment room smoke detectors shall recall the elevator to the primary floor.

5. Activation of the Equipment room heat detector shall initiate the shunt trip in the associated elevator equipment room.
C. Supervisory Operation: Upon supervisory activation of any sprinkler valve supervisory switch, fire pump off-normal, clean agent fire suppression system trouble, the following functions shall automatically occur:

1. The internal audible device shall sound at the control panel or command center.
2. The LCD display shall indicate all applicable information associated with the supervisory condition including; zone, device type, device location and time / date.
3. All system activity / events shall be documented on the system printer.
4. Any remote or local annunciator LCD / LED's associated with the alarm zone shall be illuminated. The internal audible device shall sound.
5. Transmit signal to the central station with point identification.

D. Trouble Operation: Upon activation of a trouble condition or signal from any device on the system, the following functions shall automatically occur:

1. The internal audible device shall sound at the control panel or command center.
2. The LCD keypad display shall indicate all applicable information associated with the trouble condition including; zone, device type, device location and time / date.
3. All system activity / events shall be documented on the system printer.
4. Any remote or local annunciator LCD / LED’s associated with the alarm zone shall be illuminated. The internal audible device shall sound.
5. Transmit signal to the central station with point identification.

E. Monitor Activation: Upon activation of any device connected to a monitor circuit (fire pump / emergency generator status), the following functions shall automatically occur:

1. The LCD display shall indicate all applicable information associated with the status condition including; zone, device type, device location and time / date.
2. All system activity / events shall be documented on the system printer.
3. Any remote or local annunciator LCD / LED’s associated with the alarm zone shall be illuminated. The internal audible device shall sound.

1.08 SYSTEM DESIGN PARAMETERS

A. Standby Power

1. Standby power supply shall be an electrical battery with capacity to operate the system under maximum supervisory load for twenty four (24) hours and capable of operating the system for five (5) minutes of evacuation alarm on all devices, operating at maximum load. The system shall include a charging circuit to automatically maintain the electrical charge of the battery. The system shall automatically adjust the charging of the battery to compensate for temperature.

B. Circuiting Guidelines
1. Initiating Device Circuits
   a. Where necessary, conventional initiating device circuits (i.e. waterflow switches, valve supervisory switches, fire pump functions, etc.) shall be Class B (Style “A” or “B”).

2. Notification Appliance Circuits
   a. All notification appliance circuits shall be Class B (Style “Y”). The notification circuits shall be power limited. Non-power limited circuits are not acceptable.

3. Addressable Signature Signaling Line Circuits
   a. The signaling line circuit connecting to addressable / analog devices including, detectors, monitors modules, control modules, isolation modules, intrusion detection modules and notification circuit modules shall be Class A (style 6 or 7).
   b. When a signaling line circuit covers more than one building, a wire-to-wire short shall not effect the operation of the circuit from the other fire / smoke compartments (buildings).
   c. Each addressable analog loop shall be circuited so device loading is not to exceed 80% of loop capacity in order to leave for space for future devices.
   d. Provide one (1) supervisory module circuit for each sprinkler valve supervisory and waterflow switch.

4. Network Wiring
   a. The signaling line circuit connecting network panel / nodes, annunciators, command centers, shall be Class A (style 7). The media shall be copper except where fiber optic cable is specified on the drawings.
   b. The signaling line circuit connecting to the audio communications (pre-amp signal), amplifiers, and nodes shall be Class A (style 6). The circuit shall be power limited.
   c. The signaling line circuit connecting to the two-way communications circuit (riser) shall be Class B (style 4).

1.09 APPROVALS

The system must have proper listing and/or approval from the following nationally recognized agencies:

UL Underwriters Laboratories, Inc.
CSFM California State Fire Marshal

B. The Fire Alarm Contractor shall submit shop drawings to the Project Architect before commencing work.

1.10 SUBMITTALS
A. Coordination Drawings: Prepare coordination drawings in accordance with the provisions in Section 01330.

B. Provide shop drawing containing the following but not limited to:
   1. Riser Diagram.
   2. Typical Device Wiring Diagram.
   3. Wire Legend.
   4. Battery Calculation for each control panel, power supply, field power supply and network annunciator.
   5. Worst Case Voltage drop for each circuit type per building.
   6. Scaled floor plans showing all conduits, sizes, and quantity of conductors.
   7. Mounting Height of each device and back box requirement.
   8. Zoning and address description legend.

C. Provide product data booklets with the following but not limited:
   1. Wire.
   2. Battery Calculation for each control panel, power supply, field power supply and network annunciator.
   3. Size of Batteries to be used in each panel.
   4. Worst Case Voltage drop for each circuit type per building.
   5. CSFM listing sheet for each component.

1.11 PROJECT RECORD DOCUMENTS
A. Submit under provisions of Section 01770.
B. Record actual locations of initiating devices, signaling appliances, and end-of-line devices.

1.12 OPERATION AND MAINTENANCE DATA
A. Submit under provisions of Section 01782.
B. Operation Data: Operating instructions.
C. Maintenance Data: Maintenance and repair procedures.

1.13 WARRANTY
A. Contractor shall warrant completed fire alarm system wiring and equipment to be free from inherent mechanical and electrical defects, for a period of one year from date of completed and certified test, or from date of first beneficial use.

B. System manufacturer shall include an agreement whereby system will be inspected and tested in accordance with NFPA-72, Chapter 7. Testing shall be conducted by a local factory trained technician, who will upon completion of testing, provide the OWNER with written records of testing. This agreement shall be in effect for a period of two years after initial testing and acceptance by the OWNER. Cost of such agreement shall be part of Contractor’s bid.

1.14 EXTRA MATERIALS

A. Provide 10% manual stations of each type (minimum of one for each type) rods.

B. Provide six keys of each type.

C. Provide 10% of each type of smoke and heat (minimum of one of each type) detector.

D. Provide 10% of each type of audible and visual alarm device (minimum of one of each type).

PART 2 – PRODUCTS

2.01 MANUFACTURERS

A. Edwards.

B. Notifier

C. Approval Equal

2.02 MAIN FIRE ALARM CONTROL PANEL

A. General

1. The fire alarm control panel or panels and all system devices (horn-strobes, strobes, pull stations, smoke and heat detectors, etc. shall be Edwards Systems Technology (EST) type EST3 series (or approved equal).`

2. The operating controls shall be located behind locked door with viewing window. All control modules shall be labeled, and all zone locations shall be identified.

3. The main controller shall be supervised, site programmable, and of modular design supporting up to 64 network nodes. The peer-to-peer network shall contain multiple nodes consisting of the command center, main controller, remote control panels, LCD/LED annunciation nodes, and workstations. Each node is an equal, active functional node of the network, which is capable of making all local decisions and generating network tasks to other nodes in the event of node failure or communications failure between a nodes. When utilizing a network and multiple wiring faults occur, the network shall re-configure into many sub-networks and continue to respond to alarm events from every panel that can transmit and receive network messages.
4. The Main Controller Module shall control and monitor all local or remote peripherals. It shall support a large 168 character LCD, power supply, remote LCD and zone display annunciators, printers, and support communication interface standard protocol (CSI) devices such as color computer annunciators and color graphic displays.

5. Each controller shall contain a RS232 printer/programming port for programming locally via an IBM PC. When operational, each controller shall support a printer through the RS232 port and be capable of message routing.

6. The programmer shall be able to download all network and firmware applications from the configuration computer to all the network panels from a single location on the system.

7. The panels shall have the ability to add an operator interface control/display at each node that shall annunciate, command and control system functions.

8. The system shall store all basic system functionality and job specific data in non-volatile memory. All site specific and operating data shall survive a complete power failure intact. Passwords shall protect any changes to system operations.

9. The control panel shall contain a standby power supply that automatically supplies electrical energy to the system upon primary power supply failure. The system shall include a charging circuit to automatically maintain the electrical charge of the battery.

B. Signaling Line Circuits

1. The main controller shall be supervised, site programmable, and of modular design supporting detectors and remote modules per addressable Signaling line Circuit (SLC). The CPU shall support all SLC’s and Intelligent Addressable points. The system shall be designed with peer-to-peer networking capability.

2. The system shall provide electronic addressing of analog/addressable devices.

3. The system shall have built-in automatic system programming to automatically address and map all system devices attached to the main controller.

4. The system shall use full digital communications to supervise all addressable loop devices for placement, correct location, and operation. It shall allow swapping of “same type” devices without the need of addressing and impose the “location” parameters on replacement device. It shall initiate and maintain a trouble if a device is added to a loop and clear the trouble when the new device is mapped and defined into the system.

5. The system shall have a UL Listed Detector Sensitivity test feature, which will be a function of the smoke detectors and performed automatically every 4 hours.

C. Integrated Digital Audio

1. The system shall be capable of delivering multi-channel audio messages simultaneously over copper and/or fiber media.

2. All audio messages and live pages shall originate at the one-way audio control unit.
3. The one-way audio control unit shall store pre-recorded audio messages digitally. These messages shall be automatically directed to various areas in a facility under program control.

4. The system shall support remote cabinets with zoned amplifiers to receive, amplify and send messages through speakers over supervised circuits.

5. The one-way emergency audio control shall provide control switches to direct paging messages as follows:
   a. "All Call" to direct the page message to all areas in the facility, overriding all other messages and tones.
   b. "Page to Evacuation Area" to direct the message to the evacuation area(s), overriding all other messages and tones.
   c. "Page to Alert Area" to direct page messages to the area(s) receiving the alert message and tones, overriding all other messages and tones.
   d. "Page to Balance Building" to direct page messages to the areas in the facility NOT receiving either the evacuation area or alert area messages.
   e. "Page by Phone" switch to select the firefighters telephone system as the source for paging.

6. Audio Amplifiers (Multi-Channel)
   a. Provide as minimum one twenty (20) watt audio amplifier per paging zone.
   b. The system software shall be capable of selecting the required audio source signal for amplification.
   c. To enhance system survivability, each audio amplifier shall automatically provide a local 3-3-3 1000 Hz temporal pattern output upon loss of the audio communications with the one-way audio control unit, during an alarm condition.
   d. Audio amplifiers shall be power limited and protected from short circuits conditions on the audio circuit wiring.
   e. Each amplifier shall include a dedicated, selectable 25/70 Vrms output.
   f. Each amplifier shall also include a notification appliance circuit rated at 24Vdc @ 3.5A for connection of visible (strobe) appliances. This circuit shall be fully programmable and it shall be possible to define the circuit for the support of audible, visible, or ancillary devices.
   g. Provide a standby audio amplifier that will automatically sense the failure of a primary amplifier, and replace the function of the failed amplifier.

D. DACT

1. The system shall provide off premise communications capability (DACT) for transmitting system events to multiple Central Monitoring Station (CMS) receivers.
2. The system shall provide the CMS(s) with point identification of system events using Contact ID or SIA DCS protocols.

3. In the event of a panel CPU failure during a fire alarm condition, the DACT degrade mode shall transmit a general fire alarm signal to the CMS.

E. User Interfere

1. Main Control & Display
   
a. The main display shall be a large 168 character LCD with normal, alarm, trouble, supervisory, disabled point and ground fault indicators.

b. The interface shall show the first and most recent highest priority system events without any operator intervention. All system events shall be directed to one of four message queues. Messages of different types shall never intermixed to eliminate operator confusion. A “Details” switch shall provide additional information about any device highlighted by the operator.

c. Receipt of alarm, trouble, and supervisory signals shall activate integral audible devices at the control panel(s) and at each remote annunciation device. The integral audible devices shall produce a sound output upon activation of not less than 85 dBA at 10 feet.

d. The internal audible signal shall have different programmable patterns to distinguish between alarm, supervisory, trouble and monitor conditions.

e. The annunciator shall contain the following controls:
   
   (i) System Reset Switch with Indicator
   (ii) System Alarm Silence Switch with Indicator
   (iii) System Panel Silence Switch with Indicator
   (iv) Programmable Switch with Indicator
   (v) Details Switch
   (vi) System Message Queue Scroll Switches.
   (vii) 10-Digit Keypad to Enable/Disable System and Functions.

f. An authorized operator shall have the ability to operate or modify system functions like system time, date, passwords, holiday dates, restart the system and clear control panel event history file.

g. An authorized operator shall be capable of performing test functions within the installed system.

2. Additional Annunciation & Control
   
a. The system shall be capable to receive, monitor, and annunciate signals from individual devices and circuits installed throughout the building.
b. Each zone, stairwell and elevator bank shall have a control switch to initiate paging. Each paging switch shall have an associated Green LED (zone indicating circuit on) and Yellow LED (zone indicating circuit trouble).

c. Manufacturers’ standard control switches shall be acceptable if they provide the required operation, including performance, supervision and position indication. If the manufacturers’ standard switches do not comply with these requirements, fabrication of custom manual controls acceptable to the Owner is required.

F. Internal Modular Power Supply

1. System power supply(s) shall provide multiple power limited 24 VDC output circuits as required by the panel.

2. Upon failure of normal (AC) power, the affected portion(s) of the system shall automatically switch over to secondary power without losing any system functions.

3. Each system power supply shall be individually supervised. Power supply trouble signals shall identify the specific supply and the nature of the trouble condition.

4. All standby batteries shall be continuously monitored by the power supply. Low battery and disconnection of battery power supply conditions shall immediately annunciate as battery trouble and identify the specific power supply affected.

5. All system power supplies shall be capable of recharging their associated batteries, from a fully discharged condition to a capacity sufficient to allow the system to perform consistent with the requirements of this section, in 48 hours maximum.

6. All AC power connections shall be to the building's designated emergency electrical power circuit and shall meet the requirements of NFPA 72 - The AC power circuit shall be installed in conduit raceway. The power circuit disconnect means shall be clearly labeled FIRE ALARM CIRCUIT CONTROL and shall have a red marking. The location of the circuit disconnect shall be labeled permanently inside the each control panel the disconnect serves.

G. Reports

1. The system shall provide the operator with system reports that give detailed description of the status of system parameters for corrective action, or for preventative maintenance programs. The system shall provide these reports via the main LCD, and shall be capable of being printed on any system printer.

2. The system shall provide a report that gives a sensitivity listing of all detectors that have less than 75% environmental compensation remaining. The system shall provide a report that provides a sensitivity (% Obscuration per foot) listing of any particular detector.

3. The system shall provide a report that gives a listing of the sensitivity of all of the detectors on any given panel in the system, or any given analog/addressable device loop within any given panel.
4. The system shall provide a report that gives a chronological listing of up to the last 1740 system events.

5. The system shall provide a listing of all of the firmware revision listings for all of the installed network components in the system.

H. System Printer

1. The event and status printer shall be a 9-pin, impact, dot matrix printer with a minimum print speed of 232 characters per second.

2. The printer shall be capable of serial or parallel communications protocol.

3. The communications speed for RS-232 communications protocol shall be adjustable from 300 to 9600 Baud.

4. The printer shall list the time, date, type and user defined message for each event printed.

2.03 Annunciators

A. General

1. The system shall have the capacity to support 64 network annunciators or EST3 network panel nodes.

B. Remote LCD Annunciator

1. Remote LCD annunciators shall display each and every point in the system and be sized with the same number of characters as in the main FACP display. Annunciators not capable of displaying each point will not be considered equal. Grouping points to “zones” will not be acceptable.

2. Network alphanumeric annunciators shall be located throughout the facility as indicated on the plans and in the fire safety director's office. This annunciator shall be an Integral part of the Peer to Peer Network for survivability. Systems that require a “host” Network Node to control remote annunciators shall not be considered acceptable.

3. Each annunciator shall contain a supervised, back lit, liquid crystal with a minimum of 8 line with 21 characters per line. Where required, the annunciator shall include additional zonal annunciation and manual control without additional enclosures. The annunciator shall support full ability to serve as the operating interface to the system and shall include the following features;

   a. Matched appearance with other system displays

   b. Each LCD Display on each node (cabinet) in the system shall be configurable to show the status of any or all of the following functions anywhere in the system:

      (i) Alarm

      (ii) Supervisory

      (iii) Trouble
(iv) Monitor

4. Each annunciator must be capable of supporting custom messages as well as system event annunciation. It must be possible to filter unwanted annunciation of trouble, alarm or supervisory functions on a by point or by geographic area. The annunciators shall be mounted in stand-alone enclosures or integrated into the network panels as indicated on the plans.

C. Graphic Annunciator

1. The annunciator shall depict the graphical diagrams or matrix lamps as required per the contract drawings and AHJ.

2. It shall operate on nominal 24 Vdc and is battery backed up.

3. Any annunciator switches shall be system input points and shall be capable of controlling any system output or function.

4. The graphic annunciator shall be UL, ULC and CSFM Listed.

5. The graphic shall be backlit using high intensity LEDs.

6. The unit shall be semi-flush or surface mounted to match existing.

7. The main graphic door shall be tamper resistant and equipped with a key lock.

8. It shall be possible to update the graphic image in the field without replacing the entire graphic.

2.04 Intelligent Addressable Detectors

A. General

1. Each remote device shall have a microprocessor with non-volatile memory to support its functionality and serviceability. Each device shall store as required for its functionality the following data: device serial number, device address, device type, personality code, date of manufacture, hours in use, time and date of last alarm, amount of environmental compensation left/used, last maintenance date, job/project number, current detector sensitivity values, diagnostic information (trouble codes) and algorithms required to process sensor data and perform communications with the loop controller.

2. Each device shall be capable of electronic addressing, either automatically or application programmed assigned, to support physical/electrical mapping and supervision by location. Setting a device’s address by physical means shall not be necessary.

3. The System Intelligent Detectors shall be capable of full digital communications using both broadcast and polling protocol. Each detector shall be capable of performing independent fire detection algorithms. The fire detection algorithm shall measure sensor signal dimensions, time patterns and combine different fire parameters to increase reliability and distinguish real fire conditions from unwanted deceptive nuisance alarms. Signal patterns that are not typical of fires shall be eliminated by digital filters. Devices not capable of combining different fire parameters or employing digital filters shall not be acceptable.
4. Each detector shall have an integral microprocessor capable of making alarm decisions based on fire parameter information stored in the detector head. Distributed intelligence shall improve response time by decreasing the data flow between detector and analog loop controller. Detectors not capable of making independent alarm decisions shall not be acceptable. Maximum total analog loop response time for detectors changing state shall be 0.75 seconds.

5. Each detector shall have a separate means of displaying communication and alarm status. A green LED shall flash to confirm communication with the analog loop controller. A red LED shall flash to display alarm status.

6. The detector shall be capable of identifying up to 32 diagnostic codes. This information shall be available for system maintenance. The diagnostic code shall be stored at the detector.

7. Each smoke detector shall be capable of transmitting pre-alarm and alarm signals in addition to the normal, trouble and need cleaning information. It shall be possible to program control panel activity to each level. Each smoke detector may be individually programmed to operate at any one of five (5) sensitivity settings.

8. Each detector microprocessor shall contain an environmental compensation algorithm, which identifies and sets ambient "Environmental Thresholds" approximately six times an hour. The microprocessor shall continually monitor the environmental impact of temperature, humidity, other contaminates as well as detector aging. The process shall employ digital compensation to adapt the detector to both 24 hour long-term and 4 hour short-term environmental changes. The microprocessor shall monitor the environmental compensation value and alert the system operator when the detector approaches 80% and 100% of the allowable environmental compensation value. Differential sensing algorithms shall maintain a constant differential between selected detector sensitivity and the "learned" base line sensitivity. The base line sensitivity information shall be updated and permanently stored at the detector approximately once every hour.

9. The intelligent analog detectors shall be suitable for mounting on any detector mounting base.

10. The Fire alarm system shall have the ability to set individual smoke detectors for alarm verification. Detector in the alarm verification mode shall indicate, by point in a text format at the main control and at the remote LCD annunciators.

B. Fixed Temp/Rate of Rise Heat Detector

1. Provide intelligent combination fixed temperature/rate-of-rise heat detectors. The heat detector shall have a low mass thermistor heat sensor and operate at a fixed temperature and at a temperature rate-of-rise. It shall continually monitor the temperature of the air in its surroundings to minimize thermal lag to the time required to process an alarm. The integral microprocessor shall determine if an alarm condition exists and initiate an alarm based on the analysis of the data. Systems using central intelligence for alarm decisions shall not be acceptable. The intelligent heat detector shall have a nominal fixed temperature alarm point rating of 135°F (57°C) and a rate-of-rise alarm point of 15°F (9°C) per minute. The heat detector shall be rated for ceiling installation at a minimum of 70 ft (21.3m) centers and be suitable for wall mount applications.

C. Photoelectric Smoke Detector
1. Provide intelligent photoelectric smoke detectors. The analog photoelectric detector shall utilize a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in sensitivity due to the environmental affects of dirt, smoke, temperature, aging and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a laptop PC. The photo detector shall be rated for ceiling installation at a minimum of 30 ft (9.1m) centers and be suitable for wall mount applications. The photoelectric smoke detector shall be suitable for direct insertion into air ducts up to 3 ft (0.91m) high and 3 ft (0.91m) wide with air velocities up to 5,000 ft/min. (0-25.39 m/sec) without requiring specific duct detector housings or supply tubes.

2. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 1.0% to 3.5%. The photo detector shall be suitable for operation in the following environment:
   a. Temperature: 32°F to 120°F (0°C to 49°C)
   b. Humidity: 0-93% RH, non-condensing
   c. Elevation: no limit

D. Smoke Detector Guards

1. Smoke detector guards shall be installed at the locations shown on the drawings.
2. The guards shall be Underwriters Laboratories tested and listed by for use with the smoke detectors they protect.
3. Guard design shall not affect the detector operating sensitivity and shall not reduce the listed detector spacing.
4. The guards shall be constructed of 16-gauge steel with a baked white finish to match the detectors.
5. Tamperproof mounting hardware shall be provided.

E. Standard Detector Bases

1. Provide standard detector mounting bases suitable for mounting on 1-gang, 3½” or 4” octagon box and 4” square box. The base shall, contain no electronics, support all detector types and have the following minimum requirements:
   a. Removal of the respective detector shall not affect communications with other detectors.
   b. Terminal connections shall be made on the room side of the base. Bases, which must be removed to gain access to the terminals, shall not be acceptable.
   c. The base shall be capable of supporting one (1) Remote Alarm LED Indicator. Provide remote LED alarm indicators where shown on the plans.

F. Relay Detector Bases
1. Provide standard detector mounting bases suitable for mounting on 1-gang, 3½” or 4” octagon box and 4” square box. The base shall support all detector types and have the following minimum requirements:

   a. Removal of the respective detector shall not affect communications with other detectors.

   b. Terminal connections shall be made on the room side of the base. Bases, which must be removed to gain access to the terminals, shall not be acceptable.

   c. The relay shall be a bi-stable type and selectable for normally open or normally closed operation.

   d. The position of the contact shall be supervised.

   e. The relay shall automatically de-energize when a detector is removed.

   f. The operation of the relay base shall be controlled by its respective detector processor. Detectors operating standalone mode shall operate the relay upon changing to alarm state. Relay bases not controlled by the detector microprocessor shall not be acceptable.

   g. Form "C" Relay contacts shall have a minimum rating of 1 amp @ 30 Vdc and be listed for pilot duty.

G. Duct Detector

1. Provide intelligent addressable photoelectric duct smoke detectors. The analog photoelectric detector shall utilize a light scattering type photoelectric smoke sensor to sense changes in air samples from its surroundings. The integral microprocessor shall dynamically examine values from the sensor and initiate an alarm based on the analysis of data. Systems using central intelligence for alarm decisions shall not be acceptable. The detector shall continually monitor any changes in sensitivity due to the environmental affects of dirt, smoke, temperature, aging and humidity. The information shall be stored in the integral processor and transferred to the analog loop controller for retrieval using a laptop.

2. The percent smoke obscuration per foot alarm set point shall be field selectable to any of five sensitivity settings ranging from 0.79% to 2.46%. The duct detector shall be suitable for operation in the following environment:

   a. Temperature: -20°F to 158°F (-29°C to 70°C)

   b. Humidity: 0-93% RH, non-condensing

   c. Air velocity: 100 to 4000 ft/min

3. Provide an air exhaust tube and an air sampling inlet tube, which extends into the duct air stream up to ten feet. The sampling tube can be installed with or without the cover in place and can be rotated in 45 degree increments to ensure proper alignment with the duct airflow.

4. Status LEDs shall remain visible through a clear assembly cover.

5. The unit shall contain a magnet-activated test switch.
6. One integral form C auxiliary alarm relay shall be provided. The relay contact shall be capable of being individually programmed from the control panel. The contact shall be rated for 2.0A at 30VDC.

7. Provide Magnet-activated Remote Test station with integral remote alarm indicator.

2.05 Intelligent Addressable Modules

A. General

1. Each remote device shall have a microprocessor with non-volatile memory to support its functionality and serviceability. Each device shall store as required for its functionality the following data: device serial number, device address, device type, personality code, date of manufacture, hours in use, time and date of last alarm, amount of environmental compensation left/used, last maintenance date, job/project number, current detector sensitivity values, diagnostic information (trouble codes) and algorithms required to process sensor data and perform communications with the loop controller.

2. Each device shall be capable of electronic addressing, either automatically or application programmed assigned, to support physical/electrical mapping and supervision by location. Setting a device’s address by physical means shall not be necessary.

3. It shall be possible to address each Intelligent module without the use of DIP or rotary switches. Devices using DIP switches for addressing shall not be acceptable. The personality of multifunction modules shall be programmable at site to suit conditions and may be changed at any time using a personality code downloaded from the Analog Loop Controller. Modules requiring EPROM, PROM, ROM changes or DIP switch and/or jumper changes shall not be acceptable. The modules shall have a minimum of 2 diagnostic LEDs mounted behind a finished cover plate. A green LED shall flash to confirm communication with the loop controller. A red LED shall flash to display alarm status. The module shall be capable of storing up to 24 diagnostic codes, which can be retrieved for troubleshooting assistance. Input and output circuit wiring shall be supervised for open and ground faults. The module shall be suitable for operation in the following environment:

4. Temperature: 32°F to 120°F (0°C to 49°C)

5. Humidity: 0-93% RH, non-condensing

B. Single Input Module

1. Provide intelligent single input modules. The Single Input Module shall provide one (1) supervised Class B input circuit capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on 2 ½” (64mm) deep 1-gang boxes and 1 ½” (38mm) deep 4” square boxes with 1-gang covers. The single input module shall support the following circuit types:

2. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)

3. Normally-Open Alarm Delayed Latching (Waterflow Switches)

4. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
5. Normally-Open Active Latching (Supervisory, Tamper Switches)

C. Dual Input Module

1. Provide intelligent dual input modules. The Dual Input Module shall provide two (2) supervised Class B input circuits each capable of a minimum of 4 personalities, each with a distinct operation. The module shall be suitable for mounting on 2 ⅜” (64mm) deep 1-gang boxes and 1 ⅛” (38mm) deep 4” square boxes with 1-gang covers. The dual input module shall support the following circuit types:

2. Normally-Open Alarm Latching (Manual Stations, Heat Detectors, etc.)
3. Normally-Open Alarm Delayed Latching (Waterflow Switches)
4. Normally-Open Active Non-Latching (Monitor, Fans, Dampers, Doors, etc.)
5. Normally-Open Active Latching (Supervisory, Tamper Switches)

D. Signal Module

1. Provide intelligent single input signal modules. The Single Input (Single Riser Select) Signal Module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation.

2. The module shall be suitable for mounting on 2 ⅜” (64mm) deep 2-gang boxes and 1 ⅛” (38mm) deep 4” square boxes with 2-gang covers, or 100mm square boxes.

3. The single input signal module shall support the following operations:
   c. Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25Vrms @50w or 70 Vrms @ 35 Watts of Audio)
   d. Telephone Power Selector with Ring Tone (Fire Fighter’s Telephone)

4. When selected as a telephone power selector, the module shall be capable of generating its own “ring tone”.

E. Synchronized Signal Module

1. Provide intelligent single input signal modules. The Single Input (Single Riser Select) Signal Module shall provide one (1) supervised Class B output circuit capable of a minimum of 2 personalities, each with a distinct operation.

2. The module shall be suitable for mounting on 2 ⅜” (64mm) deep 2-gang boxes and 1 ⅛” (38mm) deep 4” square boxes with 2-gang covers, or 100mm square boxes.

3. The single input signal module shall support the following operations:
   e. Audible/Visible Signal Power Selector (Polarized 24 Vdc @ 2A, 25Vrms @50w or 70 Vrms @ 35 Watts of Audio)
   f. Telephone Power Selector with Ring Tone (Fire Fighter’s Telephone)

4. Provides UL1971 auto-sync output for synchronizing multiple notification appliance circuits
F. Control Relay Module

1. Provide intelligent control relay modules. The Control Relay Module shall provide one form “R” dry relay contact rated at 2 amps @ 24 Vdc to control external appliances or equipment shutdown. The control relay shall be rated for pilot duty and releasing systems. The position of the relay contact shall be confirmed by the system firmware. The control relay module shall be suitable for mounting on 2 ½” (64mm) deep 1-gang boxes and 1 ½” (38mm) deep 4” square boxes with 1-gang covers.

G. Manual Pull Station

1. Provide intelligent single action, single stage fire alarm stations. The fire alarm station shall be of metal construction with an internal toggle switch. Provide a locked test feature. Finish the station in red with silver “PULL IN CASE OF FIRE” English lettering. The manual station shall be suitable for mounting on 2 ½” (64mm) deep 1-gang boxes and 1 ½” (38mm) deep 4” square boxes with 1-gang covers.

2.06 Notification Appliances

A. General

1. All appliances shall be UL Listed for Fire Protective Service.

2. All strobe appliances or combination appliances with strobes shall be capable of providing the “Equivalent Facilitation” which is allowed under the Americans with Disabilities Act accessibility guidelines (ADA(AG)), and shall be UL 1971.

3. All appliances shall be of the same manufacturer as the Fire Alarm Control Panel specified to insure absolute compatibility between the appliances and the control panels, and to insure that the application of the appliances are done in accordance with the single manufacturers’ instructions.

4. Any appliances, which do not meet the above requirements, and are submitted, for use must show written proof of their compatibility for the purposes intended. Such proof shall be in the form of documentation from all manufacturers which clearly states that their equipment (as submitted) are 100% compatible with each other for the purposes intended.

B. Wall Strobes

1. Strobes shall provide synchronized flash outputs. The light output shall be an even “FullLight” pattern with no hot spots. Strobes using specular reflectors are not acceptable.

2. It shall be possible to flash the strobe at a temporal flash rate to match the horn and meet the intent of UL Private Mode signaling.

3. The strobe shall have selectable 15, 30, 75 or 110 cd settings.

4. It shall be possible to change the strobe setting without removing the device from the wall.

5. The strobe shall be a low profile design, finished in neutral white and shall not protrude more than 1” off the wall. In-out screw terminals shall be provided for wiring.
6. The strobe shall be suitable for wall mounting and shall mount in a standard 1-gang box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.

C. Ceiling Strobes

1. Strobes shall provide synchronized flash outputs. The light output shall be an even "FullLight" pattern with no hot spots. Strobes using specular reflectors are not acceptable.

2. It shall be possible to flash the strobe at a temporal flash rate to match the horn and meet the intent of UL Private Mode signaling.

3. The standard ceiling strobe shall have selectable 15, 30, 75 or 95 cd settings.

4. The high output ceiling strobe shall have selectable 95, 115, 150 or 177 cd settings.

5. It shall be possible to change the strobe setting without removing the device from the ceiling.

6. The strobe shall be a low profile design, finished in neutral white and shall not protrude more than 1.6" off the ceiling. In-out screw terminals shall be provided for wiring.

7. The strobe shall be suitable for ceiling mounting and shall mount in a standard 4" square 2 1/8" (54 mm) deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.

D. Wall Speakers

1. It shall be a low profile design, finished in neutral white and shall not protrude more than 1" off the wall. In-out screw terminals shall be provided for wiring.

2. The low profile speaker shall not extend more than 1" (2.5cm) past the finished wall surface, and provide a switch selectable audible output of 2W (90dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (81dBA) at 10 ft. when measured in reverberation room per UL-464.

3. Wattage setting shall be visible with the cover installed.

4. It shall be suitable for wall mounting and shall mount in a standard 4" x 2 1/8" square electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.

E. Wall Speaker-Strobes

1. Strobes shall provide synchronized flash outputs. The light output shall be an even "FullLight" pattern with no hot spots. Strobes using specular reflectors are not acceptable.

2. It shall be possible to flash the strobe at a temporal flash rate to match the horn and meet the intent of UL Private Mode signaling.

3. The strobe shall have selectable 15, 30, 75 or 110 cd settings.
4. It shall be possible to change the strobe setting without removing the device from the wall.

5. It shall be a low profile design, finished in neutral white and shall not protrude more than 1” off the wall. In-out screw terminals shall be provided for wiring.

6. The low profile speaker shall not extend more than 1” (2.5cm) past the finished wall surface, and provide a switch selectable audible output of 2W (90dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (81dBA) at 10 ft. when measured in reverberation room per UL-464.

7. Wattage setting shall be visible with the cover installed.

8. It shall be suitable for wall mounting and shall mount in a standard 4" x 2 1/8" square electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.

F. Ceiling Speaker-Strobes

1. Strobes shall provide synchronized flash outputs. The light output shall be an even “FullLight” pattern with no hot spots. Strobes using specular reflectors are not acceptable.

2. It shall be possible to flash the strobe at a temporal flash rate to match the horn and meet the intent of UL Private Mode signaling.

3. The standard ceiling strobe shall have selectable 15, 30, 75 or 95 cd settings.

4. The high output ceiling strobe shall have selectable 95, 115, 150 or 177 cd settings.

5. It shall be possible to change the strobe setting without removing the device from the ceiling.

6. The low profile speaker shall provide a switch selectable audible output of 2W (90dBA), 1W (87dBA), 1/2W (84dBA), or 1/4W (81dBA) at 10 ft. when measured in reverberation room per UL-464.

7. Wattage and Candela setting shall be visible with the cover installed.

8. It shall be a low profile design, finished in neutral white and shall not protrude more than 1.6” off the ceiling. In-out screw terminals shall be provided for wiring.

9. The strobe shall be suitable for ceiling mounting and shall mount in a standard flush mounted 4" square 2 1/8" (54 mm) deep electrical box. All mounting hardware shall be captive and there shall be no mounting screws visible after the device is installed.

G. Wall Weatherproof Speakers

1. Provide 4" surface weatherproof re-entrant speakers at the locations shown on the drawings.

2. Speakers shall provide 2w, 4w, 8w, and 15w power taps for use with 25V or 70V systems.
3. The re-entrant speakers shall utilize a high efficiency compression drivers. Cone type drivers are not acceptable.

4. At the 15 watt setting, the speaker shall provide a 102 dBA sound output over a frequency range of 400-4000 Hz. when measured in reverberation room per UL-1480.

5. Weatherproof boxes shall be provided for outdoor mounting.

2.07 Accessory Equipment

A. Multi-Voltage Control Relays

1. General
   a. Provide remote control relays connected to supervised ancillary circuits for control of fans, dampers, door releases, etc.
   b. Relay contact ratings shall be SPDT or DPDT and rated for 10 amperes at 115 Vac.
   c. A single relay may be energized from a voltage source of 24 Vdc, 24 Vac, 115 Vac, or 230 Vac.
   d. A red LED shall indicate the relay is energized.
   e. A metal enclosure shall be provided.

B. Electromagnetic Door Holders (If Applicable)

1. General – Electromagnetic door holders submitted for use must have written proof of their compatibility for the purposes intended. Such proof shall be in the form of documentation from all manufacturers that clearly states that their equipment (as submitted) is 100% compatible with each other for the purpose intended.

2. Wall Mounted, 1504/1505/1508/1509 Series
   a. Provide flush, semi-flush or surface wall mounted electromagnetic door holder/releases selectable to 24 Vac/dc or 120 Vac as directed by the Consulting Engineer. Finish shall be brushed zinc.

C. Remote Booster Power Supplies

1. Unit shall be a self contained with 24Vdc power supply and batteries housed in its own enclosure.

2. Power supply shall be available in both 10 Amp or 6.5 Amp models and 110 Vac or 220Vac.

3. On board LED indicators for each resident NAC, battery supervision, ground fault and AC power.

4. The power supply shall provide four (4) independent 3Amp NACs. Each circuit can be configurable as an auxiliary output.
5. Configurable for any one of three signaling rates: 120SPM; 3-3-3 temporal; or, continuous.

6. Two independent and configurable inputs switch selectable to allow correlation of the two (2) inputs and the four (4) outputs.

7. NACs shall be configurable for either four Class B or two Class A circuits.

8. The unit shall be compatible for synchronization of multiple power supplies without inter-connect wiring.

9. Brackets shall be provided inside the enclosure to allow mounting the signaling modules. All signaling modules shall be listed to be located inside the booster power supply enclosure.

10. A selectable dip switch shall enable built in synchronization for horns and strobes which may be used to synchronize downstream devices, as well as other boosters and their connected devices.

2.08 WIRE

A. All low voltage wire required in this section shall be furnished and installed by the fire alarm contractor.

B. All wire shall be installed in conduit. Wiring installed in underground conduits shall be approved for wet applications in accordance with the National Electric Code.

C. All fire alarm system wiring shall be new.

D. Wiring shall be in accordance with local stated and national codes (e.g., NEC Article 760) and as recommended by the manufacturer of the fire alarm system. Number and size of conductors shall be as recommended by the fire alarm system manufacturer, but not less than 14 AWG for Initiating Device Circuits and Signaling Line Circuits, and 12 AWG for Indicating Appliance Circuits.

E. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system.

F. Wiring used for the multiplex communication loop shall be 18 AWG twisted and shielded and installed in conduit. The system shall permit use of IDC and IAC wiring in the same conduit with the communication loop.

G. All field wiring shall be completely supervised. In the event of a primary power failure, disconnected standby battery, removal of any internal modules, or any open circuits in the field wiring; a trouble signal will be activated until the system and its associated field wiring are restored to normal condition.

PART 3 – EXECUTION

3.01 INSTALLATION

A. All wire and cable shall be listed and/or approved by a recognized testing agency for use with a protective signaling system and shall be as recommended by the manufacturer. All wiring shall be in conduit.
B. Install all necessary conductors to all devices indicated on Drawings, make all necessary conductor terminations to all devices, for a complete system to function as specified or indicated on Drawings.

C. There shall be no splices made in junction boxes. All terminations shall be in terminal cabinets or on equipment terminals.

D. All conductors shall be installed within conduits, boxes, and terminal cabinets, in a manner that shall provide for completely metal enclosed installation. Furnish and install all conductors necessary to connect all incoming and outgoing circuits, including spare conductors, to terminal strips within terminal cabinets.

E. Wiring within equipment and terminal cabinets shall be terminated on terminal blocks having a terminal for each required connection. Wiring shall be cabled, neatly laced and securely fastened in place so that no weight is imposed on any equipment or terminals.

F. Install required terminal blocks within each terminal cabinet. Terminal blocks shall be installed on inside back of cabinets only, not on side. All incoming wiring shall be terminated on the left side of terminal blocks, and all outgoing wiring shall be terminated on the right side of the terminal blocks.

G. Conductors shall be color coded and tagged with code markers at each terminal cabinet, junction box, pullbox and equipment. A wire index shall be typed and installed on terminal cabinet door. Each index shall be covered with clear plastic adhesive cover. Wiring shall be identified as to building and location of devices in the index.

H. Wiring within equipment and terminal cabinets shall be carefully strapped, and shall be formed in rectangular configuration. Each wire shall be properly numbered in numerical order and shall maintain same number throughout site.

3.02 TESTING

A. Upon completion of the work and after all electrical connections have been made and the system is in full operation, the alarm system shall be tested and defective work shall be corrected.

   1. Testing shall be done in accordance with LAFD Regulation #4 by a 3rd party testing agency approved/certified by LAFD.

B. Acceptance testing of Fire Detection System shall be as required by the State Fire Marshal, and local authority having jurisdiction. Contractor shall be responsible for identifying required testing, coordinating scheduling, and conducting tests necessary to achieve occupancy certification. Tests shall include following:

   1. An operation of each signal-initiating device (smoke detectors, heat detectors and pull stations).

   2. An operation of each indicating device (alarm horn and alarm lamp).

   3. Operation of features of system under normal operation.

   4. Operation of supervisory features of system.

   5. Operation of features of system on standby power, with primary power off.
C. A hard copy of the analog value of each initiating input/device shall be given to the OWNER and Authority Having Jurisdiction (AHJ) upon completion of system tests. These values shall be used as reference in future test to determine sensor maintenance.

D. Upon completion of installation of fire alarm equipment, Contractor shall provide to the OWNER a signed, written statement confirming that fire alarm equipment was installed in accordance with the Specifications, wiring diagrams, instructions, and directions provided by manufacturer.

E. Contractor shall complete the Inspection and Testing form as required by NFPA 72 Chapter 7 and shall submit to the OWNER’s Electrical Inspector one copy of the completed form.

3.03 TRAINING

A. The Contractor shall include a minimum of eight (8) hours of operations and maintenance training at the project site for owner designated staff.
PART 1 - GENERAL

1.1 GENERAL CONDITIONS:

A. The Conditions of the Contract (General, Supplementary, and other Conditions) and the General Requirements (Sections of Division 1) are hereby made a part of this Section.

1.2 WORK INCLUDED:

A. The work covered under this Section of the Specifications consists of furnishing all labor, equipment, supplies and materials, and in performing all operations, including cutting, channeling, chasing, excavating, and backfilling necessary for the complete installation of security equipment in accordance with the specifications and the accompanying drawings, except as specifically noted otherwise.

B. The Work includes:

1. Raceways
2. Conductors and Cables
3. Grounding and Surge Protection
4. Cabinets and Enclosures
5. Maintenance and Service
6. Fiber Optic Cable System
7. Door Control and Monitoring System
8. Programmable Logic Controllers
9. Security Monitoring and Control System
10. Closed Circuit Television System
11. Site Intercom System
12. Dedicated Intercom and General Paging
13. Consoles and Control Panels
15. Watchtour System
16. Metal Detectors
17. Motion Detectors
18. Personal Alarm System
19. Television Distribution System
20. Vehicle Detectors
21. Elevator Control Interfaces
22. Utility Control Interfaces
23. Uninterruptible Power Systems

C. Coordinate with the construction supervisor the environmental and construction conditions necessary in each of the control areas and equipment rooms for systems installation and operation. Durations of installation and testing activities must be specifically addressed to permit completion of the Division 17 systems concurrently with the remainder of the facility.

1.3 WORK EXCLUDED:
A. See the Architectural Drawings for casework associated with security and communications equipment.

1.4 RELATED WORK SPECIFIED ELSEWHERE:
A. Refer to Section 01900 for security fasteners specifications.
B. Refer to Division 11 for security equipment specifications.
C. Refer to Division 11 for security equipment specifications.
D. Refer to Division 16 for conduit, raceway and electrical box specifications. Unless otherwise noted, provide all Division 17 raceways in accordance with the Division 16 Specifications.

1.5 SECURITY ELECTRONICS COMPANY QUALIFICATIONS;
A. General Requirements: The Security Electronics Company (SEC) shall have total responsibility for the coordination and installation of the work shown and described in the Division 17 Drawings and Specifications. The SEC shall specialize in the design, fabrication, and installation of integrated security electronics and communications control systems and shall be UL508A certified.

B. Qualifications Requirements: The General Contractor shall submit a Qualifications Submittal of the SEC listed on the bid form within 15 calendar days after issuance of Notice To Proceed. The evaluation of the SEC’s qualifications will be based entirely on the qualifications submittal. The submittal’s format must be on a paragraph-by-paragraph basis of the items listed below:
1. The SEC’s UL listed 508A Standard for Industrial Control Panels certification number.

2. A history of the SEC that reflects the length of time the company has performed services as a SEC. The SEC shall have completed a minimum of five projects involving major systems (programmable logic controllers, door control, intercom, and closed circuit television) similar to those described in these specifications. The SEC must have completed a minimum of three detention projects using multi-terminal (three or more terminals) touchscreen controls or sub-contract the Security Monitoring and Control System (SMCS), which is described in Section 17170.

3. Provide a list of the five most recently completed projects involving major systems similar to those described in these specifications for which the company has assumed responsibility as the SEC. For companies with multiple offices, the listed projects must have been completed by the office that will be responsible for management of this project. If more than five projects are listed, only the first five will be reviewed. If the company is not sub-contracting the SMCS, three detention projects using multi-terminal touchscreen controls must be listed. Information for each project must include the following:

   a. Project name and location.
   b. Date of project completion.
   c. Contract amount for the equipment and services for which the company had responsibility.
   d. Names of the SEC's Project Manager, Project Engineer and Field Manager.
   e. Name and telephone number of Architect/Engineer's security systems design project manager.
   f. Name and telephone number of Architect/Engineer's project manager.
   g. Name and telephone number of an individual at each facility familiar with the performance, operation, and maintenance of the facility's electronic security systems (preferably maintenance manager). References must be current.
   h. List and description of systems included on the project and the approximate installed value of each. Identify the number of terminals in touchscreen systems. System values must exceed the following amounts for at least two of the five projects.

   1. Door Control System - $150,000
   2. Intercom/Paging System - $100,000
   3. Closed Circuit Television System - $300,000
4. Security Monitoring and Control (touchscreen) System - $150,000 (unless sub-contracted).

5. Portable Duress System ($30,000)

4. Proposed SEC organizational chart to include the names of the SEC's Project Manager, Project Engineer, Field Manager, Field Technicians and Technical Support Staff.

5. For each of the individuals listed in the organizational chart, provide resumes and a delineation of the individual's project responsibilities for this project. The resumes must include information about the individuals' education, electronics systems detention experience, systems integration capabilities, factory training and length of time employed with the SEC.

6. For each of the specified systems in the Division 17 documents, provide a delineation of the tasks to be performed by the SEC's staff and those tasks, if any, to be performed by subcontractors, including the development of custom software. Technical information reflecting each subcontractor's expertise and experience in the field of the subcontracted scope of work must be included with the SEC's submittal.

7. For SECs that intended to sub-contract the SMCS (Section 17170), the following information on the SMCS Sub-Contractor must be submitted. If qualified, the SEC and named SMCS Sub-Contractor will be qualified as a team. The SEC will not be allowed to substitute another SMCS Sub-Contractor after the contract has been awarded unless prior approval is received from the Owner/Engineer.

   a. A history of the company that reflects the length of time that the Sub-Contractor has performed work as a SMCS Sub-Contractor.

   b. List of the three most recently completed multi-terminal detention touchscreen projects that are similar in scope to this project. If more than three projects are listed, only the first three projects will be reviewed. For each project provide the following information.

      1. Project name and location.

      2. Date of project completion.

      3. Size of system to include number of touchscreen terminals and approximate cost of touchscreen system.

      4. Description of system to include software utilized, network type, interface with other systems, inmate management system capabilities, etc.

      5. Name and telephone number of Owner's representative that is knowledgeable of the operations of the system (preferably maintenance manager).
6. Name and telephone number of Architect/Engineer's security systems project manager.

c. Resumes of individuals to be assigned to this project and a delineation of the individual's project responsibilities for this project. The resumes must include information about the individuals' education, electronics systems detention experience, systems integration capabilities, factory training and length of time employed with the Sub-Contractor.

d. A letter from the Surety Company reflecting the Surety Company's history and experience with the SMCS Sub-Contractor. The letter must also state the position of the Surety Company relative to supplying a 100% Payment and Performance Bond should the contract be awarded to the Sub-Contractor. The letter must be an original and include the date that the letter was issued, reference to this project and the estimated value of the work to be performed by the Sub-Contractor.

8. For prospective SECs that propose to sub-contract the SMCS (Section 17170), the following are the minimum requirements relative to the Security Monitoring and Control System.

a. All shop drawings prepared by the Security Monitoring and Control System Sub-Contractor shall be submitted to the Owner through the SEC.

b. The SMCS Sub-Contractor shall prepare and submit, through the SEC, a developmental schedule listing the milestones in the development process of the SMCS.

c. Both the SMCS Sub-Contractor and the SEC shall be required to attend the software development meeting and factory testing as described in Section 17170, as well as the final acceptance testing.

d. The SMCS Sub-Contractor shall provide on-site assistance in the installation of the SMCS.

e. The SMCS Sub-Contractor together with the SEC will be required to conduct the Owner training sessions for the SMCS.

9. A signed statement by the SEC that he has reviewed the Division 17 drawings and specifications and understands the specified system architecture and requirements.

10. A narrative description of the custom software to be furnished including the touchscreen and programmable logic controller systems. List software that is currently available and software that is to be developed by the SEC.
11. A description of the plan for maintenance and service of the system to meet the specified requirements.

12. A letter from the Surety Company reflecting the Surety Company's history and experience with the SEC. The letter must also state the position of the Surety Company relative to supplying a 100% Payment and Performance Bond should the contract be awarded to the Company. The letter must be an original and include the date that the letter was issued, reference to this project and the estimated value of the work to be performed by the SEC.

NOTE: ALL ITEMS MUST BE ADDRESSED IN THE QUALIFICATIONS SUBMITTAL. THE QUALIFICATIONS SUBMITTAL SHALL BE COMPLETED AND ACCEPTED PRIOR TO ANY WORK DONE. ANY DELAY ASSOCIATED WITH THE QUALIFICATIONS SUBMITTAL PROCESS SHALL BE THE RESPONSIBILITY OF THE GENERAL CONTRACTOR AND SEC.

1.6 ACCEPTABLE SECURITY ELECTRONICS COMPANIES:

A. The following current companies are acceptable SEC to bid the Division 17 work meeting the aforementioned qualifications:

1. EO Integrated Security Systems, Inc.
   San Antonio, TX
   www.integrated-systems.cc

2. Engineered Control Systems, Inc.
   Spokane, WA
   www.ecs-systems.com

3. Accurate Controls, Inc.
   Ripon, WI
   www.accuratecontrols.com

4. Metroplex Control Systems
   San Antonio, TX
   www.metroplex-control.com

5. Integrator.com
   Noblesville, IN
   www.integrator.com

B. The acceptable companies having current qualifications shall submit the following Information Submittal in lieu of the Qualification Submittal as stated in Paragraph 1.5 above:

1. A delineation of the tasks to be performed by the SEC's staff and those tasks, if any, to be performed by subcontractors. Utilization of subcontractors for more than conduit, wire and device installation is not acceptable.
2. A description of the plan for maintenance and service of the system to meet the specified requirements, including how response times for critical service calls will be minimized.

3. Resumes of individuals to be assigned to this project and a delineation of the individual's project responsibilities for this project. The resumes must include information about the individuals’ education, electronics systems detention experience, systems integration capabilities, factory training and length of time employed with the Sub-Contractor.

4. A letter from the Surety Company stating the position of the Surety Company relative to supplying a 100% Payment and Performance Bond should the contract be awarded to the company. The letter must be an original and include the date that the letter was issued, reference to this project and the estimated value of the work to be performed by the SEC.

C. Acceptance as an SEC is solely a determination that the company is qualified to install the specified electronic security systems. It does not constitute an approval of any software or equipment that may be produced or distributed by that company. The electronic security systems shall be as specified, or as approved equal to the specified products.

1.7 DELINEATION OF DOOR CONTROL INTERFACE RESPONSIBILITIES

A. Division 17 Responsibilities shall include the following:

1. For electrical mechanical locks and devices and exterior electrical mechanical locks and devices at pedestrian and vehicular gates, furnish and install conduit, conductors and cables required from the SEC to the field devices.

2. Furnish and install all conduit systems as shown on the Division 17 drawings or specified herein in accordance with the Division 16 specifications, unless specifically noted otherwise. Ensure that adequate conduit facilities are installed to support the intended functions of Division 17.

3. Furnish and install relay interface equipment in the Security Electronic Equipment rooms as required to interface the door control systems with the door hardware specified in Divisions 8 and 11.

4. For electrical mechanical locks and devices and exterior electrical mechanical locks and devices at pedestrian and vehicular gates, connect the mating connector "pigtails" to the control conductors at the locks and devices and connect to door control system in the security equipment rooms.

5. Provide all control hardware and systems including power supplies as required to control or monitor each door in accordance with the requirements of Division 17 and the wiring diagrams provided by Division 8 and Division 11.

6. After installation, verify proper control and monitoring operation of all doors.
7. Coordinate with specific hardware used by Division 8 and Division 11 for builders hardware and security hardware.

8. Coordinate of all interfaces with Division 16 for any lighting or power controls or Fire Alarm System interface that may be required from the Division 17 control systems.

9. Coordinate with Division 16 the exact locations and requirements for electrical power provided to the security equipment.

10. Ensure that all security system UPS units are powered from an emergency power panel.

B. Division 11 responsibilities shall include the following:

1. Furnish and install door locks, door position switches, limit switches, lock feature switches, keyswitches and push buttons, as required for the system to perform the functions as defined herein.

2. Interconnect all components described herein to include cable harnesses where applicable, and provide a single point of interconnection for Division 17. For swing doors, the interface point shall be the lock pocket. For sliding doors, the interface point shall be a junction box in the transom and shall be shown on the shop drawings.

3. The wiring interface shall be a connector type (Molex type). The mating connector to which the Division 17 conductors are connected shall be furnished as part of the connector assembly and shall be furnished with conductor "pigtail" having a minimum length of 6".

4. Furnish wiring drawings and other information as required for design and installation of the control drawings.

5. Provide all switches with a contact rating of a minimum of 2 amps. Push buttons shall be Form C contact configurations.

6. Provide solenoids for direct current (DC) application with diodes for transient protection.

7. Provide boxes or pockets in the door frame as required to accommodate door position switches, locks, keyswitches, push buttons, intercom stations, etc.

8. Provide interconnecting conduit in the door frame between all feature switches and monitoring devices and the lock pocket.

9. Extend the lock pocket to accommodate jamb mounted push buttons and/or keyswitches or provide a means to install and maintain these devices where installed.

10. After installation, adjust all locks and switches for proper mechanical alignment.

C. Division 8 responsibilities shall include the following:
1. Furnish and install door locks, door position switches, limit switches, lock feature switches, keyswitches and push buttons, as required for the system to perform the functions as defined herein.

2. Interconnect all components described herein to include cable harnesses where applicable, and provide a single point of interconnection for Division 17 at the lock pocket.

3. Provide a wiring interface for Div. 17 to make connections to the control systems. The wiring interface shall be a connector type (Molex type). The mating connector to which the Division 17 conductors are connected shall be furnished as part of the connector assembly and shall be furnished with conductor "pigtail" having a minimum length of 6".

4. Furnish wiring drawings and other information as required for design and installation of the control drawings.

5. Provide door lock and device power supplies to Div. 17 as required to power the specific equipment and to provide the required interface to the fire alarm system to release specific doors upon alarm notification in designated building areas.

6. Provide all switches with a contact rating of a minimum of 2 amps. Push buttons shall be Form C contact configurations.

7. Provide solenoids for direct current (DC) application with diodes for transient protection.

8. Provide boxes or pockets in the door frame as required to accommodate door position switches, locks, keyswitches, push buttons, power transfer hinges, etc.

9. Provide interconnecting conduit in the door frame between all feature switches and monitoring devices and the lock pocket.

10. Extend the lock pocket to accommodate jamb mounted push buttons and/or keyswitches or provide a means to install and maintain these devices where installed.

11. After installation, adjust all locks and switches for proper mechanical alignment

1.8 DEFINITIONS:

A. Provide: Furnish and install, completely ready for use, including all accessories required for operation.

B. Furnish: Purchase and deliver to the project site complete with every necessary appurtenance, support and accessory required for operation.

C. Install: Unload at the delivery point at the site and perform every operation necessary to establish secure mounting and correct operation at the proper location in the project.
D. Concealed: Embedded in masonry or other construction installed behind wall furring, with double partitions or hung ceilings, in crawl spaces, in shafts.

E. Exposed: Not concealed.

F. Listed: Equipment is "listed" if of a kind mentioned in a list which:
   1. Is published by a nationally recognized laboratory which makes periodic inspection of the production of such equipment.
   2. States that such equipment meets nationally recognized standards or has been tested and found safe for use in a specified manner.

G. Labeled: Equipment is "labeled" if:
   1. It embodies a valid label, symbol, or other identifying mark of a nationally recognized testing laboratory such as Underwriters’ Laboratories, Inc.
   2. The laboratory makes periodic inspections of the production of such equipment.
   3. The labeling indicates compliance with nationally recognized standards or tests to determine safe use in a specified manner.

H. Certified: Equipment is "certified" if:
   1. Equipment has been tested and found by a nationally recognized testing laboratory to meet nationally recognized standards or to be safe for use in a specified manner.
   2. Production is periodically inspected by a nationally recognized testing laboratory.
   3. It bears a label, tag, or other record of certification.

I. Nationally recognized testing laboratory: A testing laboratory which is approved, in accordance with OSHA regulations, by the Secretary of Labor.

J. Security Electronics Company (SEC): Shall mean the company responsible for completing the work described in the Drawings and Specifications for Division 17.

1.9 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:

A. Submit all items necessary to obtain all required permits to the appropriate Regulatory Agencies, obtain all required permits, and pay all required fees.

B. All work shall conform to the following Building Codes:
   1. California Electrical Code (CEC)
   2. National Fire Protection Association (NFPA)

C. All work shall conform to all federal, state and local ordinances.
D. Where applicable, all fixtures, equipment, and materials shall be as approved or listed by the following:

1. Factory Mutual Laboratories (FM).
2. Underwriters Laboratories, Inc. (UL).

E. References to the California Electrical Code (CEC) and National Fire Protection Association (NFPA) are a minimum installation requirement standard. Design drawings and specification sections shall govern in those instances where requirements are greater than those specified in the NEC and NFPA.

F. UL Listing:

1. All material and equipment shall be listed, labeled or certified by Underwriters’ Laboratories, Inc. where such standards have been established. Equipment and material which are not covered by UL Standard will be accepted provided equipment and material is listed, labeled, certified or otherwise determined to meet safety requirements of a nationally recognized testing laboratory. Equipment of a class that no nationally recognized testing laboratory accepts, certifies, lists, labels, or determines to be safe will be considered if inspected or tested in accordance with national industrial standards such as NEMA, ICEA or ANSI. Evidence of compliance shall include certified test reports and definitive shop drawings.

2. All custom equipment assemblies shall be UL listed 508A Standard for Industrial Control Panels. All equipment and devices connected to Class 1 circuits shall be UL listed. Class 2 power supplies must be clearly labeled as listed Class 2 supplies in accordance with NEC 725. Equipment and devices connected to class 2 circuits on the load side of a class 2 power supply are not required to be UL Listed, unless specifically required by the Authority Having Jurisdiction.

G. All work shall meet or exceed the standards and procedures of the following:

1. National Fire Protection Association (NFPA):
   - NFPA 70 National Electrical Code
2. Underwriters Laboratory (UL)

H. Include all items of labor and material required to comply with such standards and codes. Where quantity, sizes or other requirements indicated on the drawings or herein specified are in excess of the standard or code requirements, the specifications or drawings, respectively, shall govern.

1.10 INTERPRETATION OF CONTRACT DOCUMENTS:
A. This Section of the Specifications and related Drawings describes the general provisions applicable to every Section of Division 17.

B. Attention is directed to the Instructions to Bidders and to Division 1, General Conditions, which are binding in their entirety on this portion of the work.

C. Unless specifically noted otherwise, mention (or reasonable implication) of any articles, materials, operations or methods related to the execution of the work in these Specifications or Drawings requires the execution of each such item of work and the provision of all labor, materials, equipment, and appurtenances required for its execution.

D. The language used in the Drawings or Specifications shall not be interpreted as meaning that appurtenances or accessories necessary to complete any required system or item of equipment are to be omitted. The omission of express reference to any parts necessary for, or reasonably incidental to, a complete installation shall not be construed as a release from furnishing such parts.

E. The drawings of necessity utilize symbols and schematic diagrams to indicate various items of work. Neither of these have any dimensional significance nor do they delineate every item required for the intended installations. The work shall be installed in accordance with the intent diagrammatically expressed on the Drawings and in conformity with the dimensions indicated on final Architectural and Structural Drawings and on equipment shop drawings. No interpretation shall be made from the limitations of symbols and diagrams that any elements necessary for complete work are excluded. When abbreviations appear on the Drawings or Specifications in lower case letters with or without periods, their meanings shall be the same as stated above.

F. Certain details appear on the Drawings which are specific with regard to the dimensioning and positioning of the work. These details are intended only for the purpose of establishing general feasibility. They do not obviate field coordination for the indicated work.

G. Information as to the general construction shall be derived from Structural and Architectural Drawings and Specifications only.

H. The use of words in the singular shall not be considered as limited where other indications denote that more than one item is referred to.

I. The Drawings are diagrammatic and indicate the general arrangement of systems and equipment unless indicated otherwise by dimensions or detail drawings of $1/4" = 1'-0"$ scale or larger. For exact locations of building elements, refer to dimensioned drawings; however, field measurements take precedence over dimensioned drawings. Report any discrepancies discovered between the Security Electronics Drawings and the Drawings for other Divisions of Work.

J. Conduit and raceway systems shown on the drawings are diagrammatic only. The exact routing of conduits shall be determined in the field. Lock pockets and other devices cannot necessarily be used as junction boxes. Provide and locate junction boxes as required to provide a functional raceway system in compliance with the Specifications and the NEC.
1.11 QUALITY ASSURANCE:

A. System Description:

1. Los Angeles Police Department (LAPD) currently employs a sophisticated security system in its facilities to ensure a safe and secure environment for its officers and staff. All satellite police stations and facilities are inter-linked to a central security system.

2. The security system has several major components which include an automated electronic access control and alarm monitoring system (ACAM), ACAM workstations for camera monitoring, a closed circuit television system with audio recording capabilities (CCTV), an intercom voice communication system (VCS), and a web-based visitor management system (VMS). These major security components such as the ACAM, VCS and VMS are manufactured by AMAG Technology, whereas the video component and CCTV are Loronix Video Systems. Access are controlled by HID card readers.

B. Any new systems to be provided and installed for LAPD facilities shall be compatible to the currently existing system to ensure an efficient standard operation. If the product submitted is different from the specified equipment, compatibility testing shall be performed by the Contractor on the proposed system and/or any components thereof from the point of connection to the transmission, processing, recording and display of the data signal to determine compatibility to the satisfaction of LAPD representative at no additional cost to the City. See also GR Section 01630 of the Project Specifications.

C. All equipment and materials required for installation under these Specifications shall be new (less than one year from manufacturer) and without blemish or defect.

D. All equipment subject to Underwriters Laboratories' label service shall bear labels attesting to approval by Underwriters Laboratories.

E. All equipment and materials manufacturers shall have been engaged in the manufacture of similar products for a minimum of three years. If requested, manufacturers shall furnish proof of their ability by submitting affidavits and descriptive data on their products.

F. Except for custom-fabricated control panels, each major component of equipment shall have the manufacturer's name, address, model number and rating on a plate securely affixed in a conspicuous place. The nameplate of a distributing agent will not be acceptable.

G. Performance criteria delineated in the Specifications shall be interpreted as minimum performance levels.

1.12 COOPERATION WITH OTHER TRADES:

A. Coordinate the Work of this Section with that of other Sections as required to ensure that the entire work of this Project will be carried out in an orderly, complete and coordinated fashion.
B. Check equipment against space available as indicated on the Drawings, and make sure that the proposed equipment can be accommodated. If interferences occur, bring them to the attention of Architect/Engineer, in writing. Otherwise, the SEC shall, at his own expense, provide proper materials, equipment, and labor to correct any damage due to defects in his work caused by such interferences.

1.13 SUBSTITUTIONS AND APPROvals:

A. Any new systems to be substituted shall be compatible to the currently existing security system for LAPD facilities to ensure inter-linked and accurate data processing. If the product submitted is different from the specified equipment and proposed for substitution, compatibility testing shall be performed by the SEC on the proposed system and/or any components thereof from the point of connection to the transmission, processing, recording and display of the data signal to determine compatibility to the satisfaction of LAPD representative at no additional cost to the City. See also GR Section 01630 of the Project Specifications.

B. Request for approvals and substitutions will be considered only if submitted in accordance with procedures outlined in Division 0 - General Conditions regarding prior approval and equipment and material approvals and substitutions.

C. "Or Equal" Clause: Notwithstanding, any reference in the specifications to any article, device, product, software, material, fixture, form or type of construction by name, make, or catalog number shall be interpreted as establishing a standard of quality.

D. Any additional labor, materials, equipment, components, accessories, or other items required for the satisfactory installation and operation of approved substitute equipment shall be provided at no additional cost to the Owner. This includes changes to branch circuits, circuit protective devices, conduits, wire, feeders, controls, panels, and interfaces with other work. All changes must be approved by the Engineer.

E. Verify all dimensions and field conditions and advise the Architect/Engineer of any discrepancies. Submit shop drawings for approval of any proposed changes before starting the work.

1.14 SHOP DRAWINGS:

A. Prior to purchasing materials and installing the work, prepare and submit shop drawings for approval in accordance with the General Conditions and as hereinafter specified. Shop drawings are required for all materials, equipment and systems.

B. All drawings shall be computer generated using AutoCAD® compatible software.

C. Shop drawings shall be prepared based upon the specific equipment and materials intended for installation. Consult all Contract Drawings and Specifications and obtain manufacturer's recommended installation instructions before preparing shop drawings.
D. A principal of the company shall sign all shop drawings (indicating conformance with plans and specifications) before submitting to the Engineer.

E. Review of shop drawings or schedules by the Engineer shall not constitute acceptance of deviations from the Drawings or Specifications unless they have been specifically delineated in written letter form at the time of submission and secured written approval; nor shall it relieve the SEC from responsibility for errors in shop drawings or schedules.

F. Submittals must be legible. Illegible submittals will be rejected and returned without review. Drawing sheets must be on minimum "C" size (24" X 18") media. 11" X 17" drawings shall not be acceptable unless specific approval is given by the Engineer.

G. Shop drawings shall be submitted in the following four packages. Partial submittals will not be considered.

1. Equipment and materials product information. This package shall consist of catalog cut sheets and other information that confirms compliance with the Contract requirements. Include the manufacturer's name, product model numbers, and technical data sheets as required to show compliance. If more than one product is shown on a cut sheet, the specific item proposed shall be marked on the cut sheet to make it readily identifiable. Submittals shall be marked to show the reference Specification including the Section and paragraph numbers. Submit the product information in a three-ring binder with labeled tab dividers delineating each Section separately.

2. Conduit and conductor drawings. This package shall consist of plan drawings (to scale) showing all devices and conduit routing. Each conduit segment shall be tagged with the conduit size, the number and type of conductors the conduit will contain, and the percentage of conduit filled by the conductors. The drawings shall contain a conductor legend that shows the conductor tags used on the drawings, a description of each conductor type, the system application of the conductor, the manufacturer's name and product number, and the diameter and cross-sectional area of each conductor.

3. System drawings. This package shall contain details of the entire electronic security system. Among the requirements for this package are interconnection wiring diagrams, functional schematics, equipment assembly details, equipment room plan and elevation drawings (to scale), control console plan and elevation drawings (to scale) and control panel drawings (to scale). All terminal points and wiring shall be identified on wiring diagrams. Specific submittal requirements are delineated under "SUBMITTALS" in each Section.

4. Video screen drawings. This package shall contain drawings of all of the video screens required for the project. It shall also include descriptions of the operational control sequences and icon functions. See Section 17170 for specific information about video screen submittals.

H. Shop Drawing Submittal Schedule.
1. Equipment and materials product information shall be submitted no later than 90 days after Notice to Proceed.

2. Conduit and conductor drawings shall be submitted no later than 30 days after the equipment and materials submittal has been stamped by the Engineer.

3. System drawings shall be submitted no later than 60 days after the equipment and materials submittal has been stamped by the Engineer.

4. Video screen drawings shall be submitted no later than 210 days after Notice to Proceed.

1.15 RECORD DOCUMENTS:

A. Record Documents shall be Contract Drawings and Specifications updated and annotated with all Addenda, Bulletins, Architect's Supplemental Instructions (ASIs), Requests for Information (RFIs), modifications and field changes. Keep a set of Record Drawings and Specifications on the job and, as construction progresses, indicate all changes and modifications on these documents. Record Documents shall be available for inspection at any time by the Owner, Architect or Engineer.

B. The Record Documents shall be delivered to the Architect at the time of final inspection.

1.16 AS-BUILT DOCUMENTS:

A. As-Built Documents shall be detailed documentation of the installed system configuration. A minimum of three identical sets of As-Built Documents shall be submitted in accordance with the General Conditions. As-Built documentation shall include:

1. Updated shop drawings. Conduit and conductor drawings, system drawings, and video screen drawings shall be updated to include all system modifications made during construction.

2. Wire marking, wiring connection and programming schedules.

3. Equipment and materials list. For each item the manufacturer, part number and the quantity used on the project shall be listed. A list of manufacturers' names, addresses and phone numbers shall also be provided.

4. All software, including source codes, on 3.5" disks or CD ROM.

5. Electronic copies of all drawing files, spreadsheets and schedules on 3.5" disks or CD ROM.

1.17 OWNER'S MANUALS:
A. Submit three-ring binders containing manufacturer's operational, maintenance and installation manuals for all equipment and materials installed on the project. A minimum of three identical sets of Owner's Manuals shall be submitted in accordance with the General Conditions.

B. The cover of the Owner's Manual shall state the following information:

1. Project name, location and date of completion
2. Owner
3. Architect
4. Security Electronics Engineer
5. Security Electronics Company's name, address and phone number

C. The binders shall be subdivided into separate sections with tab dividers to identify subsystems of the integrated system.

D. A section for Maintenance Procedures shall be provided that shall include the following:

1. Recommended inspection and maintenance schedules for all equipment.
2. A list of manufacturers' names, addresses and phone numbers.
3. Troubleshooting procedures for all systems and equipment.
4. Emergency instructions for warranty service, including the name and phone number of the 24-hour/day response contact.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Manufactured Products:

1. All products shall be new, unused and without blemish or defect.
2. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items and for which replacement parts are available.
3. When more than one unit of the same class of equipment or material is required, such units shall be the products of a single manufacturer.
4. Equipment Assemblies and Components:
   a. All components of an assembled unit need not be products of the same manufacturer, however, all components must be acceptable to the Architect/Engineer.
b. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.

c. Components shall be compatible with each other and with the total assembly for the intended service.

d. Constituent parts which are similar shall be the product of a single manufacturer.

e. Moving parts of any element of equipment of the unit normally requiring lubrication, shall have means provided for such lubrication, and shall be adequately lubricated at the factory prior to delivery.

B. Equipment Identification:

1. In addition to the requirements of the National Electrical Code, install identification signs that clearly indicate information required for the use and maintenance of items such as cabinets, control devices and other significant equipment.

2. All equipment cabinets, power panels and CCTV monitors shall be labeled as identified on the as-built drawings. Unless specified otherwise, labels shall be engraved in laminated black phenolic resin with a white core. Lettering shall be a minimum of 1/4-inch high.

3. All UPS receptacles shall be labeled to identify their source (panel designation and circuit number). Unless specified otherwise, labels shall be engraved in laminated blue phenolic resin with a white core. Lettering shall be a minimum of 1/4-inch high.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Equipment shall be installed as close as practicable to the locations shown on the Drawings.

B. Coordinate location of equipment and conduit with other trades to minimize interferences.

C. Where the Architect/Engineer determines that equipment has been installed in a manner or location not accessible for operation or maintenance, the equipment shall be removed and reinstalled as directed at no additional cost to the Owner.

D. Secure equipment using fasteners suitable for the use, materials, and loads encountered. If requested, submit evidence proving suitability. Do not attach electrical materials to roof decking, removable or knockout panels, or temporary walls and partitions, unless indicated otherwise.
E. Hangers and other supports shall support only equipment and materials. Provide not less than a safety factor of 5, which shall conform with any specific requirements as shown on the drawings or in the specifications.

F. In security areas, exposed equipment and materials, including screws and other fasteners, shall be tamperproof and shall comply with the requirements of Section 01900 - Security Fasteners. Cover plates shall have beveled edges.

G. Provide adequate support for all equipment to satisfy the specific local seismic requirements.

H. All footings shall extend below frost line and comply with applicable building codes.

3.2 PROTECTION AND CLEANING OF SYSTEMS AND EQUIPMENT:

A. Protect all materials and equipment from physical damage, dirt, moisture, cold and rain during transportation, storage and throughout the construction period.

B. During construction, cap the top of all conduits and raceways installed vertically.

C. During installation, equipment shall be covered to protect against entry of dust and other foreign matter. Vacuum clean all equipment both inside and outside before operating.

D. Damaged equipment shall be returned to "like-new" condition.

E. Painted surfaces shall be protected with removable heavy kraft paper, sheet vinyl or similar protective material. The protective material shall be installed at the factory and removed prior to final inspection.

F. Damaged paint on equipment and materials shall be repainted and finished with the same quality of paint and workmanship used by manufacturer so repaired areas are not obvious.

3.3 EXCAVATING, TRENCHING, BACKFILLING AND RESURFACING:

A. Perform all work in accordance with the Sitework Specifications.

B. All excavation depths indicated are below finished grade.

C. Do not excavate below required depth except as necessary for removal of unstable soil or when rock is encountered. When rock is encountered, excavate six inches below the required depth. Unless indicated otherwise, pitch all electrical conduit runs downward.

D. Where backfill compaction is critical (e.g. under floor slabs, roadways, sidewalks, trenches deeper than four feet), test the degree of compaction every 75 linear feet of trench and every two feet of depth. Compact backfill until density is acceptable.

E. Repair the excavated area to original pre-excavation condition. Repair and replace sidewalks, roadways, etc.
3.4 POWER DISTRIBUTION:
A. Electrical power shall be provided by Division 16 to locations and equipment as described by the Division 16 Specifications and associated Drawings. At a minimum, a single point of power supply shall be provided to each equipment panel. Division 17 shall provide power distribution and associated overcurrent protection for all circuits deriving power from the single point of power supply.

B. For three-phase supplies, the connected load shall be balanced on all phases.

3.5 TESTING
A. The contractor shall submit a test plan 90 days prior to final completion with test procedures for each system and sign-off’s for each device tested.

B. The contractor shall notify and coordinate testing with the Commissioning Agent (CA) and the Commissioning Owner Team to execute the Commissioning Plan. Refer to Division 1- Section 01810 – Fundamental Commissioning Requirements.

C. At final completion, the contractor shall execute the test plan and submit the completed test plan with all sign-offs initialed and all components that did not pass, corrected and re-tested. The test plan must be completed and submitted to demonstrate that the system is ready for final A/E inspection. The completed test plan must be submitted two weeks prior to scheduled final A/E inspection.

3.6 COMPLETION:
A. Upon completion of the work, remove all debris, materials and equipment and leave the premises clean, neat and orderly. All bright metal or plated work shall be thoroughly polished. All pasted labels, dirt and stains shall be removed from the devices.

B. Prior to final system demonstration, all systems shall be complete and operational, all controls shall be set and calibrated, and all testing, start-up and cleaning work shall be complete.

C. Demonstration:

1. Upon completion, write a letter to the Architect/Engineer stating that all systems are complete, operational and tested. If the Architect/Engineer arrives at the site for the final demonstration and the systems are not complete, the SEC shall be responsible for compensating the Architect/Engineer for all time and expenses incurred in making the trip.

2. Provide at least two competent employees to perform the system demonstration for the Architect/Engineer. Items that function incorrectly or do not comply with the Contract Documents will be listed for correction.

D. Spare parts, equipment and any special tools required for the proper operation or maintenance of the electronic security systems shall be delivered to the Owner's Representative. Obtain a receipt for any materials transfer.
3.7 TRAINING

A. At least five (5) weeks prior to the estimated date of substantial completion, request a training schedule and a list of all individuals that are to receive operational, maintenance and both operational and maintenance training. Operational training shall be provided for staff and maintenance personnel. Maintenance personnel shall be thoroughly trained to maintain and troubleshoot all of the installed systems. Coordinate the times and locations for the training and the space and equipment requirements.

B. After all final tests, adjustments and punchlist items have been completed, provide competent employees to instruct facility personnel in the operation and maintenance of the electronic security systems. The trainers shall be thoroughly familiar with the system's equipment, installation and operation. The training shall be inclusive of all Division 17 equipment and systems and shall be coordinated with the training for the detention equipment systems. Where delineated in other Sections of the Specifications, manufacturers' representatives shall conduct the training on specialized electronic systems.

C. Training shall be conducted for a minimum of five (5) eight-hour days for operational training and five (5) eight-hour days for maintenance training.

D. Structure:

1. Training shall consist of oral, written and hands-on instruction for the operation, trouble shooting, maintenance and repair of all system components.

2. Provide a detailed outline that specifies each major training topic to be covered. The training program on the security electronic equipment shall include the sequences and instructions for the proper use and maintenance of all system equipment and control systems. The material content shall be in simple layman's terminology and shall describe and demonstrate the step-by-step operations necessary for the proper operation of each system.

3. At a minimum, the training program shall be subdivided into the following topics:

   a. Operation.

      1) Operational characteristics and features of each system.

      2) Specific operation of each control panel and video control terminal, to include all control and monitoring functions included at each control location.

      3) Specific instructions on how to manage systems in the case of component failures.

   b. Maintenance and repair.
1) Trouble shooting, general maintenance, equipment adjustments, and repair and replacement of all security electronic system components.

2) Interfaces with electrical, mechanical and detention equipment systems, including all locking devices and operators.

E. Video tape training for each system in VHS format. Structure the tape for easy reference and prepare a tape index delineating the location on the tape where each training module begins and ends.

3.8 SUPPORT

A. Supply a qualified employee at the facility for 30 days after Substantial Completion to assure that the Users are qualified to take over operation and maintenance procedures.

END OF SECTION
SECTION 17010
RACEWAYS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS:
A. The Conditions of the Contract (General, Supplementary, and other Conditions) and the General Requirements (Sections of Division 1) are hereby made a part of this Section.

1.2 SCOPE:
A. This Section includes the furnishing and installation of a complete, grounded raceway system. Except where specifically shown on the drawings, the contractor is responsible for determining the design of the raceway system including exact routing, sizing, junction box locations, and quantities.

B. All conduits for Division 17 circuits shall be concealed. All other requirements specified in Section 16110 "Raceways and Boxes" shall apply to the installation of this Division 17 raceway system.

C. The term conduit, as used in this Specification, shall mean any of the raceway types required.

1.3 RELATED WORK SPECIFIED ELSEWHERE:
A. Refer to all other Division 17 Specification Sections and associated Drawings, and to Specifications and Drawings under the General Construction Contract to ascertain the extent of work included.

B. Refer to Division 16 Specifications and associated Drawings for specifications pertaining to the installation of conduit and raceway systems. Division 17 conduits shall be installed in accordance with the Division 16 Specifications.

1.4 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:
A. California Electrical Code

B. National Electric Code.

1.5 COOPERATION WITH OTHER TRADES:
A. Coordinate the work of this Section with that of other Sections as required to ensure that the entire work of this project will be carried out in an orderly, complete and coordinated fashion.

1.6 SUBMITTALS:
A. Submittals shall be made in accordance with the General Provisions (Section 17000) of these Specifications.
B. Specific requirements include the following:

1. Equipment and materials product information.

2. Plan drawings (to scale) showing all devices and conduit routing. Each conduit segment shall be tagged with the conduit size, the number and type of conductors the conduit will contain, and the percentage of conduit filled by the conductors. The drawings shall contain a conductor legend that shows the conductor tags used on the drawings, a description of each conductor type, the system application of the conductor, the manufacturer's name and product number, and the diameter and cross-sectional area of each conductor. (These drawings also fulfill the requirement for conductor drawings listed in Section 17020-1.5-B.2.)

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Provide raceway system as specified in Section 16110 "Raceways and Boxes".

PART 3 - EXECUTION

3.1 EXECUTION:

A. All conduits for Division 17 circuits shall be concealed within walls, slabs or above ceiling wherever occurred. All other requirements specified in Section 16110 "Raceways and Boxes" shall apply to the installation of Division 17 Security Electronics Conduits.

B. All security electronics system circuits shall be installed in conduit. Class 2 or Class 3 circuits may be installed in ladder tray within the security electronics equipment rooms where allowed by the California Electrical Code.

C. Size all conduits in accordance with the California Electrical Code.

D. Conduits are to be provided in accordance with the California Electric Code. Specific conduits are shown on the drawings where minimum configurations are required for spare capacity or special needs.

E. Circuits from different types of systems shall not be combined in the same conduit to minimize the potential for interference or cross-talk between circuits. The following device groupings are permissible, unless recommended otherwise by the product manufacturers. Each line item below represents a group.

<table>
<thead>
<tr>
<th>Group #</th>
<th>Devices</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Intercom Stations</td>
</tr>
<tr>
<td>2.</td>
<td>Paging Speakers and paging volume controls</td>
</tr>
</tbody>
</table>
3. Card Readers, REX pushbuttons, keyswitches, watchtour pushbuttons, PIRs, and Access Control Data Circuits.

4. Class 2 door locks, monitoring switches, watchtour pushbuttons, REX pushbuttons, call pushbuttons, doorbells, and keyswitches.

5. Class 1 door lock circuits.

6. Duress pushbuttons and personal alarm receivers.

7. UPS Power.

8. CCTV cameras, monitors, and CCTV data circuits.


10. Audio microphones.

11. Video Visitation Stations, unless manufacturer recommends separation of individual circuits.

12. Fiber optic cable.

13. MATV coaxial cable.

14. Motion detectors, vehicle detectors, photoelectric detectors, pushbuttons, and keyswitches.

15. All other devices not listed shall have dedicated conduits to each device, unless specifically approved by the engineer.

F. Class 1 circuits shall be separated from Class 2 and Class 3 circuits as required by the California Electrical Code.

G. Where shown, conduit and raceway systems shown on the drawings are diagrammatic only. The exact routing of conduits shall be determined in the field. Lock pockets and other devices cannot necessarily be used as junction boxes. Provide and locate junction boxes as required to provide a functional raceway system in compliance with the National Electrical Code.

H. All backboxes shall be flush mounted on walls and drop ceilings and shall be surface mounted on exposed ceilings where the slab is too thin for flush mounted backboxes.

I. Where conduit is installed above security ceilings the use of junction boxes must be minimized. Where junction boxes cannot be avoided, provide access panels at junction box locations. Coordinate locations with the architect. The contractor shall be responsible for all costs associated with the installation of these access panels.

J. Conduit sizes shall be no less than ¾”.
3.2 COMPLETION:

A. Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools, and the like and leave the premises clean, neat, and orderly.

END OF SECTION
SECTION 17020
CONDUCTORS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS:

A. General: The Conditions of the Contract (General, Supplementary, and other Conditions) and the General Requirements (Sections of Division 1) are hereby made a part of this Section.

1.2 WORK INCLUDED:

A. The work under this Section consists of providing, installing, and connecting a complete security electronics cable and wiring system to perform the functions shown on the Drawings and hereinafter specified. Except where specifically shown on the Drawings, the contractor is responsible for determining the design of the SE cable and wiring system including exact routing, sizing, types, length and quantities.

B. The term cable and wiring, as used in this Specification, shall mean any of the conductor types required.

1.3 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:

A. The following specifications and standards, except as hereinafter modified, are incorporated herein by reference and form a part of this specification to the extent indicated by the references thereto. Except where a specific date is given, the issue in effect (including amendments, addenda, revisions, supplements, and errata) on the date of Invitation for Bids shall be applicable. In text such specifications and standards are referred to by basic designation only.

1. National Fire Protection Association (NFPA) Publications
   No. 70 National Electrical Code (NEC)

2. Underwriters' Laboratories, Inc. (UL) Publications:
   No. 44 Rubber-Insulated Wire and Cables
   No. 83 Thermoplastic-Insulated Wires
   No. 493 Thermoplastic-Insulated Underground Feeder and Branch Circuit Cables
   No. 486 Wire Connectors and Soldering Lugs
1.4 COORDINATION WITH OTHER TRADES:
A. The Contractor shall coordinate the work of this Section with that of other Sections as required to ensure that the entire work of this Project will be carried out in an orderly, complete, and coordinated fashion.

1.5 SUBMITTALS:
A. General: Submittals shall be made in accordance with the General Provisions (Section 17000) of these specifications.
B. Specific requirements include the following:
   1. Equipment and materials product information.
   2. Plan drawings (to scale) showing all devices and conduit and conductor routing. Each conduit segment shall be tagged with the conduit size, the number and type of conductors the conduit will contain, and the percentage of conduit filled by the conductors. The drawings shall contain a conductor legend that shows the conductor tags used on the drawings, a description of each conductor type, the system application of the conductor, the manufacturer's name and product number, and the diameter and cross-sectional area of each conductor. A typical conductor legend is shown in Table 17020-1 (Note: These drawings also fulfill the requirement for conduit drawings listed in Section 17010-1.6-B.2.)

PART 2 - PRODUCTS
2.1 MATERIALS:
A. Power Conductors:
   1. Insulated wire conductors for circuit voltage, 600 volts or less, shall be copper. Conductors shall have U.L. approved 600 volt insulation of the type specified below or elsewhere in the specifications.
   2. Conductors No. 8 AWG and smaller shall be solid or stranded type THWN or XHHW, unless otherwise indicated.
   3. Conductors No. 6 AWG and larger shall be stranded type THWN or XHHW, unless otherwise indicated.
   4. Minimum size of power conductors - No. 14 AWG, unless otherwise indicated.
   5. Conductors underground or outside buildings shall be type THWN.
   6. Conductors installed in exposed conduit outside of buildings and conduit within or just under roofing material shall be type THWN.
   7. All conductor insulation shall be color coded to indicate phase leg, voltage, and use. For power conductors, each phase shall be the same color throughout the entire facility and shall be a different color from the
other phases. The following color code shall be used for all branch circuits:

Neutral . . . . White
Ground . . . . Green
Phase A . . . . Black for 120/208
Phase B . . . . Red for 120/208
Phase C . . . . Blue for 120/208

8. Conductor insulation type, wire gauge and U.L. approval shall be printed with permanent white paint on all conductor insulation, continually repeating.

B. Data and Signal Conductors:

1. Cables and conductors furnished for the electronic security systems shall be of the types recommended by the equipment manufacturers to support the intended functions. Conductor transmission properties and wire size shall be selected to satisfy system requirements.

2. Cables routed underground shall be rated for direct burial.

3. Cables routed through grade-level slabs shall be rated for use in wet locations.

4. Conductors for data and audio circuits shall be shielded.

5. All conductor insulation shall be color coded to indicate its function. Color codes shall be consistent throughout the project.

6. Conductor insulation type, wire gauge, and U.L. approval shall be printed with permanent white paint on all conductor insulation, continually repeating.

C. CCTV Video Cable:

1. Coaxial video cables shall have a copper center conductor and a copper shield providing a minimum 93% coverage.

2. Nominal dc resistance shall not exceed 12 ohms/1000 ft for 59/U-type cables, 8 ohms/1000 ft for 6/U-type cables, and 4 ohms/1000 ft. for 11/U-type cables.

3. Nominal impedance shall be 75 ohms.

4. Cable runs shall not exceed 1000 ft. for 59/U-type cables, 1500 ft. for 6/U-type cables, and 3000 ft for 11/U-type cables.

5. Utilize cable with flexible center conductor for movable cameras.

6. Cable installed in exterior locations shall have a moisture-proof jacket.

7. Manufacturer:
a. Indoor:
   1) West Penn 815 (RG-59), 811 (RG-11), 806 (RG-6)
   2) Belden 543945 (RG-59), 513945 (RG-11), 533945 (RG-6)
   3) Or approved equal
b. Exterior:
   1) West Penn 4815 (RG-59), 4811 (RG-11), 4806 (RG-6)
   2) Or approved equal.
c. Miniature:
   1) West Penn 825
   2) Belden 8218
   3) Or approved equal.

D. Television Distribution Cable:
   1. Coaxial broadband distribution cables shall have a solid copper center conductor and a shield coverage 100% foil and minimum 40% aluminum braid.
   2. Nominal attenuation at 700 MHz shall not exceed:
      a. 21.3 dB/100 m for RG-59/U-type cables.
      b. 17.4 dB/100 m for RG-6/U-type cables.
      c. 11.5 dB/100 m for RG-11/U-type cables.
   3. Nominal impedance shall be 75 ohms.
   4. All cables installed in exterior conduits shall be gel filled moisture proof, direct burial type cable.

E. Cable Connectors for Copper Branch Circuit Conductors:
   1. For #10 AWG and #12 AWG, connector body shall consist of a cone shaped, expandable coil spring insert, insulated with a nylon shell and 2 wings placed opposite to each other to serve as a "built-in" wrench. Shell shall be molded one-piece as manufactured by Ideal Industries "Wing Nut" connectors or approved equal.
   2. For #8 AWG, connectors shall be screw pressure lugs made of high strength structural aluminum alloy and UL approved for use with both copper and/or aluminum wire as manufactured by Ilsco, T&B Burndy, O.Z. Companies, or approved equal.
F. Cable tags shall be pre-marked, self-adhesive, wrap-around cloth type.

PART 3 - EXECUTION

3.1 EXECUTION:

A. Except where specifically shown on the drawings, the contractor is responsible for determining the exact routing, sizing, types, length and quantities of the conductors.

B. Deliver all conductors to the site on their original cable reels or in their original unbroken packages.

C. Make all copper conductor branch circuits and fixture joints for #10 AWG and smaller wire with U.L. approved listed for 600 volts, approved for use with copper and/or aluminum wire and for No. 8 AWG and larger use screw pressure lugs.

D. Control and communications cables shall not be spliced except as approved by the Engineer.

E. Tape all connections made with noninsulated type connectors with half-lapped, rubber-type tape, to 1-1/2 times the thickness of the conductor insulation, then cover with Scotch No. 33 Tape.

F. All wiring must conform to the specified sequence of operation and the manufacturer's wiring diagrams, to control the equipment in the manner specified under the appropriate Division 17 section of the specifications. Color code all wiring.

G. Where conductors in conduit pass through exterior walls, a sealing compound of moisture resistive materials shall be applied in the ends of the conduits to seal around the conductors.

H. Permanently label all conductors and cables. Labeling system shall be an industry standard type approved by the manufacturer for the conductor and cable types and locations required. Conductors and cables shall be labeled in each junction box, pull box, wireway or auxiliary gutter, at each device, outlet, panel, switch, or other conductor termination and at the distribution panel or headend equipment termination location.

I. Wiring within all equipment and panel enclosures shall be neatly grouped and laced or taped together.

J. Wire lubricating compound shall be suitable for the wire insulation and conduit used with it and shall not harden or become adhesive. Do not use lubricant on isolated type electrical power systems.

K. Install a red warning indicator on the handle of the branch circuit breaker feeding for the power supply circuit for each system to prevent accidental de-energizing of Division 17 systems.

L. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat, and orderly.
TABLE 17020-1

SAMPLE CONDUCTOR SCHEDULE*

<table>
<thead>
<tr>
<th>Cable Mark</th>
<th>Application</th>
<th>Description</th>
<th>Manufacturer/Product Number</th>
<th>Diameter (inches)</th>
<th>Max Area (in²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Interior CCTV</td>
<td>RG-6/U Coax (&lt;1500 ft.)</td>
<td>XYZ #0000</td>
<td>0.28</td>
<td>0.06</td>
</tr>
<tr>
<td>B</td>
<td>Exterior CCTV</td>
<td>RG-6/U Coax (&lt;1500 ft.) Direct Burial</td>
<td>XYZ #0000</td>
<td>0.33</td>
<td>0.09</td>
</tr>
<tr>
<td>C</td>
<td>Door Control</td>
<td>14 AWG THWN Camera Power</td>
<td>XYZ #0000</td>
<td>0.11</td>
<td>0.01</td>
</tr>
<tr>
<td>D</td>
<td>DPS Indication</td>
<td>18 AWG, 2 cond.</td>
<td>XYZ #0000</td>
<td>0.18</td>
<td>0.025</td>
</tr>
<tr>
<td>E</td>
<td>Intercom Station</td>
<td>20 AWG, 2 pair 1-Shielded, 1-Unshielded</td>
<td>XYZ #0000</td>
<td>0.21</td>
<td>0.035</td>
</tr>
<tr>
<td>F</td>
<td>Exterior Intercom</td>
<td>18 AWG, 2 pair 1-Shielded, 1-Unshielded Direct Burial</td>
<td>XYZ #0000</td>
<td>0.24</td>
<td>0.045</td>
</tr>
<tr>
<td>G</td>
<td>PLC/LAN Network</td>
<td>24 AWG, 4 pair Cat 5</td>
<td>XYZ #0000</td>
<td>0.22</td>
<td>0.04</td>
</tr>
<tr>
<td>H</td>
<td>Access Reader</td>
<td>18 AWG, 8 cond Shielded</td>
<td>XYZ #0000</td>
<td>0.29</td>
<td>0.07</td>
</tr>
</tbody>
</table>

(Modify and complete the table to reflect the correct data for all conductor types required for the electronic security systems)

*Note: This schedule is provided for example only. It is not intended to be complete or to necessarily represent the cable types required for this project. The actual cable types and conductor gauges must be selected based upon the system requirements and the specific requirements of the Specifications.

END OF SECTION

MASTER BUILDING SPECIFICATION

CONDUCTORS

17020 - 7
SECTION 17030
COMPUTERS

PART 1 - GENERAL

1.1 SUMMARY

A. This section covers all computers as shown on the drawings or as required to support the systems defined in these specifications. The work under this section consists of furnishing materials and equipment, performing labor and services necessary for the installation of the computers required for the security electronics, communications, and fire alarm system.

B. Related Work Specified Elsewhere: Refer to all other Division 17 specification sections and drawings, and to the specifications and drawings under the General Construction Contract to ascertain the extent of work included.

1.2 SUBMITTALS

A. Since the Division 17 systems must be reviewed by the Contracting Officer as a system, no individual, specific submittal shall be made for this section. Submittals shall be packaged in groups and shall be made in accordance with the General Provisions (Section 17000) of these specifications.

B. Unless specifically specified in this section, do not submit cut sheets for computer equipment in the 17030 binder. Include computer equipment cut sheets in the binder associated with the specification section that the computer equipment is specified.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Computer:

1. All computers shall have the following features:

   a. 2.5 GHz Pentium IV processor, minimum.

   b. 1 GB RAM capacity (minimum).

   c. Configured with a minimum of 512 MB of RAM. Provide additional RAM as necessary to optimize system performance.

   d. Minimum three (3) 36 GB hot swapable, self-restoring, SCSI or IDE hard drives in RAID 5 configuration. If any of the hard drives fail during system use, the controller shall initiate an audible alarm or similar to alert the maintenance technicians to the failure.

   e. Minimum 40 GB (80 GB compressed) tape back-up. Tape back-up shall back-up the Operating System and other System Software installed on the computer.
2. Unless noted otherwise, all computers shall be rack mount computers. The rack mount computers shall include these additional features:
   a. Industrial grade rack mounted chassis.
   b. Locking front access panel.
   c. Vibration protection drive mounting.
   d. Hard drives accessible from front panel.
   e. Withstand shock of 5 g, on 3 axis. Testing shall be conducted by a reputable laboratory using industry standard practices.
   f. Withstand vibration of 1 g, on 3 axis. Testing shall be conducted by a reputable laboratory using industry standard practices.
   g. Rack mounted monitor.
   h. Keyboard and mouse on a rack mounted pull out drawer.
   i. Filters for the intake cooling fans.
   j. Hold down bars for the internal plug in cards.
   k. Chassis shall be Kontron's 7XXX series or approved equal.

3. Laptop computer shall include these additional features:
   a. 15" SXGA TFT monitor display.
   b. Lithium-ion Battery
   c. A single hard drive in the place of RAID hard drives. Hard drive shall be 30GB minimum.
   d. No tape back-up.

4. Desktop computer shall include these additional features:
   a. Tower chassis.
   b. Desktop monitor.

B. Monitor:
1. Rack or panel mount touchscreen monitor and transducer – 19”.
   a. 19” diagonal active matrix color TFT LCD display.
   b. Resolution: 1280 x 1024 maximum.
   c. Dot Pitch: 0.25mm
   d. Viewing angle: ±80° from center horizontal and vertical
   e. Display shall be surface mounted on countertop.
   f. Touch screen transducer shall be a Surface Acoustical Wave touch transducer.
   g. Positional Accuracy: Maximum error of 0.080 inch.
   h. Operation must be unaffected by scratches in the glass or static electricity.
   i. Activation Force: <3 ozs.
   j. Shall be powered by a UPS.
   k. Manufacturer: Elo TouchSystems, Model 1925L.

2. Rack or panel mount non-touchscreen monitor – 19” color LCD Flat Panel screen.
   a. 19” color screen, non-glare.
   b. RGB input signal.
   d. Monitor shall be Kontron's RMVS series or approved equal.

3. Desktop monitor - 430 mm color LCD Flat Panel screen.
   a. 430 mm color screen, non-glare.
   b. RGB input signal.
   d. Monitor shall be Samsung TFT series or approved equal.

C. Printer:

1. Laser printer.
   a. 600 dpi resolution.
b. 500 sheet automatic or manual feed paper bin.

c. Capability of printing 220mm x 280mm (8 ½" x 11") or 220mm x 360mm (8 ½" x 14") paper.

d. Fonts compatible with the application software.

e. Printer shall be capable of printing at least 8 pages per minute.

2. Dot matrix printer.


b. Serial and Parallel interfaces.

c. Minimum 4K buffer.

d. Tractor feed.

3. Photo Quality Color Printer:

a. 4800 x 1200 dpi color resolution.

b. 100 sheet automatic feed paper tray.

c. Capability of printing on photo quality paper.

d. Fonts compatible with the application software.

e. Printer shall be capable of printing at least 0.9 color photo quality pages per minute.

f. Thermal ink jet technology.

g. Equipped with external print server.

h. Printer shall be Hewlett Packard HP photo smart 7900 series, or approved equal.

D. Local Area Network Switches:

1. Equipped with a minimum of eight (8) 10/100Base-T ports.

2. Alarm relay outputs to signal a loss of port connection.

3. Configured to accept power from two independent 24VDC power supplies. Upon loss of power from the primary power supply, the switch shall automatically switch from the primary to the secondary power supply without loss of operation.

4. Alarm relay outputs to signal loss of either power input, a fault in any port, or a permanent fault in the switch.

5. Front panel status LEDs.
6. IEEE802.3 compliant.

7. Switches shall be Hirschmann RS2 Rail Switch, or approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Configure equipment with software, back boards, power supplies, cooling fans, expansion slots, cards, modules, cords, connectors and other hardware as required to support the specific functions or applications.

B. Where shown on the plans, or as required by the Specifications, ensure that the power source for each computer is from a UPS unit.

C. A full time modem connection for contractor access to the computer shall be not be permitted during or after construction. Temporary modem connections shall not be left unattended.

D. All Microsoft games such as "solitaire" should be removed from all computers supplied by the Division 17 Contractor.

3.2 COMPLETION

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat and orderly.

B. Testing: The completed system shall be tested by the Contractor prior to the acceptance test.

END OF SECTION
SECTION 17040
GROUNDING AND SURGE PROTECTION

PART 1- GENERAL

1.1 GENERAL CONDITIONS:

A. See the Conditions of the Contract (General, Supplementary, and Special Conditions) and the General Requirements (Division 1).

1.2 WORK INCLUDED:

A. Furnish all materials and labor necessary to complete the installation of the grounding and surge protection systems as described herein and as shown on the Drawings. The work of this Section includes, but is not necessarily limited to, the following:

1. Grounding System
2. Surge Protectors

1.3 REFERENCE SPECIFICATIONS, MATERIALS, AND CODES:

A. National Fire Protection Association (NFPA) Publications:
   1. No. 70 National Electrical Code (NEC)
   2. No. 780 Lightning Protection Code

B. EIA/TIA-607 Commercial Building Grounding and Bonding Requirements for Telecommunications.

C. Underwriters Laboratories (UL) Standards
   1. UL 497, Protectors for Paired Conductor Communications Circuits
   2. UL 497A, Standard for Safety for Secondary Protectors for Communications Circuits
   3. UL 497B, Standard for Safety for Protectors for Data Communication and Fire Alarm Circuits
   4. UL 497C, Standard for Protectors for Coaxial Communications Circuit
   5. UL 1449, Transient Voltage Surge Suppressors

1.4 SUBMITTALS:

A. Submittals shall be made in accordance with the General Provisions, Section 17000.
B. Specific requirements include the following:

1. Equipment and materials product information. Surge protector product submittals must address the specific criteria contained in the Specification and must include a circuit diagram of the protection device with the components identified.

2. Single-line drawings of the grounding and surge protection systems. All equipment cabinets, ground bars, grounding conductors and conductor sizes shall be shown.

1.5 SYSTEM DESCRIPTION

A. Signal Ground System:

1. In each equipment room in which Division 17 systems are installed, a signal ground system shall be provided to effect a ground reference level for all Division 17 systems installed within the space. Equipment racks and equipment shall be bonded to the common signal ground system.

2. The Signal Reference Ground (SRG) system backbone shall be provided by Division 16 as shown on the electrical drawings. Division 16 shall provide a SRG bus bar in each security electronics equipment room. Division 17 shall connect all signal grounds, signal and data line surge protector grounds, outside cable sheaths and equipment cabinet ground busses to the SRG bus bar.

3. Each equipment cabinet shall be individually grounded to the SRG. Grounding conductors shall not be looped between cabinets to ground multiple cabinets with a single conductor.

4. Signal ground systems shall be isolated from the power ground system except at the point where the signal ground system connects to the power ground system electrode.

B. Exterior Equipment Grounding System:

1. Division 17 shall ground all exterior CCTV camera poles, microwave poles, and perimeter security enclosures.

2. Exothermic welding-type connectors shall be used to connect the grounding conductors to the ground rods.

C. Surge Protection:

1. Surge protection devices shall be installed on signal wiring entering a building from the exterior.

2. Division 16 shall provide a panelboard transient voltage surge suppressor (TVSS) on each panelboard feeding Division 17 equipment.

3. Where Division 17 equipment in an electronics equipment room is not located in the same building as the power panelboard, Division 17 shall provide a branch circuit surge protector on each power circuit feeding the electronic equipment.
PART 2 - PRODUCTS

2.1 GROUND SYSTEM

A. Conductors:

1. All ground wire shall be in accordance with Underwriter Laboratories (UL) and NEC requirements, as shown on the drawings and as specified herein.

2. All grounding conductors shall be continuous from connector to connector with no splices.

3. Interior grounding conductors from equipment to the SRG buss bars shall be a minimum No. 6 AWG insulated stranded copper unless otherwise indicated. Conductor size shall be increased as required to meet NEC requirements.

4. Exterior grounding conductors from poles, cabinets, and equipment to ground rods shall be a minimum No. 2/0 AWG bare, stranded copper conductor unless otherwise specified. Conductor size shall be increased as required to NEC requirements.

B. Connectors:

1. Interior connectors shall be solid bronze, compression type, suitable for intended use.

2. Exterior connectors for connecting grounding conductors to the ground rods shall be exothermic welding-type. Connectors shall be CADWELD as manufactured by Erico Products, Inc., or approved equal.

C. Ground Rods: Sectional, copper-clad 3/4" x 10'-0"

2.2 SURGE PROTECTION

A. Data, Signal, and Low Voltage Power Circuits:

1. Shall incorporate Silicon Avalanche Diode devices as the primary protection means.

2. Shall have a surge life of at least 10 operations for 1,000 Amp, 8 X 20 microsecond wave.

3. Shall have an initial clamping voltage suitable to the application and shall not exceed 200% of the peak signal voltage rating of the device.

4. Shall have a peak clamping voltage suitable to the application and shall not exceed 300% of the peak signal voltage rating of the device.

5. Select as required for particular data frequency and signal level characteristics of the application.

6. Shall be UL497B compliant.
B. Branch Power Circuits:

1. Shall incorporate Silicon Avalanche Diode devices as the primary protection means.

2. Shall have secondary protection devices consisting of MOV or silicon avalanche technology.

3. Shall have an indicator to indicate the operational status of the primary and secondary protection devices.

4. Shall have a surge life of at least 200 operations for 3,000 Amps, 8 x 20 microsecond wave for 120V single-phase application.

5. Shall have a maximum single surge capacity of at least 19,000 Amps for 8 x 20 microsecond wave.

6. Shall be UL1449 certified at the 500 VAC rating.

C. Video Coaxial Lines:

1. Shall incorporate Silicon Avalanche Diode devices as the primary protection means.

2. Shall have a surge life of at least 10 operations for 1,000 Amp, 8 x 20 microsecond wave.

3. Shall be specifically designed for CCTV coaxial video applications.

4. Shall have an initial clamping voltage suitable to the application and shall not exceed 200% of the peak signal voltage rating of the device.

5. Shall have a peak clamping voltage suitable to the application and shall not exceed 30V.

6. Select as required for the particular data frequency and signal level characteristics of the application.

7. Shall be UL497C compliant.

D. MATV Lines:

1. Shall have a surge life of at least 600 operations for 500 Amps peak, 8 x 20 microsecond wave.

2. Shall have an insertion loss of less than 0.5 dB at 500 MHz.

3. Shall have a peak clamping voltage suitable to the application and shall not exceed 100V (DC clamping point).

4. Select as required for the particular data frequency and signal level characteristics of the application.

5. Shall be UL497C compliant.
E. Telephone Station Lines:
   1. Shall incorporate Silicon Avalanche Diode devices as the primary protection means with the following characteristics:
   2. Signal Line Voltage - Up to 150V
   3. Peak Clamping Voltage - 200V
   4. Response Time - 5 nanoseconds or less
   5. Peak Pulse Power Dissipation - 10 Joules.
   6. Shall be UL497A compliant.

PART 3 - EXECUTION

3.1 GROUNDING:
   A. All equipment shall be grounded in accordance with the NEC, the Specifications and Drawings, and the equipment manufacturers' recommendations.
   B. All AC power supporting Division 17 equipment shall be isolated ground type receptacles and circuits. Division 17 equipment grounds shall be connected to the isolated ground bus bar in the equipment room panelboard.
   C. Each equipment cabinet shall be bonded directly to the Signal Reference Ground System.
   D. Cable shields shall only be grounded at one end, unless required otherwise by the equipment manufacturer. Ground shields for field devices only at the equipment room end.

3.2 SURGE PROTECTION:
   A. All metallic data, communications, video, and sensor lines entering or leaving a building shall be protected with surge protection devices.
   B. Grounding of protective devices shall be in accordance with the manufacturers' recommendations and as described in the Specifications and Drawings.
   C. All signal line protective devices shall be located at the terminal point nearest the cable interface with the exterior cable plant. Devices shall be mounted to the backpanel of the cabinet.
   D. Verify power panelboards feeding Division 17 equipment have panelboard protectors provided by Division 16.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL CONDITIONS:
A. See the Conditions of the Contract (General, Supplementary and Special Conditions) and the General Requirements (Division 1).

1.2 WORK INCLUDED:
A. This section covers all equipment cabinets and enclosures as shown on the drawings or as required to house the specified devices and equipment. The work under this section consists of furnishing materials and equipment, performing labor and services necessary for the installation of the cabinets and enclosures required for the security system.

1.3 RELATED WORK SPECIFIED ELSEWHERE:
A. Refer to all other Division 17 specification sections and drawings, and to the specifications and drawings under the General Construction Contract to ascertain the extent of work included.

1.4 REFERENCED SPECIFICATIONS, MATERIALS AND/OR CODES:
A. National Electrical Code

1.5 COOPERATION WITH OTHER TRADES:
A. The Contractor shall coordinate the work of the section with that of other sections as required to ensure that the entire work of this Project will be carried out in an orderly, complete and coordinated fashion.

1.6 SUBMITTALS:
A. General: Submittals shall be made in accordance with the General Provisions (Section 17000) of these specifications.

PART 2 - PRODUCTS

2.1 MATERIALS:
A. Cabinets - Wall Mounted:
   1. All equipment cabinets installed indoors shall be NEMA 1 enclosures.
   2. All equipment cabinets installed outside or exposed to weather shall be NEMA 3 enclosures.
3. Cabinets shall be constructed of 14 gauge rolled steel.

4. Cabinet doors shall be furnished with key lockable doors with all cabinets under Division 17 keyed alike.

5. All cabinets shall be furnished with removable steel back panels for mounting equipment.

6. Cabinets shall be furnished with appropriate size and quantity of knock-outs for conduit entry.

7. Cabinets shall be grounded as specified in Section 17040.

8. Cabinets shall be provided with adequate vents.

9. All cabinets shall be furnished with black-on-white laminated plastic name plates identifying each cabinet as noted on the drawings.

10. Cabinet finish shall be ANSI 61 gray inside and out.

11. Cabinets shall be sized in strict accordance with the NEC.

12. Cabinet back panels shall be furnished with a ground buss bar.

13. Door size shall be selected to allow a minimum door swing of 90 degrees within the dimensional constraints of the equipment room.

B. Vertical Cabinet - Floor Mounted:

1. All vertical cabinets shall be free-standing floor mounted type having features and/or characteristics as follows:

   a. Panel Width - 19"

   b. Panel Height - 78-3/4"

   c. Overall Height - 87" Nominal

   d. Overall Depth - 25" Nominal

   e. Rear Door - Vented, except as otherwise specified.

   f. Front door with vents at top and bottom, except as otherwise specified.

   g. Plain top panel

   h. Frame- 14 ga. CRS

   i. Side panels - 18 ga.

   j. Styled frames with trim
k. 19” EIA adjustable mounting rails for front and rear equipment mounting

l. Locks - all cabinets to be keyed alike

m. Units shall be pre-assembled type

n. Color - to be selected by Architect

2. Cabinets grouped side-by-side shall have side panels on each section.

3. Furnish and install blank 19” panels of color to match cabinet for all unused vertical mounting units on front mounting rails. Maximum height of each filler panel shall be 10.5”.

C. Power Strips:

1. Furnish and install plug-in or hardwired outlet strips as required to support the installed equipment.

2. Power strips shall have a metallic case.

3. Plug-in power strips shall be equipped with a locking plug and shall only be used with a compatible locking-type receptacle.

D. Pedestals:

1. Pedestals shall be weather-tight, seam welded, constructed of 14 gauge galvanized steel. Where indicated on the drawings construction shall be stainless steel.

2. Pedestals shall be furnished with gasketed panel for access to equipment contained within. Panel shall be secured with security screws as specified in the Security Hardware Division of these specifications.

3. Pedestal shall be painted to withstand environmental conditions and the final color shall be as specified by the Architect.

4. Pedestal shall be pre-drilled for mounting of intercom stations, loop detectors, and other equipment as specified herein.

5. Pedestal dimensions shall be as shown on the drawings.

PART 3 - EXECUTION

3.1 EXECUTION:

A. Cabinets:

1. Provide cabinets as necessary for proper installation of the equipment specified and in compliance with all codes and regulations.

2. Secure all cabinets in place with lead shield anchors and lag bolts.
3. Unused openings in cabinets shall be closed to afford protection equivalent to that of the wall of the cabinet.

B. Ventilation:

1. Furnish and install ventilation fans, vents, and filters for all cabinets where forced air cooling is required to maintain interior cabinet temperature at or below 95°F.

2. For cabinets with forced ventilation, doors and side panels shall be solid with no louvers.

3. Division 17 Subcontractor shall select vented vs. forced air cabinets based on the environment's conditions of the equipment room and equipment to be installed in each cabinet.

C. Pedestals:

1. Provide pedestals at all locations shown on the drawings.

2. Secure pedestals to concrete base with four (4) redhead type anchors. Anchors shall be located such that they are only accessible from inside the enclosure.

3. Coordinate installation of required conduit such that all conduit is stubbed up inside pedestal enclosure.

4. Cabinets shall be large enough and equipment spaced in cabinets to provide adequate spacing for airflow and maintenance.

5. Locate all heat producing equipment, such as power supplies and amplifiers, at top of equipment cabinets.

3.2 COMPLETION:

A. General:

1. Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat and orderly.

2. All cables shall be dressed neatly in each cabinet and enclosure. Excess cable shall be trimmed and disposed of.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL CONDITIONS

A. See the Conditions of the Contract (General, Supplementary and Special Conditions) and the General Requirements (Division 1).

1.2 SCOPE

A. Quarterly scheduled maintenance and service of all Division 17 systems.

B. Service of all Division 17 systems upon notification of failure.

1.3 COMPENSATION. There shall be no additional charges to the Owner for Guarantee, Maintenance and Service work; all costs shall be included in the Division 17 Contract.

1.4 GUARANTEE, MAINTENANCE AND SERVICE PERIOD. The duration of the Guarantee, Maintenance and Service Period shall be two (2) years from the date of Substantial Completion.

1.5 MAINTENANCE. Routine daily maintenance functions shall be performed by facility personnel. Quarterly scheduled maintenance of all Division 17 systems shall be performed during the Guarantee, Maintenance and Service Period by the SEC. Minimum maintenance tasks are listed in Table 17060-1.

1.6 SERVICE

A. Daily operations and inspections by the facility personnel shall determine the operational state of the systems. Service calls for component failures shall be initiated by facility personnel.

B. The SEC shall maintain a 24-hours-per-day, 7-days-per-week toll-free phone number for Guarantee, Maintenance and Service requests. Calls to this number shall initiate the time response period.

C. Classifications of component failures and the required response time for each classification are as follows:

1. Critical - Items which compromise the security of the facility or have an adverse effect on the operations of the facility. Items in this category shall be returned to service within eight (8) hours after receipt of a Guarantee, Maintenance and Service request. Service shall be available seven (7) days per week and twenty-four (24) hours per day. The SEC shall call the designated Owner’s Facility Administrator within 2 hours of receiving the Guarantee, Maintenance and Service request to inform him of the estimated arrival time of the service personnel.
2. Sensitive - Items which adversely impact the operations of the facility but are not considered "critical" as defined above. Items in this category shall be returned to service within twenty-four (24) hours after receipt of a Guarantee, Maintenance and Service request. Service shall be available eight (8) hours per day during weekdays. The SEC shall call the designated Owner's Facility Administrator within 2 hours of receiving the Guarantee, Maintenance and Service request to inform him of the estimated arrival time of the service personnel.

3. Normal - Items which require Guarantee, Maintenance and Service support but are not "critical" or "sensitive" as defined above. These are typically items that facility personnel identify and accept that maintenance will be performed by the SEC during the next quarterly maintenance visit.

1.7 MAINTENANCE/SERVICE DOCUMENTATION

A. If changes are made to the systems, modify drawings, schedules, and other documents as required to maintain accurate as-built documentation.

B. Upon completion of the Guarantee, Maintenance and Service Period, or subsequent service contracts, return all system documents to the Owner, including electronic files of all documentation.

C. The SEC shall develop maintenance reports and logs to record maintenance activities on the system. Included for each repair shall be a list of equipment required to make the repair or adjustment. If requested, the reports and logs shall be provided to the Owner on a monthly basis.

1.8 SPARE PARTS INVENTORY

A. An inventory of spare parts must be provided and maintained by the SEC to support the Guarantee, Maintenance and Service requirements defined in this Section.

B. During the Guarantee, Maintenance and Service Period, the SEC shall maintain a log of all component failures and parts replaced. Six months prior to the expiration of the Guarantee, Maintenance and Service Period, the SEC shall submit the replaced parts log, a list of recommended spare parts and a parts price list to the facility. The facility shall use the replaced parts log and list to evaluate the spare parts inventory required for future maintenance.

C. At a minimum, the following spare parts shall be stored at the site in the main security equipment room and shall be property of The City. This requirement is not intended to include all spare parts required to meet the service response time limits. The contractor shall replace any of these spare parts, if used for service work during the warrantee period within 10 days. The spare parts shall be the same type submitted and installed in the facility.

1. One (1) of each type of surge protector used.

2. Two (2) door control interface boards.
3. Four (4) door control relays.
4. Ten (10) of each type door control fuses.
5. One (1) PLC processor.
6. One (1) PLC communication module.
7. One (1) PLC power supply.
8. One (1) complete touchscreen unit with CPU.
9. One (1) of each type of CCTV camera used.
10. Two (2) each type of lenses used for fixed cameras.
11. Two (2) Dome mount camera “replacement domes”.
12. Two (2) of each type CCTV monitor.
13. One (1) camera input CCTV switcher card.
14. One (1) monitor output CCTV switcher card.
15. One (1) camera power supply.
16. One (1) DVRS encoder unit.
17. One (1) SIS master station.
18. One (1) SIS exchange terminal card.
19. One (1) dedicated intercom master.
20. Four (4) intercom remote stations.
21. Two (2) intercom master microphones.
22. Two (2) intercom master speakers.
23. Four (4) each type of control panel switches.
24. One (1) of each type of access control remote panels.
25. Two (2) of each type of card readers.
26. One (1) biometric reader.
27. One (1) access control network switch.
28. Two (2) watchtour pushbutton stations.
29. One (1) video visitation station monitor.
30. One (1) inmate visitation station intercom
31. One (1) visitor visitation station intercom.
32. One (1) visitation station camera.
33. Four (4) personal alarm system receivers.

1.9 SOFTWARE ENHANCEMENTS: If software that will enhance the system operation is introduced after system acceptance, the SEC shall inform the Owner of the software, its features, and the cost (including labor) to upgrade the existing software.

1.10 INSURANCE: Insurance shall be maintained during the Guarantee, Maintenance and Service Period.

PART 2 - PRODUCTS

2.1 All products used in parts replacement shall meet the specifications for the original equipment. Any substitutions must be approved by the Owner.

PART 3 - EXECUTION

3.1 SCHEDULED QUARTERLY MAINTENANCE. The maintenance tasks identified in Table 17060-1 represent the minimum tasks required for each system; the SEC shall expand these tasks as required to support the maintenance recommendations of the equipment manufacturers.

3.2 SERVICE. See Section 17060-1.6C and Table 17060-2 for the response time categories and the restoration time response for each category.

3.3 SPECIAL SERVICE CONDITION

A. Lightning:

1. If there is evidence that the systems have incurred lightning damage, the SEC shall identify the nature and extent of the damage.

2. The SEC shall not be responsible for damage beyond his control. However, restoration of circuits or equipment caused by power surges or transients due to improper grounding or surge suppression devices or the installation of those devices will be the responsibility of the SEC.
TABLE 17060-1

SCHEDULED QUARTERLY MAINTENANCE

1. PAGING AND INTERCOM
   A. Verify operational status with Facility Manager
   B. Inspect and Clean Equipment Enclosures
   C. Record Amplifier Gain Settings

2. SECURITY/MONITORING AND CONTROL SYSTEM
   A. Inspect and Clean Control Console Equipment
   B. Verify operational status with Security Officer
   C. Inspect and Clean Equipment Enclosures

3. UNINTERRUPTIBLE POWER SUPPLY (UPS)
   A. Review and Record Voltage and Current for Input and Output
   B. Check system diagnostics
   C. Interrupt Input Power and Test
   D. Inspect Battery System
   E. Inspect and Clean Equipment Enclosure

4. CLOSED CIRCUIT TELEVISION SYSTEM
   A. Verify Proper Video Level at Monitors
   B. Verify Proper Auto-Iris Operation
   C. Check video clarity for each camera
   D. Adjust Monitor Controls As Required
   E. Adjust camera controls as required

5. GROUNDING AND SURGE PROTECTION
   A. Check surge protector status indicators where applicable
6. PROGRAMMABLE LOGIC CONTROLLERS
   A. Check communications lines and all I/O for proper operation.
   B. Check and record condition of processor battery back-up.

7. MOTION AND VEHICLE DETECTORS
   A. Review operational status with Security Officer.
      Make adjustments as required.
   B. Check sensitivity of each unit. Make adjustments as required.

8. PERIMETER SYSTEM
   A. Conduct detection performance of each zone and verify
      annunciation
   B. Verify operational status with Facility Manager
   C. Inspect and clean equipment enclosures
   D. Record processor field settings for each processor

9. FIBER OPTIC CABLE SYSTEM
   A. Check all transmitters and receivers for proper operation
   B. Inspect and clean equipment enclosures

10. CARD ACCESS SYSTEM
    A. Review operational status with Security Officer
    B. Check communication lines and all I/O for proper operation
    C. Check operation of each reader and interface with door control system
    D. Inspect and clean terminals and equipment cabinets

11. CONTROL PANELS/CONTROL CONSOLES
    A. Inspect and clean control panels
    B. Check panels for proper operation and excessive wear or abuse
TABLE 17060-1

SCHEDULED MAINTENANCE (CONTINUED)

12. PERSONAL ALARM SYSTEM
   A. Review operational status with Security Officer. Make adjustments as required.
   B. Test all zones for proper annunciation.

13. SECURITY METAL DETECTOR
   A. Check operation of each unit
   B. Inspect and clean equipment enclosures.
### TABLE 17060-2

**SERVICE RESPONSE CATEGORIES**

<table>
<thead>
<tr>
<th>SYSTEM CATEGORY</th>
<th>RESPONSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PAGING/INTERCOM</td>
<td></td>
</tr>
<tr>
<td>a. Loss of Multiple Stations (i.e. amplifier loss)</td>
<td>CRITICAL</td>
</tr>
<tr>
<td>b. Single Paging Station</td>
<td>NORMAL</td>
</tr>
<tr>
<td>c. Single Intercom Station</td>
<td>SENSITIVE</td>
</tr>
<tr>
<td>2. DOOR CONTROL/MONITORING</td>
<td></td>
</tr>
<tr>
<td>a. Site Perimeter Doors and Gates</td>
<td>CRITICAL</td>
</tr>
<tr>
<td>b. Other Doors</td>
<td>CRITICAL</td>
</tr>
<tr>
<td>3. UNINTERRUPTIBLE POWER SUPPLY</td>
<td></td>
</tr>
<tr>
<td>a. All components</td>
<td>CRITICAL</td>
</tr>
<tr>
<td>4. CCTV SYSTEM</td>
<td></td>
</tr>
<tr>
<td>a. Door Control Cameras</td>
<td>CRITICAL</td>
</tr>
<tr>
<td>b. Perimeter Cameras</td>
<td>CRITICAL</td>
</tr>
<tr>
<td>c. All other cameras</td>
<td>SENSITIVE</td>
</tr>
<tr>
<td>d. Monitors</td>
<td>CRITICAL</td>
</tr>
<tr>
<td>e. Video Switcher</td>
<td>CRITICAL</td>
</tr>
<tr>
<td>f. VCR/DVRS</td>
<td>SENSITIVE</td>
</tr>
<tr>
<td>5. PROGRAMMABLE LOGIC CONTROLLERS</td>
<td></td>
</tr>
<tr>
<td>a. All components</td>
<td>CRITICAL</td>
</tr>
<tr>
<td>6. CONTROL PANELS/CONTROL CONSOLES</td>
<td></td>
</tr>
<tr>
<td>a. Touchscreen Control Systems</td>
<td>CRITICAL</td>
</tr>
<tr>
<td>b. All other components</td>
<td>NORMAL</td>
</tr>
</tbody>
</table>
## TABLE 17060-2 (Continued)

### SERVICE RESPONSE CATEGORIES

<table>
<thead>
<tr>
<th>SYSTEM CATEGORY</th>
<th>RESPONSE</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. MOTION/VEHICLE DETECTORS</td>
<td></td>
</tr>
<tr>
<td>a. All components</td>
<td>SENSITIVE</td>
</tr>
<tr>
<td>8. CARD ACCESS SYSTEM</td>
<td></td>
</tr>
<tr>
<td>a. All components</td>
<td>CRITICAL</td>
</tr>
<tr>
<td>9. PERIMETER DETECTION SYSTEM</td>
<td></td>
</tr>
<tr>
<td>a. All components</td>
<td>CRITICAL</td>
</tr>
<tr>
<td>10. PERSONAL ALARM SYSTEM</td>
<td></td>
</tr>
<tr>
<td>a. All components</td>
<td>CRITICAL</td>
</tr>
<tr>
<td>11. MATV SYSTEM</td>
<td></td>
</tr>
<tr>
<td>a. All components</td>
<td>NORMAL</td>
</tr>
<tr>
<td>12. SITE INTERCOM SYSTEM</td>
<td></td>
</tr>
<tr>
<td>a. Loss of multiple stations (problems with system switch)</td>
<td>SENSITIVE</td>
</tr>
<tr>
<td>b. Single intercom station</td>
<td>SENSITIVE</td>
</tr>
<tr>
<td>13. SECURITY MONITORING AND CONTROL</td>
<td></td>
</tr>
<tr>
<td>a. PLC Network</td>
<td>CRITICAL</td>
</tr>
<tr>
<td>b. LAN Network</td>
<td>CRITICAL</td>
</tr>
<tr>
<td>c. Touchscreen terminals</td>
<td>CRITICAL</td>
</tr>
<tr>
<td>d. File Server</td>
<td>SENSITIVE</td>
</tr>
<tr>
<td>e. Printer</td>
<td>SENSITIVE</td>
</tr>
<tr>
<td>14. FIBER OPTIC DISTRIBUTION SYSTEM</td>
<td></td>
</tr>
<tr>
<td>a. Loss of Transmission</td>
<td>CRITICAL</td>
</tr>
<tr>
<td>15. GROUNDING AND SURGE PROTECTION</td>
<td></td>
</tr>
<tr>
<td>a. Evidence of damaging power transients</td>
<td>CRITICAL</td>
</tr>
</tbody>
</table>
END OF SECTION
PART 1 - GENERAL

1.1 RELATED DOCUMENTS:
A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY:
A. Work Included: Provide materials, labor, equipment and services necessary to furnish, deliver and install a fiber optic distribution system as shown on the Drawings, as specified herein, and/or as required by job conditions.

B. RELATED WORK SPECIFIED ELSEWHERE: The work of this Section is related to the work of the following Sections:
1. General Provisions (17000)
2. Closed Circuit Television System (17200)
3. Perimeter Security System (17401)

1.3 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:
A. National Electrical Code

1.4 COOPERATION WITH OTHER TRADES:
A. The Division 17 Subcontractor shall coordinate the work of this Section with that of other sections as required to ensure that the entire work of this Project will be carried out in an orderly, complete and coordinated fashion.

1.5 SUBMITTALS:
A. General: Submittals shall be made in accordance with the General Provisions (Section 17000) of these specifications.

1. Division 17 Subcontractor shall submit Quality Assurance data sheets prepared by the cable supplier for each cable reel.

2. Division 17 Subcontractor shall submit final test results for tests as conducted on each installed fiber. Data shall include both Optical Time Domain Reflectometer (OTDR) and the power through loss.

3. All test results shall be bound in a single binder titled "Fiber Optic Cable - Site Distribution Performance Measurements".
1.6 DESCRIPTION

A. GENERAL:

1. A site-wide fiber optic cable system shall be furnished and installed to support the following systems or functions:

   a. Closed circuit television video and control signal.

2. Cable system shall consist of multimode, tight buffered breakout cables for both interior and exterior applications.

3. Cables shall be installed in conduits and in the site duct bank system and routed in accordance with the distribution riser diagrams shown in the drawings.

4. Cables shall be terminated in Light Cable Terminals (LCT) where shown on the drawings or as required to terminate unused fibers.

5. Cables shall be installed point-to-point as required to support the transmission requirements.

B. All cable shall be continuous between the terminals with no splicing.

C. The loss performance of each fiber terminated connector shall be measured and recorded.

D. All cables shall be terminated with "ST" type connectors at the LCT bulkhead or at terminal equipments. Interface to building systems shall be made at the bulkhead connectors.

E. All fiber optic transducers shall be provided with power supplies, mounting hardware and equipment as required for a functional transmission link.

PART 2 - PRODUCTS

2.1 OUTDOOR DISTRIBUTION CABLES

A. Tight buffer fiber optic cables: The tight buffered optical cable shall consist of color coded multimode graded index fiber with a primary coating diameter of 250 micron UV cured acrylate buffer material and the secondary buffer coating of tight buffer 900 micron High Performance PVC buffer. This design is to prevent moisture penetration. Rod Fillers shall consist of central dielectric strength member surrounded by an extruded elastic polymer coating. The synthetic yarn strength member shall be individually tensioned and held helically laid directly over the stranded cable core. The outer jacket shall consist of extrusion of Polyvinyl chloride (PVC) having a wall thickness of 1 millimeter and a minimum wall thickness of 0.75 millimeter at any point.

B. Loose tube fiber optic cables: The fiber optic cable shall consist of color code multimode graded index fibers contained in gel filled loose buffer tubes. Each color-coded buffer tube shall be filled with a gel to prevent moisture penetration. All other areas around the buffer tubes and cable core components shall be filled with water-blocking compounds for added moisture blocking protection. A glass
reinforced plastic (GRP or epoxy matrix rod) shall be used for central strength member. High tensile yarns shall be utilized over the cable core for additional tensile strength. A medium density polyethylene outer jacket shall be applied overall.

C. The fiber optic cable shall conform to the following specifications as a minimum:

1. **62.5/125 microns**: Loose tube cable or tight buffer cable
2. **Fiber Type**: Multimode, Graded Index
3. **Core Diameter**: 62.5 +/- 3.0 microns
4. **Cladding Diameter**: 125 +/- 2.0 microns
5. **Buffer Coating Diameter**: 250 +/- 15 microns
6. **Secondary Coating**: 900 microns (Tight Buffered Only)
7. **Operating Wavelengths**: 850 nm and 1300 nm
8. **Maximum Attenuation**
   - @ 850 nm: 3.75 dB/km
   - @ 1300 nm: 1.75 dB/km
9. **Minimum Bandwidth**
   - @ 850 nm: 160 MHz-km
   - @ 1300 nm: 500 MHz-km
10. **Numerical Aperture**: 0.275
11. **Proof Test**: 0.35GPa (50 kpsi) (Minimum)
12. **Tensile Strength**: (Minimum)
    - (Loose Tube Type) During Installation: 2700 N Long Term: 500 N
    - (Tight Buffered Type)
      - Fiber Count
        - 6 fiber or less: 1600 N Long Term: 500 N
        - 8 fiber: 1800 N Long Term: 525 N
        - 10 to 12 fiber: 2100 N Long Term: 600 N
        - 14 to 18 fiber: 2700 N Long Term: 700 N
        - 20 to 24 fiber: 3000 N Long Term: 1000 N
        - 24 and greater: 3000 N Long Term: 1000 N
13. **Crush Resistance**: 440N/cm (armored) 220N/cm (non-armored)
14. **Operating Temperature**: -40°C to + 70°C
15. Storage Temperature: -40°C to +70°C
16. Installation Temperature: -30°C to +60°C
17. Minimum Bend Radius
   During Installation: 20 X Cable O.D.
   Long Term: 10 X Cable O.D.
18. Rated for buried exterior use for ductbank cable and shall meet the requirements of TIA/EIA-455-82B.
19. Outside Diameter
   48 fibers or less less than 10.5mm (0.41 inches)
   49 to 84 fibers less than 13.0mm (0.51 inches)

D. Cable shall be as manufactured by the Pirelli Communications Division, Optical Cable Corporation, or approved equal.

2.2 INTERIOR ASSEMBLY CABLES

A. Flexible jumpers and patch cords utilized to extend optic signals from the LCT to the fiber optic transceivers and equipment. Cables shall be cut to length and factory terminated utilizing terminations compatible with the specified equipment. Cable shall be simplex or duplex zipcord type as required and shall include a high-performance tight-buffer coating on each optical fiber. Cable jacket shall be a flame-retardant flexible PVC that is OFNR rated and color coded per TIA-598-A.

B. Assembly cables shall conform to the following specifications as a minimum:

1. Attenuation: 0.2 dB typical
2. Bandwidth: 160 MHz/km @ 850 nm
   500 MHz @ 1300 nm
3. Cladding Diameter: 125 microns
4. Core Diameter: 62.5 microns
5. Fiber Type: Multi-mode
6. Insertion Loss: 0.3 dB typical, 0.5 dB max
7. Minimum Bend Radius: 5 cm
8. Operating Temperature: -20°C to +70°C
9. Reflectance: less than –20dB

C. Cables shall be Blackbox EFN Series, or approved equal.
2.3 VIDEO OPTICAL TRANSMITTER/RECEIVER:

Fiber optic transmitter/receiver for optic links transmitting video only shall have the following characteristics or features:

A. Video Input/Output: 1V p-p 75 ohms BNC
B. Operational Wavelength: 850 nm
C. Optical Power Budget: 14 dB
D. Power: 12 VDC
E. Operating Temperature: -20°C to +70°C
F. Optical Connection: Type ST
G. Compatible with RS-170A, NTSC
H. Bandwidth: 5 Hz - 10 MHz
I. S/N Ratio: 60 dB
J. Differential Gain: <5%
K. Differential Phase: <5%
L. Tilt: <1%
M. Transformers, power supplies, and racks shall be furnished and installed as required.
N. Transmitter units shall be International Fiber Systems Inc. Model VT1001-R3 rack mounted units or approved equal. Receivers shall be rack mounted VR1100-R3 series with automatic gain control or approved equal.

2.4 VIDEO/DATA OPTICAL TRANSMITTER/RECEIVER:

Fiber optic transmitter/receiver units used to transmit video and data and receive data as required for communications with the video system receiver units shall have the following features or characteristics:

A. Video Input/Output: 1V pk-pk 75 ohms BNC
B. Bandwidth: 5 Hz - 6.5 MHz
C. Differential Gain: <5%
D. Differential Phase: <5%
E. Signal-to-Noise: 60 dB
F. Data Compatibility: RS-232, RS-422, RS-485, TTL
G. Data Rate: DC-50 Kbps (NRZ)
H. Number of Fibers: 2
I. Wavelength: 850 nm
J. Operating Temperature: -40°C to +74°C
K. Optical Connection: ST type
L. Power: 12V DC
M. MTBF: Greater than 100,000 hours
N. Mounting: Rack
O. Furnish and install rack units with power supplies at each CCTVIC location.
P. Units shall be International Fiber Systems Inc. VT/VR1900-R3 Series or approved equal.

2.5 DATA OPTICAL TRANSMITTER/RECEIVER (RS-422):

Fiber Optic transmitter, receiver, and repeater units to effect RS-422 communication links for CCTV system remote controllers shall have the following features or characteristics:

A. Data - RS-422
B. Data Rate - DC - 100 Kbaud
C. Wavelength: 850 nm
D. Number of fibers: 2
E. Operating temperature: -20°C to +70°C
F. Connectors: ST
G. Power: 12VDC
H. Transformers, power supplies, and racks shall be furnished and installed as required.
I. Units shall be International Fiber Systems, Inc. D1110-R3 series rack mounted units, or approved equal.

2.6 MISCELLANEOUS

A. Connectors shall be "ST" type, zirconia ferrule or Epoxy type, compatible with cable characteristics listed in this section and manufactured by AT&T or approved equal.
B. Light Cable Terminal (LCT) cabinets shall be wall or rack mounted as indicated on the drawings and configured for termination of specified quantity of fiber optic cables. Units shall be manufactured by Pirelli, Radiant Communications Corporation, FiberOpticX or approved equal.
2.7 PERIMETER SECURITY CONTROL:

Fiber optic transmitters/receivers shall be furnished and installed as an integral component of perimeter security equipments. Fiber cable shall be extended to these equipments and properly terminated to the equipments.

PART 3 - EXECUTION

3.1 EXECUTION:

A. All fiber optic cable shall be inspected prior to installation.

B. All cable shall be factory tested on a reel basis and performance data for each cable. Tests shall be conducted at 850 nm 1300 nm and the attenuation in dB/km recorded for each fiber.

C. Each installed fiber cable shall be tested using an Optical Time Domain Reflectometer (OTDR). A trace of each cable shall be made depicting the following:
   1. Fiber loss.
   2. Fiber length.
   3. Fiber irregularities.

D. Each installed fiber cable shall be tested for power through loss to reflect the following:
   1. Total end-to-end loss.
   2. All tests shall be based on 850 nm and 1300 nm wavelengths.

E. Traces for the OTDR shall include a notation of scale divisions.

F. Cable shall be installed in accordance with manufacturer's recommended practices for field installation.

G. Splices used to terminate the site cable to the bulkhead connector jumper shall have a loss of equal to or less than 0.25dB.

H. End-to-end loss shall be measured from bulkhead-to-bulkhead to include cable splice jumper and connector losses. Cable loss measurements shall be made in conformance with cable manufactures recommendations. Measurements shall be recorded on a per cable basis with loss measured for each fiber.

3.2 COMPLETION:

A. Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat and orderly.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL CONDITIONS:

A. The Conditions of the Contract (General, Supplementary and other Conditions) and the General Requirements (Sections of Division 1) are hereby made a part of this Section.

1.2 WORK INCLUDED:

A. Included under this Section of the Work shall be the furnishing, installation, connection and testing of the complete door control system. Door control system shall be microprocessor based. This Section shall include the device hereafter designated the Programmable Logic Controller (PLC) which shall accept the various inputs from systems being interfaced with door control, cause operation as described in this Section and elsewhere in the documents and provide outputs to the various systems.

B. All electrically operated or monitored doors are listed in the schedule in this Section. This schedule indicates the type of door control and the electrical interlocks.

1.3 WORK EXCLUDED:

A. The following work is covered under other sections of the specifications:

   1. Door Hardware: Division 8, Division 11.

1.4 RELATED WORK SPECIFIED ELSEWHERE:

A. The work of this section is related to the work of the following sections:

   1. General Provisions (17000)
   2. Conductors (17020)
   3. Programmable Logic Controllers (17160)
   4. Security Monitoring and Control System (17170)

1.5 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:

A. National Electrical Code

1.6 COOPERATION WITH OTHER TRADES:

A. The Contractor shall coordinate the work of this Section with that of other Sections as required to ensure that the entire work of this Project will be carried out in an orderly, complete and coordinated fashion.
B. Coordinate with specific hardware used by Division 8 and Division 11 Contractors for builders hardware and security hardware.

1.7 SUBMITTALS:

A. General: Submittals shall be made in accordance with the General Provisions (Section 17000) of these specifications.

B. Specific Requirements:

1. Submit catalog cuts for all equipment and devices being furnished under this Section.

2. Submit floor plans showing locations of all control equipment and the size, type, quantity and routing of conductors.

3. Submit point-to-point wiring diagrams for the complete door control system including interface controllers and control consoles/panels.

1.8 SYSTEMS DESCRIPTION: The following functional descriptions describe the operation of each type of door. See Section 17170 for a complete description of operational sequences as they apply to the Security Monitoring and Control System.

A. Definitions: The following definitions of functions or indications shall apply to the descriptions contained herein.

1. "Secure" The door is closed and locked. This is effected by monitoring the series connector of the latchbolt monitor switch and the door position switch.

2. "Open" The door is not "Secure".

3. "Locked" The status of a locking device when the latchbolt is fully extended. The device will not be locked until the door is closed.

4. "Unlocked" The status of a locking device when the latchbolt is partially or fully retracted.

5. "Lock" Control power is applied to, or removed from, the locking device as required to effect a "locked" mode. The nature of the locking signal or sequence is determined by the specific locking device.

6. "Unlock" Control power is applied to the locking device to place the device in an "unlocked" mode. Control may be by momentary or continuous application of power as dictated by the locking device.
7. "Group Unlock" (Not Used).
8. "Group Lock" (Not Used).
9. "Emergency Release" This function requires that two switches be pressed simultaneously. When pressed, all doors assigned to the emergency release group will unlock and remain unlocked until electrically or manually locked.

Reset of the emergency unlock shall place all locks in the emergency group in the locked mode. Doors may not be secured until they are physically closed as dictated by the specific locking device.

10. "Interlock" Interlocked doors will be electrically controlled so that only a single door in the interlock group can be opened at one time.

11. "Interlock Override" By depressing the interlock override switch and the unlock switches for specific doors in the interlock group, two or more doors in the interlock group may be simultaneously opened.

12. "Unauthorized Exit" The change of state of any door or door position switch, from a secure state to a non-secure state shall constitute an "unauthorized exit" unless the change in state occurred by a door "open" or "unlock" command from an operator terminal or control panel.

B. Type A - Sliding/Roll-Up Door Control:

1. Functions:
   a. Intercom call-in to control panel shall be via push-button. Call-in shall initiate flashing indicator and audible tone.
   b. Upon acknowledging call-in, system will effect intercom link and, where applicable, switch CCTV camera monitoring door to designated CCTV monitor.
   c. Console operator may open, close, or stop door by means of switch(es) on console. Switches shall be momentary action.
   d. Upon completing control function, intercom system is reset by operator.
2. Console Controls:
   a. "Open", "Close", "Stop" control switch(es)
   b. Intercom acknowledge/reset

3. Console Indicators:
   a. "Stop" - amber indicator
   b. "Open" - red indicator
   c. "Call-in" - green indicator

C. Type B - Individual Swinging Door or Gate Control (With Intercom):

1. Functions:
   a. Intercom call-in to control panel shall be via push button on intercom station located at door. Call-in shall initiate flashing visual indication and audible tone.
   b. Upon acknowledging call-in, system will effect intercom link and, where applicable, switch CCTV cameras monitoring door to designated CCTV monitors.
   c. Console operator may unlock door from console.
   d. Upon completing door control function, intercom system is reset by the operator.

2. Console Controls:
   a. "Unlock" switch.
   b. Intercom acknowledge/reset.

3. Console Indicators:
   a. "Open" - red indicator
   b. "Call-in" - green indicator

D. Type C1 - Inmate and Holding Cell Door (Kick-Release Sliding Door With Intercom):

1. Function:
   a. The console operator shall be capable of "Unlocking" any cell door on an individual door basis.
   b. The "Unlock" function will unlock cell door. The door shall relock when closed manually.
c. The intercom push button in the cell shall function as a call-in to the console, unless the call-in has been disabled.

d. Doors can be unlocked and opened manually at all times with a master key. Unlocking manually will generate an alarm at the controlling console.

2. Console Controls (Individual Door):

   a. "Unlock" switch.

   b. "Intercom Select" connect/reset switch.

3. Console Indicators:

   a. "Open" - red indicator

   b. "Call" - green indicator

E. Type C2 Holding Cell Door (Kick-Release Sliding Door and LEK):

1. Function:

   a. The console operator shall be capable of "Unlocking" any cell door on an individual door basis.

   b. The "Unlock" function will unlock cell door. The door shall relock when closed manually.

   c. Doors can be unlocked and opened manually at all times with a master key. Unlocking manually will generate an alarm at the controlling console.

   d. Doors are equipped with local electric keyswitches. Keyswitches shall be wired as inputs to the PLC and shall not generate an alarm when operated. Door unlocks when the key is turned to the "unlock" position.

   e. The local keyswitch may be disabled from the control panel.

   f. Activation of the personal alarm system in holding area shall automatically disable the keyswitches. The keyswitches shall be reset by the control panel.

2. Console Controls (Individual Door):

   a. "Unlock" switch.

3. Console Indicators:

   a. "Open" - red indicator

F. Deleted
J. Type D - Door Position Switch:

1. Function:
   a. Type D doors (equipped with door position switch and bolt lock monitor switch) shall be connected to provide an unsecured or "open" status indication at the control panel when the door is not secure. In an open state, an indicator shall flash and an audible tone shall sound. The tone shall be silenced by a panel switch. The "unsecured" indicator shall remain until the door is secured and the "reset" function is executed at the control panel.
   b. All doors equipped with door position switch and/or bolt lock monitor switch including electrically operated doors shall generate an alarm on the associated control panel when unsecured in the absence of an electronic control signal.

2. Console Controls:
   a. Alarm "Acknowledge" switch.
   b. Alarm "Reset" switch.

3. Console Indicators:
   a. "Open" - red indicator (one per door).

K. Type E - Emergency Exit:

1. Function:
   a. Where indicated in the schedules, the control panel shall monitor the status of the door. Emergency release shall be effected through push button(s) on the console. Doors shall remain unlocked until reset from the control panel.

2. Console Controls:
   a. Emergency Release/Reset switch(es). (See Table 17150-3)

3. Console Indicators:
   a. "Open" - red indicator.
L. Type F – Deleted

M. Type G - Programmed Door Position Switch:

1. Function:
   a. Door position switch shall function as described for a Type "D" door, but the door alarm shall be user programmable to enable the door alarm to be automatically shunted during certain hours of the day.
   b. When the alarm is shunted, the graphic map shall continue to show the status of the door without initiating alarms.

2. Console Controls:
   a. Alarm "Acknowledge" switch.
   b. Alarm "Reset" switch.
   c. Alarm window set controls.

3. Console Indicators:
   a. "Open" red indicator (one per door)

N. Type H - Deleted:

O. Type I - Card Access Door:

1. Function:
   a. Control of door shall be via use of card sensor or card sensor plus keypad for entry into space and by card reader, push button, or by manual hardware set for exit from space. Exit push button shall be included in the hardware set (where noted in the hardware schedules) and mounted in the door frame.
   b. Where shown on the "Door Control Schedules", door position switch shall be used to monitor door status. When door is opened illegally, an audible alarm will sound at the control panel and a panel indicator light will flash. Console operator acknowledges alarm by pressing an "Acknowledge" switch on the video display which silences the audible alarm. The visual indicator will continue to flash until the alarm is removed. Exact alarm location can be determined by viewing the graphic map.
   c. When a door is opened with a legitimate card or by an exit push button, the door position switch and bolt lock monitor alarms shall be shunted for a preset period of time that is software controllable.
2. Console Controls:
   b. "Alarm Reset"  
3. Console Indicators:
   a. "Door Alarm" - red indicator.
   b. All system activity will be logged and "alarms" will be displayed on the video terminal and printer as specified.

P. Type J - Sliding or Bifold Gate:

1. Function:
   a. Control of gates shall be via the use of vehicle detectors, intercoms, and CCTV as shown on the drawings for entry and exit. Where indicated, photo-cell systems shall be installed at the vehicle gates to prevent gates from closing on vehicles.
   b. Where shown on the drawings, an intercom station with push button call-in shall be located at the gate entry. A call-in either by initiation of a vehicle detector contact or intercom push button shall initiate a flashing indicator and an audible tone at the control panel. Upon acknowledging a call-in, the system will effect an intercom link and, where applicable, switch the CCTV camera monitoring the gate to the designated CCTV monitor.
   c. The console operator may open, close or stop the gate by means of switch(es) on the console. Pressure must be maintained on the Close icon while closing the gate.
   d. Upon completing the control function, the intercom system is reset by the operator.
   e. Console switches may be used at any time for gate operation.
   f. Vehicle detector intercom call-ins shall be shunted while the gate is open.
   g. Where a card reader and an intercom station are provided on a pedestal, the intercom call via the vehicle detector shall be delayed for seven (7) seconds to allow time to read a card. If a valid card is read in the seven second interval the gate will open shunting the intercom call until the gate is again closed. The gate close signal shall be applied after the photo electric eye indicates that the vehicle is clear.
   h. Each time a gate is opened by card reader, a soft tone shall sound at the Master Control terminal and a "Gate Card Access" icon shall appear on the control terminal while the gate is open. Selecting this icon shall display the CCTV cameras associated...
with the gate. This function shall allow the operator to observe the gate areas while the gate is open. This function may be enabled/disabled on the door control screen associated with the gate.

i. The Master Control terminal shall be able to disable the card reader gate open operation for any vehicle gate with a card reader. While the card reader gate open function is disabled, the card reader shall generate an intercom call.

j. Provide an "Safety Override" function to allow the operator to close the door when the photocells are activated. The safety override must be activated each time prior to selecting the close function.

2. Console Controls:
   b. Intercom acknowledge/reset.
   c. Safety Override

3. Console Indicators:
   a. "Stop" - amber indicator.
   b. "Open" - red indicator.
   c. "Call-in" - green indicator.

Q. Type K - Individual Door Control (Without Intercom):

1. Functions:
   a. The console operator may unlock these doors using a panel switch. The latchbolt will remain retracted until the door is closed, at which time the bolt is returned to its normal, locked position.

2. Console Controls:
   a. "Unlock" switch.

3. Console Indicators:
   a. "Open" - red indicators.

R. Type L - Door Control with Call Button:

1. Function:
   a. Control of door shall be as described for a Type "B" door except call-in to the control console shall be initiated with a call push
button rather than an intercom station. Call shall be annunciated on the control panel, but no audio path shall be established for communications.

S. Interlock:

1. Function:
   a. The latch-bolt monitor in conjunction with the door position indicator switch controls an interlock with the movement control panel. When the door is in the unlocked or open position, the door control logic circuits shall inhibit any other door in the interlock group from being opened. See Table 17150-3 for the interlocked door schedule.
   
   b. If a switch is pressed on the control panel for a door in an interlock group while another door in the same interlock group is not secure, an amber "Interlock" indicator shall illuminate and an audio tone shall sound as long as the switch is depressed and the impeding door is not secure.

2. Console Controls - none.

3. Console Indicators:
   a. "Interlock" - Amber indicator
   b. Interlock warning tone.

T. Interlock Override:

1. Function:
   a. Interlock override allows the operator to disable any interlocks associated with the switch so that more than one door in the interlock group may be opened simultaneously. Pressing the "Interlock Override" switch and selecting the door to be opened will execute the override function.

2. Console Controls:
   a. "Interlock Override" switch

3. Console Indicators:
   a. "Override" - red indicator
   b. Audible tone when in override position
U. Panel Disable:

1. Function:
   a. In an emergency situation, depressing the "Panel Disable" switch shall disable all control functions from the control panel. Power must be restored from Master Control.

2. Console Controls:
   a. "Panel Disable" switch (at each control console).
   b. "Return Control" switch (one for each console) at Master Control.

3. Console Indicators:
   a. Panic alarm annunciator - red indicator (at individual consoles and at Master Control).

V. Emergency Door Release:

1. Function:
   a. The Master Control shall have emergency door release functions. Each function shall require that multiple switches be pressed to unlock the doors.
   b. The emergency release function shall automatically override all interlocked doors in the emergency release groups.
   c. All devices activated by this function shall have their associated indicators continuously flash and the audio alarm shall sound until the function is reset. All locks, gates and doors connected to these groups shall remain unlocked and open until the emergency system is reset.
   d. Touching the "Emergency Release" icon on the touchscreen shall switch the view to the primary emergency release screen, which shall contain the primary "Enable" switch, an emergency release "Cancel" switch, and switches to view the graphic maps of the facility. Touching the "Enable" switch within 3 seconds shall arm the system for emergency release and shall display an "Are You Sure?" prompt and "Yes" and "No" icons. Touching the "No" icon shall again display the primary emergency release screen and reset the 3-second response window. After touching the "Yes" icon, icons for all of the groups listed in Table 17150-3 and for all of the individual emergency release doors (Type "E") shall appear on the facility maps. A pulsing audible tone shall sound every 4 seconds while the system is armed. If the "Enable" switch is not pressed within 3 seconds, the function shall reset.

While armed, touching a group release switch, an emergency release door switch, or a normally controlled door release switch
shall unlock the door or doors associated with that switch and the doors shall remain unlocked until reset. A "Reset" switch shall appear on each screen. Touching the "reset" switch and than an activated door or group switch shall reset the emergency release function for that door or group and the door(s) shall lock.

The emergency release function shall continue to be armed and the audible tone shall continue to sound until the operator returns to the primary emergency release screen and touches the emergency release "Cancel" switch. The "Cancel" switch shall disarm the emergency release function, cancel the audible tone, and lock all doors opened by the emergency release function.

e. Changes or additions to the emergency release groups listed in Table 17150-3 and 17150-4 shall be made at no additional cost to the Owner if requested prior to substantial completion of the system.

2. Console Controls:
   b. "Enable" icon.
   c. "Cancel" emergency release icon.
   d. "Yes" and "No" prompt response icons.
   e. Individual door release icons.
   f. Door "Reset" icons.

W. Door Monitoring.

1. Doors that are unlocked via normal operational methods (control panel, touchscreen, card reader, request-to-exit device, electric keyswitch, etc.) shall not create an alarm at the respective control station monitoring the door. The status of the door shall indicate that it is unsecure, but an alarm condition shall not be initiated.

2. Any monitored and/or controlled door that is unlocked or opened via a means other than a normal operational method (forced open, mechanical key, etc.) shall initiate an audible and visual alarm at the respective control station monitoring the door.

3. Doors that are unlocked via normal operational methods (control panel, touchscreen, card reader, request-to-exit device, electric keyswitch, etc.) shall initiate an audible and visual alarm at the respective control station monitoring the door if the door is held open for an extended period of time. The hold open alarm time shall be a programmable PLC function and shall be coordinated with the Owner. Alarm time shall be changed by the Contractor at no additional charge as requested by the Owner throughout the maintenance and warranty period.
PART 2 - PRODUCTS

2.1 SCHEDULES:

A. General:

1. The "Door Control Schedule" (Table 17150-1) delineates door control functions and locations.

2. Table 17150-2 titled "Interlock Schedule" identifies doors that are interlocked. Door control systems shall provide interlocking circuits with "Interlock Override" capability from the control panel having door control responsibility.

3. Doors to be controlled in groups via the "Emergency" control switches are identified in Table 17150-3.

4. The schedules noted above shall be coordinated with the hardware schedules in Division 8 and Division 11. Installation of systems shall be in accordance with shop drawings for Division 8 and Division 11. Shop drawings shall be furnished to the Division 17 Contractor for coordination and installation. If a discrepancy exists between information in this section and that of Division 8 and Division 11, the discrepancy shall be brought to the attention of the Architect in writing.

5. All Schedules and Tables are located at the end of this Section.

2.2 MATERIAL

A. Door Bell Chime:

1. Shall be wall mounted as shown on the plans. Shall be an electronic chime with sixteen dip switch selectable chime tones, each with three volume settings. Shall operate at 12 or 24 VDC. Shall be smaller than 6 inches high, 6 inches wide, and 3 inches deep. Shall be white. SpectraAlert Electronic Chime/Sounder CH12/24 or approved equal.

2. Push button: Shall be wall mounted as shown on the plans and be incorporated into a single gang 11 gauge stainless steel face plate. The switch mechanism shall be a momentary pushbutton, 3A AC, abuse and jam resistant. Delt-Rex AV148-12L1 or approved equal.

B. Local Door Alarm:

1. Local Door Alarm: EST Model 340A or approved equal. Unit shall be 24VAC and have adjustable volume control with maximum volume of at least 70dB at 3 meters. Provide with tamper-proof hardware and 14 gauge steel grill painted white. Unit shall be completely flush mounted.

2. Transformer: 24VAC transformer shall be provided in the SCC cabinet and fused for each circuit.
C. Keyswitches: Keyswitches for holding cells provided under Section 11190.

PART 3 - EXECUTION

3.1 EXECUTION:

A. General:

1. Contractor shall install all conductors and make final connections to the locking system hardware and controls as required to effect the locking and control functions defined in these specifications and those in Division 8 and Division 11.

2. All conductors from "SEC" to 120VAC electrically operated door locks shall be minimum 14 ga. copper THWN. All conductors from "SEC" to door position switches and bolt position switches at 120VAC locks shall be minimum 14 ga. copper THWN. Number of conductors shall be installed as required to provide the control and monitoring functions specified in Divisions 8, 11, and 17.

3. Use appropriately listed cable for Class 2 circuits. Note that single conductor type wire for Class 2 circuits may not be permissible in cable tray per NEC 725.

4. Programmable Logic Controllers (PLC) shall be utilized to perform functions as specified. PLC's shall be as specified in Section 17160.

5. The door locking PLC's and operator control terminals system shall be powered from a UPS.

6. Division 17 shall furnish and install all panel boards, breakers, wiring, etc. to provide protected branch circuits for the required power distribution beyond the main panel furnished and installed by Division 16. Contractor to determine ratings of panelboards and circuit breakers.

7. Interposing relays for door lock control shall be plug-in type with hold down clip and LED indicator. AC or DC types shall be selected as appropriate for the application. Each door lock/relay circuit shall be individually fuse protected to isolate shorted circuits.

3.2 COMPLETION:

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave premises clean, neat and orderly.

B. Testing:

1. Component Testing: Each separate component of the door control system shall be tested individually. In particular, each printed circuit board shall be tested for circuit continuity and circuit isolation. All electronic components shall be operated for the time duration required to identify product failures and the board shall be completely operationally tested. This testing shall be done at the site of the board manufacturer.
2. Factory Testing:
   a. All components of the door control system shall be operationally tested together with the exception of the end devices. At this time, all components such as control panels, interface controllers, interface relay cabinets and interconnecting wiring shall be complete and fitted with their connectors.
   b. Give notice at least 4 weeks prior to system testing as the Owner may wish to be present.

3. Site Testing: After complete installation of the system in the field, all problems shall be corrected prior to final testing. Once the Contractor is satisfied that the system is operating satisfactorily, operation of the entire system shall be demonstrated to the Owner. If, during this final demonstration, it becomes evident that there are still problems with the system, the demonstration will be canceled and rescheduled when all problems are corrected.
LEGEND FOR DOOR CONTROL SCHEDULE, TABLE 17150-1

HARDWARE
FUNCTION = Letter designations refer to types of door control described in this section.

EOL = Electrically Operated Lock.
DPS = Door Position Switches.
SEC = Security Electronics Cabinet. See security and communications drawings for cabinet locations.
Control = Control panel having primary control or monitoring responsibility of door. See Table 17300-1, Control Panel Schedule, for abbreviations and locations of control panels.

Remarks:
1. Connect to door release lever switch for “request to exit” signal.
2. Pushbutton at counter unlocks door.
3. Local pushbutton shunts local alarm horn for 5 seconds.
4. Delayed egress door.
5. Pushbutton unlocks door to exit.
6. Video Visitation rooms in cell blocks to have an intercom on the exterior and an alternate call button on the interior that shall activate the same intercom call as the pushbutton on the exterior station.
7. Intercom call shall transfer to CP-MC if not answered in 30 seconds.
8. Connect door lock to fire alarm contact to release door when the fire alarm zone is in the alarm state.
<table>
<thead>
<tr>
<th>SHEET NUMBER</th>
<th>DOOR NUMBER</th>
<th>FUNCTION</th>
<th>EOL</th>
<th>DPS</th>
<th>SEC NO.</th>
<th>CONTROL</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE100</td>
<td>1SY01A</td>
<td>J</td>
<td>X</td>
<td>X</td>
<td>SEC-B</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE100</td>
<td>1SY01B</td>
<td>J</td>
<td>X</td>
<td>X</td>
<td>SEC-B</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE100</td>
<td>1SY01C</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-B</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>B05A</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-B</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>B05B</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-B</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>B06</td>
<td>D</td>
<td>X</td>
<td></td>
<td>SEC-B</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>BP01A</td>
<td>B,I</td>
<td>X</td>
<td>X</td>
<td>SEC-B</td>
<td>CP-PC</td>
<td>7</td>
</tr>
<tr>
<td>SE200</td>
<td>BP01B</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-B</td>
<td>CP-PC</td>
<td>1, 7</td>
</tr>
<tr>
<td>SE200</td>
<td>BP08C</td>
<td>D</td>
<td></td>
<td>X</td>
<td>SEC-B</td>
<td>CP-PC</td>
<td>7</td>
</tr>
<tr>
<td>SE200</td>
<td>BP13</td>
<td>I</td>
<td>X</td>
<td>X</td>
<td>SEC-B</td>
<td>CP-PC</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>BP14</td>
<td>I</td>
<td>X</td>
<td>X</td>
<td>SEC-B</td>
<td>CP-PC</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>BP15</td>
<td>I</td>
<td>X</td>
<td>X</td>
<td>SEC-B</td>
<td>CP-PC</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>BP16A</td>
<td>D</td>
<td></td>
<td>X</td>
<td>SEC-B</td>
<td>CP-PC</td>
<td>3</td>
</tr>
<tr>
<td>SE200</td>
<td>BP16B</td>
<td>K</td>
<td></td>
<td>X</td>
<td>SEC-B</td>
<td>CP-PC</td>
<td>2</td>
</tr>
<tr>
<td>SE200</td>
<td>BP17</td>
<td>B,I</td>
<td>X</td>
<td>X</td>
<td>SEC-B</td>
<td>CP-PC</td>
<td>1, 7</td>
</tr>
<tr>
<td>SE200</td>
<td>BP18A</td>
<td>I</td>
<td>X</td>
<td>X</td>
<td>SEC-B</td>
<td>CP-PC</td>
<td>1</td>
</tr>
<tr>
<td>SE200</td>
<td>BP18B</td>
<td>I</td>
<td>X</td>
<td>X</td>
<td>SEC-B</td>
<td>CP-PC</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>BP19</td>
<td>I</td>
<td>X</td>
<td>X</td>
<td>SEC-B</td>
<td>CP-PC</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>BP21A</td>
<td>B,I</td>
<td>X</td>
<td>X</td>
<td>SEC-B</td>
<td>CP-PC</td>
<td>1, 7</td>
</tr>
<tr>
<td>SE200</td>
<td>BS01A</td>
<td>B,I</td>
<td>X</td>
<td>X</td>
<td>SEC-B</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>BS01B</td>
<td>D</td>
<td></td>
<td>X</td>
<td>SEC-B</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>BST.03A</td>
<td>D</td>
<td></td>
<td>X</td>
<td>SEC-B</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>BST03B</td>
<td>D</td>
<td></td>
<td>X</td>
<td>SEC-B</td>
<td>CP-PC</td>
<td>7</td>
</tr>
<tr>
<td>SE200</td>
<td>BST04A</td>
<td>D</td>
<td></td>
<td>X</td>
<td>SEC-B</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>BST04B</td>
<td>D</td>
<td></td>
<td>X</td>
<td>SEC-B</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>101</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>103</td>
<td>D</td>
<td></td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>105A</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>105B</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>105C</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>111</td>
<td>D</td>
<td></td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SHEET NUMBER</td>
<td>DOOR NUMBER</td>
<td>FUNCTION</td>
<td>EOL</td>
<td>DPS</td>
<td>SEC NO.</td>
<td>CONTROL</td>
<td>REMARKS</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>----------</td>
<td>-----</td>
<td>-----</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>SE201</td>
<td>113B</td>
<td>D</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B01A</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B01B</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B03</td>
<td>D</td>
<td>X</td>
<td></td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B04</td>
<td>D</td>
<td>X</td>
<td></td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B05A</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B06</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B07A</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B08A</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B09</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B10</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B11A</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B12</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B13</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B14A</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B15</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B16A</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B18A</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B19A</td>
<td>I</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B19B</td>
<td>I</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B21B</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B22</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1J01</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1J02A</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1J03</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1L01A</td>
<td>B,I</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1L01B</td>
<td>G</td>
<td>X</td>
<td></td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1L04A</td>
<td>B,I</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1L04B</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1L04C</td>
<td>B,I</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1M01</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SHEET NUMBER</td>
<td>DOOR NUMBER</td>
<td>FUNCTION</td>
<td>EOL</td>
<td>DPS</td>
<td>SEC NO.</td>
<td>CONTROL</td>
<td>REMARKS</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>----------</td>
<td>-----</td>
<td>-----</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>SE201</td>
<td>1M11</td>
<td>I</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1PB04A</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1PB05</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1PB06A</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1PB06B</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1PB06C</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1R04</td>
<td>I</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1R05A</td>
<td>B, I</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1R05B</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1SR01</td>
<td>J</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1ST01</td>
<td>D</td>
<td>X</td>
<td></td>
<td>SEC-1</td>
<td>CP-MC</td>
<td>4</td>
</tr>
<tr>
<td>SE201</td>
<td>1ST02</td>
<td>D</td>
<td>X</td>
<td></td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1ST03</td>
<td>D</td>
<td>X</td>
<td></td>
<td>SEC-1</td>
<td>CP-MC</td>
<td>4</td>
</tr>
<tr>
<td>SE201</td>
<td>1ST04</td>
<td>D</td>
<td>X</td>
<td></td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1T01A</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1T01B</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1T03A</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1T04</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1T05A</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1T12A</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1T13A</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1T14</td>
<td>C2</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-WC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1VS01A</td>
<td>J</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1VS01B</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1VS01C</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1VS01D</td>
<td>J</td>
<td>X</td>
<td>X</td>
<td>SEC-1</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>202</td>
<td>D</td>
<td>X</td>
<td></td>
<td>SEC-2</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>215A</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-2</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>215B</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-2</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>2A01</td>
<td>I,K</td>
<td>X</td>
<td>X</td>
<td>SEC-2</td>
<td>CP-MC</td>
<td>1</td>
</tr>
<tr>
<td>SE202</td>
<td>2A03</td>
<td>I</td>
<td>X</td>
<td>X</td>
<td>SEC-2</td>
<td>CP-MC</td>
<td>1</td>
</tr>
<tr>
<td>SHEET NUMBER</td>
<td>DOOR NUMBER</td>
<td>FUNCTION</td>
<td>EOL</td>
<td>DPS</td>
<td>SEC NO.</td>
<td>CONTROL</td>
<td>REMARKS</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>----------</td>
<td>-----</td>
<td>-----</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>SE202</td>
<td>2A04</td>
<td>I</td>
<td>X</td>
<td>X</td>
<td>SEC-2</td>
<td>CP-MC</td>
<td>1</td>
</tr>
<tr>
<td>SE202</td>
<td>2A05A</td>
<td>I</td>
<td>X</td>
<td>X</td>
<td>SEC-2</td>
<td>CP-MC</td>
<td>1</td>
</tr>
<tr>
<td>SE202</td>
<td>2A09</td>
<td>I</td>
<td>X</td>
<td>X</td>
<td>SEC-2</td>
<td>CP-MC</td>
<td>1</td>
</tr>
<tr>
<td>SE202</td>
<td>2MC01A</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-2</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>2MC01B</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-2</td>
<td>CP-MC</td>
<td>5</td>
</tr>
<tr>
<td>SE202</td>
<td>2MC04</td>
<td>D</td>
<td></td>
<td></td>
<td>SEC-2</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>2SA04</td>
<td>I,B</td>
<td>X</td>
<td>X</td>
<td>SEC-2</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>2ST03</td>
<td>D</td>
<td></td>
<td></td>
<td>SEC-2</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>2ST04</td>
<td>D</td>
<td></td>
<td></td>
<td>SEC-2</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>2ST05</td>
<td>D</td>
<td></td>
<td></td>
<td>SEC-2</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>2ST06</td>
<td>D</td>
<td></td>
<td></td>
<td>SEC-2</td>
<td>CP-MC</td>
<td>8</td>
</tr>
<tr>
<td>SE202</td>
<td>2TR01B</td>
<td>D</td>
<td></td>
<td></td>
<td>SEC-2</td>
<td>CP-MC</td>
<td>4</td>
</tr>
<tr>
<td>SE202</td>
<td>3ST02A</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>3ST02B</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>3ST02C</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>3ST03A</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>3ST03B</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>3ST03C</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>3ST04A</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>3ST04B</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>3ST04C</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>E100A</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>E100B</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>E100C</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>E100D</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>E100E</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>E200</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td>5</td>
</tr>
<tr>
<td>SE203</td>
<td>3.02</td>
<td>B,I</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3.06</td>
<td>D</td>
<td></td>
<td></td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3.09</td>
<td>D</td>
<td></td>
<td></td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3.10</td>
<td>D</td>
<td></td>
<td></td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SHEET NUMBER</td>
<td>DOOR NUMBER</td>
<td>FUNCTION</td>
<td>EOL</td>
<td>DPS</td>
<td>SEC NO.</td>
<td>CONTROL</td>
<td>REMARKS</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>----------</td>
<td>-----</td>
<td>-----</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>SE203</td>
<td>3ST01A</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3ST01B</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3ST01C</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3ST05A</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3ST05B</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3ST06A</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3ST06B</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>E101</td>
<td>D</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EA101</td>
<td>B</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-EA</td>
<td>6</td>
</tr>
<tr>
<td>SE203</td>
<td>EB101</td>
<td>C1</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EB102</td>
<td>C1</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EB103</td>
<td>C1</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EB104</td>
<td>C1</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EB105</td>
<td>C1</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EB106</td>
<td>C1</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EB107</td>
<td>C1</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EB108</td>
<td>C1</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EB111</td>
<td>B</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td>6</td>
</tr>
<tr>
<td>SE203</td>
<td>EC101</td>
<td>C1</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EC102</td>
<td>C1</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EC103</td>
<td>C1</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EC104</td>
<td>C1</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EC105</td>
<td>C1</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EC106</td>
<td>C1</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EC107</td>
<td>C1</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EC108</td>
<td>C1</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EC111</td>
<td>B</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td>6</td>
</tr>
<tr>
<td>SE203</td>
<td>ED101</td>
<td>K</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-E</td>
<td>6</td>
</tr>
<tr>
<td>SE203</td>
<td>N100A</td>
<td>A</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>N100B</td>
<td>A</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>N100C</td>
<td>A</td>
<td></td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SHEET NUMBER</td>
<td>DOOR NUMBER</td>
<td>FUNCTION</td>
<td>EOL</td>
<td>DPS</td>
<td>SEC NO.</td>
<td>CONTROL</td>
<td>REMARKS</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>----------</td>
<td>-----</td>
<td>-----</td>
<td>---------</td>
<td>---------</td>
<td>--------</td>
</tr>
<tr>
<td>SE203</td>
<td>N101</td>
<td>D</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>N103</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>N104</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>N200</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td>5</td>
</tr>
<tr>
<td>SE203</td>
<td>NA101</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA102</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA103</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA104</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA105</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA106</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA107</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA108</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA109</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA110</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA111</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA112</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA113</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA114</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA115</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA116</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA119</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td>6</td>
</tr>
<tr>
<td>SE203</td>
<td>NA120</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td>6</td>
</tr>
<tr>
<td>SE203</td>
<td>NB101</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB102</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB103</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB104</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB104</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB105</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB106</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB107</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB108</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SHEET NUMBER</td>
<td>DOOR NUMBER</td>
<td>FUNCTION</td>
<td>EOL</td>
<td>DPS</td>
<td>SEC NO.</td>
<td>CONTROL</td>
<td>REMARKS</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>----------</td>
<td>-----</td>
<td>-----</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>SE203</td>
<td>NB109</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB110</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB111</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB112</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB113</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB114</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB115</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB116</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB119</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td>6</td>
</tr>
<tr>
<td>SE203</td>
<td>NB120</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-N</td>
<td>6</td>
</tr>
<tr>
<td>SE203</td>
<td>S100A</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S100B</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S100C</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S100D</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S100E</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S101</td>
<td>D</td>
<td>X</td>
<td></td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S103A</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S103B</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S103C</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S104A</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S104B</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S104C</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S200</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SA101</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td>6</td>
</tr>
<tr>
<td>SE203</td>
<td>SB101</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB102</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB103</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB104</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB105</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB106</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB107</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SHEET NUMBER</td>
<td>DOOR NUMBER</td>
<td>FUNCTION</td>
<td>EOL</td>
<td>DPS</td>
<td>SEC NO.</td>
<td>CONTROL</td>
<td>REMARKS</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>----------</td>
<td>-----</td>
<td>-----</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>SE203</td>
<td>SB108</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB109</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB110</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB111</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB112</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB113</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB114</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB115</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB116</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB117</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td>6</td>
</tr>
<tr>
<td>SE203</td>
<td>SC101</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC102</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC103</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC104</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC105</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC106</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC107</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC108</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC109</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC110</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC111</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC112</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC113</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC114</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC115</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC116</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC117</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td>6</td>
</tr>
<tr>
<td>SE203</td>
<td>SD101</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-S</td>
<td>6</td>
</tr>
<tr>
<td>SE203</td>
<td>W100A</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-W</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>W100B</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-W</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>W100C</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-W</td>
<td></td>
</tr>
<tr>
<td>SHEET NUMBER</td>
<td>DOOR NUMBER</td>
<td>FUNCTION</td>
<td>EOL</td>
<td>DPS</td>
<td>SEC NO.</td>
<td>CONTROL</td>
<td>REMARKS</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>----------</td>
<td>-----</td>
<td>-----</td>
<td>---------</td>
<td>---------</td>
<td>--------</td>
</tr>
<tr>
<td>SE203</td>
<td>W100D</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-W</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>W100E</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-W</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>W101</td>
<td>D</td>
<td>X</td>
<td></td>
<td>SEC-3</td>
<td>CP-W</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>W200</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-W</td>
<td>5</td>
</tr>
<tr>
<td>SE203</td>
<td>WA101</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-W</td>
<td>6</td>
</tr>
<tr>
<td>SE203</td>
<td>WB101</td>
<td>B</td>
<td>X</td>
<td></td>
<td>SEC-3</td>
<td>CP-W</td>
<td>6</td>
</tr>
<tr>
<td>SE203</td>
<td>WC101</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-W</td>
<td>6</td>
</tr>
<tr>
<td>SE203</td>
<td>WD101</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-3</td>
<td>CP-W</td>
<td>6</td>
</tr>
<tr>
<td>SE203M</td>
<td>3M02</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>3M06</td>
<td>D</td>
<td></td>
<td>X</td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>3MST05A</td>
<td>E</td>
<td>X</td>
<td></td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>3MST05B</td>
<td>E</td>
<td>X</td>
<td></td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>3MST06A</td>
<td>E</td>
<td>X</td>
<td></td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>3MST06B</td>
<td>E</td>
<td>X</td>
<td></td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E201A</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E201B</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E201C</td>
<td>A</td>
<td>X</td>
<td></td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E202A</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E202B</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E203A</td>
<td>B</td>
<td>X</td>
<td></td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E203B</td>
<td>B</td>
<td>X</td>
<td></td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EA201</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td>6</td>
</tr>
<tr>
<td>SE203M</td>
<td>EB201</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EB202</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EB203</td>
<td>C1</td>
<td>X</td>
<td></td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EB204</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EB205</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EB206</td>
<td>C1</td>
<td>X</td>
<td></td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EB207</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EB208</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EB211</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td>6</td>
</tr>
<tr>
<td>SHEET NUMBER</td>
<td>DOOR NUMBER</td>
<td>FUNCTION</td>
<td>EOL</td>
<td>DPS</td>
<td>SEC NO.</td>
<td>CONTROL</td>
<td>REMARKS</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>----------</td>
<td>-----</td>
<td>-----</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>SE203M</td>
<td>EB212</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td>6</td>
</tr>
<tr>
<td>SE203M</td>
<td>EC201</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EC202</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EC203</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EC204</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EC205</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EC206</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EC207</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EC208</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EC212</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td>6</td>
</tr>
<tr>
<td>SE203M</td>
<td>ED201</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-E</td>
<td>6</td>
</tr>
<tr>
<td>SE203M</td>
<td>N201</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>N202</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA201</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA202</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA203</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA204</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA205</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA206</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA207</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA208</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA209</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA210</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA211</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA212</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA213</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA214</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA215</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA216</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA219</td>
<td>K</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA220</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td>6</td>
</tr>
</tbody>
</table>
### TABLE 17150-1
DOOR CONTROL SCHEDULE (CONTINUED)

<table>
<thead>
<tr>
<th>SHEET NUMBER</th>
<th>DOOR NUMBER</th>
<th>FUNCTION</th>
<th>EOL</th>
<th>DPS</th>
<th>SEC NO.</th>
<th>CONTROL</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE203M</td>
<td>NB201</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB202</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB203</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB204</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB205</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB206</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB207</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB208</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB209</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB210</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB211</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB212</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB213</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB214</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB215</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB216</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB219</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td>6</td>
</tr>
<tr>
<td>SE203M</td>
<td>NB220</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-N</td>
<td>6</td>
</tr>
<tr>
<td>SE203M</td>
<td>S201A</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>S201B</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>S201C</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>S202A</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>S202B</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>S202C</td>
<td>E</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SA201</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td>6</td>
</tr>
<tr>
<td>SE203M</td>
<td>SB201</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB202</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB203</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB204</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB205</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SHEET NUMBER</td>
<td>DOOR NUMBER</td>
<td>FUNCTION</td>
<td>EOL</td>
<td>DPS</td>
<td>SEC NO.</td>
<td>CONTROL</td>
<td>REMARKS</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>----------</td>
<td>-----</td>
<td>-----</td>
<td>---------</td>
<td>---------</td>
<td>--------</td>
</tr>
<tr>
<td>SE203M</td>
<td>SB206</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB207</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB208</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB209</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB210</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB211</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB212</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB213</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB214</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB215</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB216</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB217</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td>6</td>
</tr>
<tr>
<td>SE203M</td>
<td>SC201</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC202</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC203</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC204</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC205</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC206</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC207</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC208</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC209</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC210</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC211</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC212</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC213</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC214</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC215</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC216</td>
<td>C1</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC217</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td>6</td>
</tr>
<tr>
<td>SE203M</td>
<td>SD201</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td>6</td>
</tr>
<tr>
<td>SE203M</td>
<td>SD201</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-S</td>
<td>6</td>
</tr>
<tr>
<td>SHEET NUMBER</td>
<td>DOOR NUMBER</td>
<td>FUNCTION</td>
<td>EOL</td>
<td>DPS</td>
<td>SEC NO.</td>
<td>CONTROL</td>
<td>REMARKS</td>
</tr>
<tr>
<td>--------------</td>
<td>-------------</td>
<td>----------</td>
<td>-----</td>
<td>-----</td>
<td>---------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>SE203M</td>
<td>W201A</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-W</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>W201B</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-W</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>W201C</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-W</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>W202A</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-W</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>W202B</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-W</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>W203A</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-W</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>W203B</td>
<td>A</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-W</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>WA201</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-W 6</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>WB201</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-W 6</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>WC201</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-W 6</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>WD201</td>
<td>B</td>
<td>X</td>
<td>X</td>
<td>SEC-4</td>
<td>CP-W 6</td>
<td></td>
</tr>
<tr>
<td>SE204</td>
<td>P01A</td>
<td>D</td>
<td></td>
<td></td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE204</td>
<td>P01B</td>
<td>D</td>
<td></td>
<td></td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE204</td>
<td>P01C</td>
<td>D</td>
<td></td>
<td></td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE204</td>
<td>P01D</td>
<td>D</td>
<td></td>
<td></td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE204</td>
<td>P02</td>
<td>D</td>
<td></td>
<td></td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SE204</td>
<td>PST05</td>
<td>B</td>
<td></td>
<td></td>
<td>SEC-4</td>
<td>CP-MC</td>
<td></td>
</tr>
<tr>
<td>SHEET #</td>
<td>GROUP</td>
<td>DESCRIPTION</td>
<td>DOOR NUMBERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>-------</td>
<td>------------------</td>
<td>------------------</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1-1B</td>
<td>Internal Access</td>
<td>1L04C, 1L44B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1-2</td>
<td>Transfer Vest.</td>
<td>1T01A, 1T01B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1-3A</td>
<td>Prebooking SP</td>
<td>1PB.06A, 1PB06B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1-3B</td>
<td>Prebooking SP</td>
<td>1PB06A, 1PB06C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1-4A</td>
<td>Release Vestibule</td>
<td>1R05A, 1R05B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1-4B</td>
<td>Release Vestibule</td>
<td>1R05B, 1R04</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1-5A</td>
<td>Vehicle SCllyport</td>
<td>1T01A, 1VS01A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1-5B</td>
<td>Vehicle SCllyport</td>
<td>1T01A, 1VS01B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1-5C</td>
<td>Vehicle SCllyport</td>
<td>1T01A, 1VS01D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1-5D</td>
<td>Vehicle SCllyport</td>
<td>1PB06A, 1VS01A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1-5E</td>
<td>Vehicle SCllyport</td>
<td>1PB06A, 1VS01B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1-5F</td>
<td>Vehicle SCllyport</td>
<td>1PB06A, 1VS01D</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>B1-1A</td>
<td>Internal Access</td>
<td>1L04A, 1L448</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>2-1</td>
<td>Staff SCllyport</td>
<td>2.15A, 2.15B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>2-2</td>
<td>Mast. Control SP</td>
<td>2MC01A, 2MC01B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3-1</td>
<td>East Block SP</td>
<td>E100A, E100B, E100C, E100D, E100E, E200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3-2</td>
<td>North Block SP</td>
<td>N100A, N100B, N100C, N200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3-3</td>
<td>West Block SP</td>
<td>W100A, W100B, W100C, W100D, W100E, W200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3-4</td>
<td>South Block SP</td>
<td>S100A, S100B, S100C, S100D, S100E, S200</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>4-1</td>
<td>East Staging SP</td>
<td>E201A, E141B, E201C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>4-2</td>
<td>West Staging SP</td>
<td>W201A, W201B, W201C</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>4-3</td>
<td>NE Vestibule</td>
<td>E202A, E202B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>4-4</td>
<td>SE Vestibule</td>
<td>E203A, E203B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>4-5</td>
<td>NW Vestibule</td>
<td>W203A, W203B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>4-6</td>
<td>SW Vestibule</td>
<td>W202A, W202B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TABLE 17150-3

EMERGENCY DOOR RELEASE GROUPS

Notes:
1. All exit doors to be released individually. All Housing and Holding to be released in Groups.
2. Holding cells may be released individually.

<table>
<thead>
<tr>
<th>PANEL</th>
<th>GROUP #</th>
<th>DESCRIPTION</th>
<th>DOOR NUMBERS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP-MC</td>
<td>1</td>
<td>Transfer Holding</td>
<td>1T12, 1T13, 1T14, 1T05, 1T04, 1T03</td>
</tr>
<tr>
<td>CP-MC</td>
<td>2</td>
<td>Booking</td>
<td>1B05, 1B06, 1B07, 1B08, 1B09, 1B10, 1B11, 1B12, 1B13, 1B14, 1B15, 1B16, 1B17, 1B18</td>
</tr>
<tr>
<td>CP-MC</td>
<td>3</td>
<td>Juvenile</td>
<td>1J.01, 1J.02A, 1J.03</td>
</tr>
<tr>
<td>CP-MC</td>
<td>4</td>
<td>East Block B</td>
<td>Cells EB101 thru EB108 &amp; EB201 thru EB208, EB111, EB212</td>
</tr>
<tr>
<td>CP-MC</td>
<td>5</td>
<td>East Block C</td>
<td>Cells EC101 thru EC108 &amp; EC201 thru EC208, EC111, EC212</td>
</tr>
<tr>
<td>CP-MC</td>
<td>6</td>
<td>North Block A</td>
<td>Cells NA101 thru NA116 &amp; NA201 thru NA216, NA120, NA220</td>
</tr>
<tr>
<td>CP-MC</td>
<td>7</td>
<td>North Block B</td>
<td>Cells NB101 thru NB116 &amp; NB201 thru NB216, NB120, NB220</td>
</tr>
<tr>
<td>CP-MC</td>
<td>8</td>
<td>South Block B</td>
<td>Cells SB101 thru SB116 &amp; SB201 thru SB216, SB117, SB217</td>
</tr>
<tr>
<td>CP-MC</td>
<td>9</td>
<td>South Block C</td>
<td>Cells SC101 thru SC116 &amp; SC201 thru SC216, SC117, SC217</td>
</tr>
</tbody>
</table>

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL CONDITIONS:
   A. The Conditions of the Contract (General, Supplementary and other Conditions) and the General Requirements (Sections of Division 1) are hereby made a part of this Section.

1.2 WORK INCLUDED:
   A. Provide materials, labor, equipment programming, and services as required to install programmable logic controllers as shown on the drawings or as specified herein.

1.3 RELATED WORK SPECIFIED ELSEWHERE:
   A. The work of this Section is related to the work of the following Sections:
      1. General Provisions (17000)
      2. Door Control System (17150)
      3. Security Monitoring and Control System (17170)
      4. Dedicated Intercom and General Paging System (17260)
      5. Control Panels (17300)
      6. Uninterruptible Power Systems (17900)

1.4 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:
   A. National Electrical Code

1.5 COOPERATION WITH OTHER TRADES:
   A. Division 17 shall coordinate the work of this Section with that of other sections as required to ensure that the entire work of this Project will be carried out in an orderly, complete and coordinated fashion.

1.6 SUBMITTALS
   A. Submittals shall be made in accordance with the General Provisions (Section 17000) of these specifications.

1.7 DESCRIPTION
   A. Programmable Logic Controllers (PLC) shall provide control and monitoring functions for systems as described on the drawings and in these specifications.
B. The controllers shall provide all necessary logic functions, timing functions, memory, software, input/output points and communication capabilities for the operating features required to meet all of the requirements of the specifications.

C. The controller shall be general purpose in nature and not custom designed and built for this isolated application. The controller shall be generally non-location specific in its construction. The controller shall be made location specific and operationally customized by installing EEPROM (including FLASH Memory) with applicable software, and making the I/O interface boards system specific and installing the proper I/O modules.

D. Logic functions shall include but not be limited to AND, OR and INVERT functions with sufficient levels to provide operating features required to perform all of the functions required by the specifications.

E. Timing functions shall include, but not be limited to, on-delay, off-delay, stepping and pulsing. Sufficient variations of programmable timing shall be available to provide all the operating features as required by the specifications.

F. Input cards or software must be configured to prevent logic errors on input contact bounce. For example, if a closing door has a DPS bounce (change of state from closed, open, closed in a few milliseconds) the system should not indicate a door secure followed by door alarm on forced entry.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. The PLC shall be the product of a manufacturer engaged in the production of controllers for industrial application for a minimum of five years. Only manufacturers with national distribution and local parts outlets will be considered.

B. System software shall be contained in EEPROM. RAM operation data base shall be battery backed up. The program shall be developed for each controller on an individual basis.

C. The programming format shall be traditional relay ladder logic utilizing basic and advanced instruction sets for function generation.

D. Each controller shall be equipped with a processor, I/O modules, communication modules, power suppliers, and accessories as required for a complete and functional unit.

E. Controller shall be configured to operate in a distributed processor environment and equipped with communications capability as required.

F. The I/O interface boards shall be standard printed circuit boards containing the necessary coding/decoding solid state circuits for communicating with the processor, LED indicators which display the status of each point and plug-in input/output modules.

G. The controller shall operate on 105 to 130 VAC, 60 Hz and contain an integral circuit breaker for overload protection. The controller shall operate properly in temperatures of 0 to 60 deg. C and up to 95 percent humidity (noncondensing).
H. The controller shall be tested to IEC68-2-6 to withstand shock of at least 10G for at least 10ms.

I. Programming Data Terminal: Division 17 Subcontractor shall furnish a programming data terminal equipped with all accessories as required to load each PLC. A single unit shall be provided for the facility. The programming data terminal shall include, at a minimum, the following components and features:

1. Laptop case (6 lb. maximum with Lithium-Ion battery).
2. Minimum Pentium 4, 2.2 GHz processor.
3. 1024 MB RAM capacity (minimum).
4. Configured with a minimum of 256 MB of RAM.
5. 14.1 (minimum) active matrix display.
6. 20 GB capacity hard drive (minimum).
7. Configured with LAN communications card and LAN terminal software.
8. Configured with PLC communications card and or ports to communicate with PLC devices/network.
9. Mouse pointing device integrated into keyboard.
10. 1.44MB floppy disk drive
11. 24X CD-RW Drive.
12. Two PCMCIA type II or one type III card slots with controlling bus and software.
13. RS-232 serial port, Parallel printer port, PS/2 mouse/keyboard port and video port.
14. 2 - Lithium-Ion batteries.

J. Each PLC program shall be furnished to the Owner as follows:

1. Hard copy printout
2. Each program on a CD-R disk
3. All programs stored on the hard drive of the programming data terminal.

K. All PLC’s installed for Division 17 systems shall be of the same manufacturer.

L. The PLC communication network (PLC-to-PLC) shall be a dedicated network (separate from the LAN) via a fiber optic transmission medium configured in a loop as indicated on the drawings.
M. The PLC shall be Square D Modicon Series, Allen-Bradley PLC5 series, GE Fanuc Series 90-70, Omron Sysmax Series, or approved equal.

PART 3 - EXECUTION

3.1 EXECUTION:

A. Division 17 shall develop software as required to effect the functions of the PLC as dictated by the drawings and specifications.

B. Division 17 shall configure equipments with modules as required for the PLC to support the specific functions or applications.

C. Division 17 shall provide equipment cabinets for installation of the PLC equipments and cable terminations to the PLC.

D. Division 17 shall be responsible to ensure that the PLC is equipped with a UPS module or that the power source for the PLC is from a UPS unit.

3.2 COMPLETION:

A. Division 17 shall inspect and test the installation and operations of the entire system prior to initiating acceptance tests.

B. Acceptance testing shall be conducted by the Owner or Owner's representative to ensure compliance with the drawings and specifications.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL CONDITIONS:
   A. The Conditions of the Contract (General, Supplementary and other Conditions) and the General Requirements (Sections of Division 1) are hereby made a part of this Section.

1.2 WORK INCLUDED:
   A. Provide materials, labor, equipment, and services necessary to furnish, deliver, and install a security monitoring and control system as shown on the drawings, as specified herein, and/or as required by job conditions.
   B. Major sub-systems include:
      1. Video display (touchscreen) terminals.
      2. Control panels
      3. Programmable Logic Controllers (PLCs)

1.3 RELATED WORK SPECIFIED ELSEWHERE:
   A. The work of this Section is related to the work of the following sections.
      1. General Provisions (17000)
      2. Computers (17030)
      3. Cabinets and Enclosures (17050)
      4. Door Control System (17150)
      5. Programmable Logic Controllers (17160)
      6. Closed Circuit Television System (17200)
      7. Dedicated Intercom and General Paging System (17260)
      8. Control Panels and Consoles (17300)

1.4 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:
   A. National Electrical Code

1.5 COOPERATION WITH OTHER TRADES: The Division 17 Subcontractor shall coordinate the work of this Section with that of other sections as required to ensure that
the entire work of this Project will be carried out in an orderly, complete and coordinated fashion.

1.6 SUBMITTALS:

A. General:

1. Submittals shall be made in accordance with the General Provisions (Section 17000) of these specifications.

B. Specific Requirements:

1. Submit catalog cuts for all equipment and devices being furnished under this Section.

2. Submit drawings of all control screens, which shall designate colors and icons for each condition.

3. Provide a complete touchscreen operator terminal, as specified herein, shipped to the Engineer's office with all software and screens loaded. The terminal shall be provided prior to the submittal of the control screen shop drawings. The terminal will be used by the Engineer during the submittal process to review each screen, icons, and colors. After all control screens have been reviewed, revised as required and reviewed as final, the Engineer will ship the terminal in its original carton back to the Contractor for use on the project. The Engineer assumes no responsibility for the terminal during the submittal and review process or during transit.

C. Software Development:

1. Within one (1) month of receiving the reviewed shop drawing submittal, the security equipment contractor shall schedule a preliminary meeting with the Owner and architect/engineer at a location to be determined by the Owner.

Specific operation and function of the security control system must be determined prior to the preliminary meeting. The security equipment contractor shall come to the meeting prepared to demonstrate screen layouts and control panel layouts based on the information included in the contract documents. Extensive analysis outlining all performance of software design and application will be reviewed and determined at the preliminary meeting. General issues such as icon shape, color, function and specific system operation shall be discussed at the meeting. A proposed meeting agenda shall be prepared by the security equipment contractor and submitted for review at least 2 weeks prior to the date of the meeting.

2. The security equipment contractor shall prepare a detailed report summarizing all software design and function criteria (based on the contract documents and direction provided in the preliminary meeting) to be delivered to the Architect/Engineer and Owner no later than three (3) weeks from the date of the preliminary meeting. The Architect/Engineer and Owner shall review this document and provide specific comments to
be implemented into the system design. The custom software that runs the security control system shall be designed specifically from this document.

3. Based on the preliminary meeting, the Division 17 Contractor shall develop the control and display software. The complete set of control screens shall be submitted as shop drawings on both paper prints and electronic files, to be loaded on the demo terminal delivered to the Engineer. If necessary, shop drawings shall be resubmitted until approved.

4. Any changes or modifications to the system resulting from the shop drawings shall be incorporated into the system and demonstrated at a meeting to finalize the system.

5. Any modifications to the system resulting from the meeting will be incorporated and demonstrated at the factory testing.

D. Factory Testing:

1. The Division 17 Contractor shall bear the cost of travel and subsistence for an Owner's representative and the Engineer to witness factory testing of the touchscreen control and monitoring system assembled in the factory. The Contractor shall give written notice that the system is ready to be tested a minimum of 14 days prior to testing, and testing should occur a minimum 4 months prior to the scheduled completion date for the project.

2. All equipment cabinets, control panels, touchscreen control terminals, CCTV equipment, card access equipment, etc. must be fully assembled, integrated and programmed for demonstration at the factory test.

3. The factory testing, at a minimum should demonstrate the following.

   a. The operation and control of at least 3 of each type device. For door control and monitoring, LED's and switch inputs at the I/O of the PLC will be adequate.

   b. The integration of all systems as specified herein.

   c. The integration of the security control systems with other systems (electrical, mechanical, fire alarm, elevator control, etc.).

1.7 GENERAL DESCRIPTION:

A. The Security Monitoring and Control System (SMCS) is an integrated monitoring and control system that includes touchscreen systems, control panels, and programmable logic controllers.

B. The SMCS interfaces directly with the following systems:

1. Door Control System (17150)

2. Programmable Logic Controllers (17160)
3. Closed Circuit Television System (17200)
4. Dedicated Intercom and General Paging Systems (17260)
5. Card Access System (17350)
6. Uninterruptible Power Systems (17900)

C. The SMCS shall be fully user programmable.

1.8 SMCS NETWORK:
A. The SMCS shall utilize a redundant Ethernet ring. Failure of a transmission path shall be recognized by the switches in less than 300 ms and the data routed to a redundant path.
B. Ethernet switches shall be powered from redundant power supplies.
C. Ethernet switches shall have alarm relay outputs to signal the loss of a port connection or power supply. Alarm contacts shall be monitored by the PLC. All alarms shall be reported on the touchscreen station in Central Control and logged on the data logger.

1.9 TOUCHSCREEN SYSTEM SOFTWARE:
A. The Graphical User Interface (touchscreen) system software shall be a non-proprietary, standard, off-the-shelf product of a company other than the Division 17 Contractor.
B. The software shall have national distribution and support.
C. The software shall run on a Microsoft Windows NT operating system.
D. The software shall be user programmable.

1.10 TOUCHSCREEN SYSTEM DESCRIPTION:
A. Touchscreen input/output (I/O) processors provide the human interface device at locations as shown on the drawings for security alarm monitoring and control of security devices including doors, cameras, and intercoms.
B. The touchscreen terminal consists of a 19" high-resolution LCD color video monitor integrated with a touchscreen transducer which is applied to the monitor surface. Touchscreens shall be freestanding or rack mounted in turrets as indicated on the drawings. Freestanding monitors shall have adjustable swivel bases secured to the casework. Coordinate casework dimensions and configurations with casework contractor.
C. Control Functions: The transducer is driven by a controller which is interfaced with a Pentium®-based personal computer. The touchscreen transducer controller feeds the X-Y coordinates of the finger contact with the monitor surface to the personal computer. The personal computer stores the graphic images consisting of icons (or targets), which perform the functions of typical push button
switches. When a particular icon (or target) is activated by touch, the personal computer sends the information to the Programmable Logic Controller (PLC). The PLC then performs logic functions (such as timing and interlocking) and activates the appropriate field devices (such as door locks or video switcher control) based on the touchscreen command.

D. Monitoring Functions: The PLC receives signals from the field devices, performs the necessary logic functions and routes the required information to the touchscreen personal computer for display on the touchscreen terminal. The PLC also downloads alarm data to the Information Management System for alarm data storage and report generation for applications where data is not received directly from the touchscreen operator terminal.

E. Screen Saver: The Touch Screen system shall have a means to prevent image burn-in on the CRT when the system control panel has been inactive for more than 5 minutes. Any change in status, intercom call-in, or touch of the screen should return the panel control graphics.

F. Log-In: Access to the touchscreen system shall be password protected and all operators shall log into the system. Touchscreen keypads shall utilize a "scramble" function so that the digits do not appear in the same location each time an operator logs into the system. All log-in/log-out activities shall be recorded on the system data logger. Terminals shall be limited to three consecutive invalid log-in attempts. After three failed attempts, the terminal shall be disabled and an alarm shall be generated at Master Control. Control of the screen must be returned from Master Control.

G. Mouse: Each touchscreen station shall also be equipped with a mouse to operate the terminal using an on-screen indicator rather than by using the touch of a finger. Selecting a program segment or option requires moving the display cursor to the appropriate screen location with the mouse and depressing one of the "pick" buttons.

H. Headsets: Each console shall be equipped with a headset jack and a matching headset to provide the panel speaker and microphone functions during periods of high ambient noise.

I. Control Transfer: Two methods of control/transfer shall be provided:

1. Substation Transfer: Activating the "Log Off" icon on the touchscreen monitors shall automatically transfer all control and indicating functions to the designated location. When logged off, the transferred terminal shall not be capable of performing control functions. Return to normal operation shall be accomplished by logging onto the system using the video keypad.

2. Control "Takeover": Activating the "Takeover" icon on the touchscreen monitor shall automatically transfer all control and indicating functions to the higher control location. No control functions can be initiated from the transferred substation. Return to normal substation operation must be accomplished from the higher control location. Master Control shall be capable of taking over every control panel.

J. Control Transfer Hierarchy:
1. CP-PC transfers to CP-MC.
2. CP-PL transfers to CP-MC.
3. CP-WC transfers to CP-MC.
4. CP-E transfers to CP-MC.
5. CP-W transfers to CP-MC.
6. CP-S transfers to CP-MC.
7. CP-N transfers to CP-MC.

K. UPS Alarms: UPS alarms shall send a text message to Master Control and be logged on the data logger.

L. Failure of any touchscreen or network PC shall not affect the operation of any other touchscreen station. Touchscreen control stations shall communicate directly with the PLC’s for control functions. PLC’s shall be located in each equipment room.

M. Touchscreen station configuration: Each touchscreen station shall be configured with all of the software and map files required for the station to function if relocated to another control console position. Each station shall be configured with an initiation routine that, when power is initially applied, takes the user to a screen that allows the user to select the current location of that station. When the location has been selected, the station will then access only those files required for the selected control location. This configuration allows any station to be used as a spare for any other station.

N. Screen touch operation: When the video terminal is being operated with the touchscreen, the on-screen indicator display for the mouse shall move to the finger target location when the screen is touched. Activation of the command shall occur when the finger is removed from the touchscreen.

O. The system shall utilize voice instructions for alerting the operator to alarm conditions and critical control sequences such as interlock, interlock override, emergency release, and other functions as directed by the Owner/User. There shall also be a voice annunciation ON/OFF switch to enable and disable the voice instructions.

P. Redundant Controls. For doors indicated in Table 17150-1 and intercoms indicated in Table 17260-1, or as indicated elsewhere in these specifications as being controlled from multiple locations, the control console that answers the intercom call first will seize control of the intercom link, the door, and any associated CCTV cameras. Control will remain with the respective control console until the intercom circuit is reset.

1.11 TOUCHSCREEN SYSTEM - SCREEN CONTROLS/MONITORING FUNCTIONS - GENERAL:

A. General: Control screens shall be comprised of switches and text fields. Switches shall designate the sensitive area for touch control and display an icon which provides a pictorial representation of the switch's function.

1. The housing control screens typically contain "select" icons that determine which door, cell or device will be operated by the "control"
switches. Anytime an incorrect cell or device is selected, touching another "select" icon shall reset the previously selected icon. If a "select" icon is touched but a "control" function is not executed within 6 seconds, the selected icon will reset.

2. All icon activations shall be annunciated with an audible tone and a color change of the icon. Audible tones shall only sound when an icon is activated, not when a blank portion of the screen is touched.

3. Each screen shall annunciate off-screen inputs, such as intercom calls and alarm events. The control terminal operator shall be notified of these events regardless of the screen that is currently displayed on the terminal.

B. Switching Types: Control functions may be effected by selecting a single switch or by selection of a sequence of switches as follows:

1. Single switch functions as a momentary type of switch.

2. Sequential switch - multiple switch inputs are required to effect a switching function. After selecting the first switch, the switch color and/or icon shall flash to designate that the switch was selected. Each switch in the sequence shall function as described above except when the last switch in the sequence is selected the controlled output or function shall be executed and all selected switches change state to represent the new state condition.

   If a switch in the sequence is not selected within three (3) seconds from the previous switch selection, all switches shall default to the steady state condition prior to the initiation of the switching sequence.

C. Functions: The touchscreens shall perform the functions described in the plans and specifications. Screen layouts, icons, colors, nomenclature and operator sequences shall be totally customized as directed by the Owner.

1.12 TOUCHSCREEN SYSTEM - SCREEN CONTROLS/MONITORING FUNCTIONS - SPECIFIC:

A. Specific Icon Control Functions: The drawings include representative control and monitoring screens for several console locations. Following is a description of the control and monitoring functions for the icons presented on those drawings. The following descriptions may not include all control and monitoring functions for all icons required for this project, but provides a representative sample to indicate the type and level of control and monitoring expected.

B. Door Control and Monitoring

1. SWING DOOR. When a swing door is secure, the icon shall be green with a closed padlock symbol. Touching the icon shall unlock the door and the icon shall change color to red with an open padlock symbol. When closed and locked, the icon shall change back to its secure indication.

2. SLIDING DOOR CONTROL. Sliding door control shall utilize either separate "Open", "Stop", and "Close" icons or a single icon that changes
state to perform these functions. The Owner shall dictate which switching method shall be used. Touching the "OPEN" icon shall open the door. Once the door position switch indicates that the door is open, the color of the icon shall change to red. Touching the "CLOSE" icon shall close the door. When the door position switch indicates that the door is secure, the icon shall change back to its secure (green) indication. Touching the "STOP" icon while the door is moving shall stop the door.

3. MONITORED DOOR. Door status shall be indicated on the touchscreens with a padlock symbol. The padlock shall be green and closed when the door is secure, and red and opened when the door is not secure.

4. CELL DOOR. To operate a cell door, the cell number icon shall be touched to select the door. The icon shall change color (from green to yellow) to indicate that the door has been selected. If the incorrect door is selected, touching another cell shall select the new position and reset the previous position. When the proper cell is highlighted, touching the "OPEN" icon shall open the door. Once the door position switch indicates that the door is open, the color of the icon shall change to red. Touching the "CLOSE" icon shall close the door. When the door position switch indicates that the door is secure, the icon shall change back to its secure (green) indication. Touching the "STOP" icon while the door is moving shall stop the door.

5. GROUP UNLOCK. (Not Used).

6. EMERGENCY RELEASE (at Master Control). Touching the "Emergency Release" icon on the Touchscreen shall switch the view to the primary emergency release screen, which shall contain the primary "Enable" switch, an emergency release "Cancel" switch, and switches to view the graphic maps of the facility. Touching the "Enable" switch within 3 seconds shall arm the system for emergency release and shall display an "Are You Sure?" prompt and "Yes" and "No" icons. Touching the "No" icon shall again display the primary emergency release screen and reset the 3-second response window. After touching the "Yes" icon, icons for all of the groups listed in Table 17150-3 and for all of the individual emergency release doors (Type "E") shall appear on the facility maps. A pulsing audible tone shall sound every 4 seconds while the system is armed. If the "Enable" switch is not pressed within 3 seconds, the function shall reset.

While armed, touching a group release switch, an emergency release door switch, or a normally controlled door release switch shall unlock the door or doors associated with that switch and the doors shall remain unlocked until reset. A "Reset" switch shall appear on each screen. Touching the "reset" switch and then an activated door or group switch shall reset the emergency release function for that door or group and the door(s) shall lock.

The emergency release function shall continue to be armed and the audible tone shall continue to sound until the operator returns to the primary emergency release screen and touches the emergency release
"Cancel" switch. The "Cancel" switch shall disarm the emergency release function, cancel the audible tone, and reset and lock all doors opened by the emergency release function.

7. INTERLOCK/INTERLOCK OVERRIDE. Anytime an attempt is made to open a door that is interlocked with an open door, an "Interlocked Door" message box shall be displayed on the screen that indicates the condition and instructs the operator that the "Interlock Override" function must be used to open the door. An "OK" icon shall also be displayed that will eliminate the message box when touched. The "Interlock Override" function allows two interlocked doors to be opened at the same time. Touching the "INTERLOCK OVERRIDE" icon shall display a message box stating "Executing this function may cause a breach of security. Are you sure you want to unlock an interlocked door?" "Yes" and "Cancel" icons shall be provided. Touching the "Cancel" icon shall eliminate the message box and return the screen to its normal state. Touching the "Yes" icon shall eliminate the message box and begin a 5-second time window during which an interlocked door may be opened. After opening a door or allowing the time window to expire, the screen shall return to its normal state.

C. Intercom Control

1. RESET. Touching this icon resets a selected remote intercom station.

2. INTERCOM. When the "call" button on a remote intercom station is pressed, the associated intercom icon on the video screen shall change color and flash, and an audible chime tone shall sound at 5-second intervals. Touching the intercom icon shall activate the audio channel to that remote station, cause the flashing intercom icon to illuminate continuously, and cause the tone to cease. The call-in tone shall not sound while an audio path is open. Once activated, the individual at the remote intercom station can talk to the control console master station hands free. The control console operator can also activate any remote intercom channel by touching an intercom icon. Touching the icon shall cause it to change to its activated color and switch any associated CCTV cameras to the designated intercom call-up monitor(s). The operator at the control console master station can either monitor the area or talk to the remote station by pressing the push-to-talk switch. Touching the remote intercom station icon a second time, selecting another remote intercom station, or touching the "RESET" icon shall disconnect the intercom channel and change the color of the remote intercom icon back to its inactivated color.

3. ENABLE/DISABLE. To prevent an inmate from placing nuisance calls from his intercom station, the intercom system shall be capable of ignoring calls from "disabled" intercom stations. To do this, the cell number icon shall be touched to select the cell. The cell number icon shall change color (to yellow) to indicate that the cell has been selected. When the proper cell is highlighted, touching the Intercom "ENABLE/DISABLE" icon shall make a slash appear through the intercom symbol, reset the cell selection, and prevent calls from being received from that intercom station. Repeating the sequence shall remove the slash from the intercom symbol and allow calls to be received from that intercom station.
4. NEXT CALL. This icon shall flash when an intercom call is received. Touching this icon when an intercom call is received shall switch the display to the screen showing the location of the call and automatically activate the intercom channel. At the completion of the conversation, touching the "NEXT CALL" icon when there is another call in queue waiting to be answered shall automatically disconnect the previous intercom channel, switch the screen to the next calling location, and activate the intercom channel. Touching the "NEXT CALL" icon when there are no calls in queue waiting to be answered shall disconnect the intercom channel. The "NEXT CALL" icon shall appear on each screen.

D. Alarm Functions

1. LOCATE ALARM. This icon shall flash when an alarm is received. Touching this icon when an alarm tone and message is received shall switch the display to a graphic map showing the location of the alarm. The alarming device shall flash in red and an audible alarm tone shall sound continuously. The "LOCATE ALARM" icon shall appear on each screen.

2. ALARM SILENCE. After an alarm has been identified on the graphic map, touching the "ALARM SILENCE" icon and then within 6 seconds touching the alarming device icon shall acknowledge the alarm by silencing the audible tone and cause the alarming device indication to stop flashing and be displayed as continuously red.

3. ALARM RESET. After an alarming device has been restored, touching the "ALARM RESET" icon and then within 6 seconds touching the alarming device icon shall reset the alarm and restore the icons to their inactivated states. Resetting an alarming device that has not been restored shall cause the alarm to be initiated again.

4. ALARM SHUNT. For malfunctioning devices, any acknowledged alarm (except for exterior exit door alarms) may be disabled by touching the "ALARM SHUNT" icon and then within 6 seconds touching the alarming device icon. The alarming device icon shall change color to orange.

5. ALARM QUEUE. Touching this icon shall switch the screen to a listing of all active, acknowledged and shunted alarms. The listing shall show the device type, number, and location description. Selecting an alarm from this screen shall automatically switch the display to a graphic map showing the location of the alarm.

E. Paging Functions

1. Selecting a paging icon connects the appropriate paging amplifiers to the intercom master. Selecting the push-to-talk enables the voice path. Selecting the intercom reset function will de-select the paging icon(s).

2. Multiple paging zones may be stacked by selecting/de-selecting the paging icons.

F. Miscellaneous Functions
1. PANEL DISABLE. Touching this icon will render the terminal inoperative. The screen shall be blank except for the words "PANEL DISABLED." An alarm shall be generated at Master Control and all control functions will be transferred to Master Control. The panel shall remain inoperative until control capabilities are returned by Master Control. When control is returned by Master Control, the "LOG-IN" screen shall be displayed at the remote terminal.

2. PANEL CONTROL. Touching the "PANEL CONTROL" icon shall switch the display to the "Panel Control" screen. This screen allows the operator to see the status of all control panels, take control of panels, and restore control of panels. The screen shall list each control panel, the status of each control panel (normal, transferred, disabled, or taken over) and display the appropriate control icons based upon a panel's status. Panels with a "normal" status or transferred to another location shall have a "TAKEOVER" icon displayed. Panels taken over by Master Control or "Disabled" by the control panel officer shall have a "RETURN CONTROL" icon displayed.

3. CONTROL TRANSFER/LOG OFF. Touching the "LOG OFF" icon will switch control of all panel functions to the designated transfer control station (see schedule in this section) and cause the "LOG-IN" screen to be displayed. Control can be returned to the panel by entering a valid log-in code; no action is required by the station to which the panel was transferred.

4. MAIN SCREEN. Touching this icon shall switch the display to the control console's primary control screen, which is typically the screen that shows the control points immediately surrounding the control room or console.

5. AREA ICONS. Touching one of these icons shall switch the display to the control screen for that area. If the area has been taken over, control functions may be executed. If the area has not been taken over, the area may only be viewed. The area icons for any areas containing active or acknowledged alarms shall be red; the area icons for any areas containing shunted alarms shall be orange.

6. MESSAGE BLOCK/MESSAGE BAR. Each screen shall contain a field to display text messages. This field shall announce alarms, intercom calls, and system messages associated with the control station.

7. CCTV. Touching this icon shall switch the display to a screen listing all of the CCTV camera and monitor numbers and a description of the camera and monitor locations available to be viewed at that location. Central Control shall be able to view all CCTV cameras in the facility.

8. CAMERA ICON. Touching a CCTV camera icon shall cause the video from that camera to be displayed on the designated "operator select" monitor. If a console does not have a designated "operator select" monitor, video shall be displayed on the intercom call monitor.

9. (Deleted).

10. DAYROOM/CELL GROUP LIGHTING. Touching this icon at the housing terminal will take the operator to a window with ON/OFF icons.
for the each dayroom lighting zone as well as ALL ON/OFF icons that control all the cells in each dayroom. This window shall include a PREVIOUS SCREEN icon which will return the operator to the previous operating screen.

11. CLEAN SCREEN. Touching this icon shall disable all of the screen touch zones to allow the screen to be cleaned. A TOUCH TO CLEAN THIS AREA OF THE SCREEN active icon shall be displayed in the upper left portion of the screen. When touched, a RETURN TO CONTROL icon shall be displayed in the lower left portion of the screen. When touched, the screen will change back to the previous control screen.

12. UTILITY CONTROL. Touching this icon shall display utility functions that are available to the operator. Those functions include as a minimum:
   a. The option to show/hide icons that are normally hidden when not in the alarm condition. Examples include monitored doors, UPS alarms, personal alarms, panic alarms, and CPU alarms.
   b. Clean screen function.
   c. Touchscreen calibration function. Function allows operator to calibrate the touchscreen to his/her specific touch patterns.
   d. The option to turn on or off the voice annunciation messages associated with specific alarms.

13. KEYSWITCH DISABLE/ENABLE. CP-WC shall have an icon that shall disable the holding cell keyswitches. In addition, activation of a Personal Alarm Receiver (PAR) in the booking area shall automatically disable holding cell keyswitches in the same area as the activated PAR. Selecting the keyswitch disable/enable icon on CP-WC shall enable the keyswitch function. Activating a keyswitch after the PAR is reset and prior to enabling the keyswitch function shall generate an alarm message on CP-WC "Keyswitches Disabled".
14. **CELL CONTROL ICON:** Each cell block housing touchscreen terminal shall have a cell control icon for each cell. Selecting this icon shall enable the cell functions for this cell. Cell functions include TV audio ON/OFF to disable the TV audio on the cell intercom, an intercom select icon, and a door unlock icon. The cell control icon shall display the cell door status and the TV audio status.

15. **GANG LISTEN:** For each cell block housing touchscreen and CP-WC provide a Gang Listen Icon. Selecting this icon and then selecting cell or holding cell icons gangs selected icons together for ganged listening. Again selecting the Gang Listen icon shall disconnect the ganged intercoms. The settings will be retained and displayed when the Gang Listen icon is again selected. Selecting the intercom Reset function while the Gang Listen icon is active will de-select all intercoms. Selecting the Next Call icon shall automatically de-activate the gang listen function.

16. **TASK GROUPS:** Intercoms reporting to Master Control shall be divided into task groups. Up to six task groups shall be provided. The utility screen shall provide access to the task groups for assignment each terminal. It shall be possible to assign any or all task groups to both terminals. Any task group not assigned on a single terminal shall be assigned to both terminals. The contractor shall meet with the owner and engineer to develop the task group schedules.

1.13 **TOUCHSCREEN SYSTEM - COLORS/ICONS:**

A. **Color Selection.**

1. Division 17 Contractor shall develop a color scheme for all video terminals which supports the monitoring and control functions with emphasis on ergonomic considerations.

2. Basic selection of colors shall provide that red shall designate non-secure, emergency or alarm functions, activities, or conditions. Yellow shall typically designate caution conditions such as intermediate steps in control sequences and "access" conditions. Green shall indicate a secure condition.

3. Color selections shall be approved by the Owner. Any reference to indicator or icon colors in these specifications or on the drawings may be modified by the Engineer or Owner during the screen development and review process.

B. **Icons.**

1. Division 17 Contractor shall develop icons which pictorially reflect the function related to a screen display. Icons shall change state to reflect a change of status for the display.

2. Final icon selection shall be approved by the Owner. Icons indicated on the drawings are for reference only to indicate function and may be modified as required.
3. Icons shall typically be no smaller than 3/4" square with no less than 1/4" spacing between icons.

C. Orientation of Screens:
1. The Division 17 contractor shall verify that all graphic screen displays are oriented correctly from the perspective of the control console operator for areas that are visible from the control console.
2. Owners shall designate the orientation of graphic screens not visible from the control console.

1.14 TOUCHSCREEN SYSTEM ALARM REPORTING FUNCTIONS:
A. The following alarms shall be reported on the Master Control touchscreen terminal:
1. Unauthorized exit (opening) of any door monitored/controlled by the Master Control terminal, or any station transferred to Master Control.
2. Door Held Open alarms
3. "Panel Disable" alarms from any control station.
4. Personal Alarms
5. UPS Alarms
6. Ethernet Switch Alarms
B. The following alarms shall be reported on the other touchscreen terminals:
1. Unauthorized exit (opening) of any door monitored/controlled by the control terminal. (Reports only on the terminal that has control over the door in alarm.).
2. Door Held Open alarms

1.15 CONTROL SYSTEM TRAINING STATION:
A. General:
1. To facilitate training of staff, a Control System Training Station shall be furnished and installed at the location as directed by the Owner. A single station shall be provided.
2. The system shall be a stand-alone portable unit. The graphics displayed on the operator's screen will be identical to the displays of the actual housing unit control stations. Inputs to the operator's display will be initiated from the instructor workstation. The trainer's station will be linked to the operator's station only by electronics, and the actions of the operator will be displayed electronically at the trainer's station. No actual mechanical devices will be controlled by this stand-alone system, but the electronic components of the operator's station will be identical to the equipment used in the housing units and could be used as replacement
components should one of the housing systems require repair. The training system programs will be maintained on both the facilities network server and on disk to allow reprogramming of the training station should it be used to replace a malfunctioning housing or wing control station. Only the operator station's monitors and CPU can be used as replacement equipment.

The trainer will be able to simulate most of the control and alarm conditions the operator will be required to manage. Input will be through the instructor's workstation and will utilize a windows menu type selection for the activation of any of control sequence. The display will record the operators input and will allow the trainer to interact with the operator. The station will also allow the trainer to input the names of inmates for display on the operators station. Movement selections made by the operator will be recorded at the trainers station.

3. Operator Touchscreen and Trainer Station - Screen Control/Monitoring Functions:

The control and monitoring functions which the system will emulate shall be identical as the functions specified in this section.

a. Operator Control/Monitoring Functions:

1) Clean Screen
2) Interlock Override
3) Emergency Open
4) Slider Door/Gate Control - Open, Close, and Stop
5) Swing Door - Open
6) Swing Door - Lock, Unlock
7) Intercom Select
8) Intercom Reset
9) Alarm/Monitor
10) Screen Select
11) Area Select
12) Housing Unit Emergency Open Status
13) Housing Unit Exit Status
14) Interlock Override Selected
15) CCTV Select

b. Trainer's Controls/Monitoring Activation Functions:
1) Function Selection Screen
2) Interlock Override Monitor
3) Emergency Open Monitor
4) Slider Door/Gate Control Monitor - Open, Close, and Stop
5) Swing Door Monitor - Open
6) Swing Door Monitor - Lock, Unlock
7) Intercom Call Select/Activation
8) Unauthorized Swing Door Open/Alarm Activation
9) Unauthorized Slider Door Open/Alarm Activation
10) Panic Alarm Activation
11) Area Selection Monitoring
12) Unauthorized Housing Unit Emergency Exit Door/Open Activation
13) System Trouble Activation PLC Unit
14) System Trouble Activation Local Area Network (LAN)
15) CCTV Trouble Activation

B. System Equipment Description:

1. The major items to be included as part of the Training Station shall be as follows:
   a. Operator Touchscreen Terminal and CPU
   b. Trainer Terminal and CPU
   c. Software
   d. Communications Network
   e. Cables

2. Equipment shall be installed on and within Contractor furnished roll carts as described herein.

3. Division 17 Contractor shall develop a detailed operational description and final system configuration diagrams for Owner/Architect approval prior to fabrication and programming release. A complete start-up and operating manual shall be developed and provided as a part of the
system. The manual shall provide instruction on the use of all of the systems functions. Manuals shall be provided in three ring hard cover.

C. The training station shall be provided to the Owner no later than 90 days prior to facility scheduled completion date.

PART 2 - PRODUCTS

2.1 TOUCHSCREEN SYSTEM:

A. Graphical User Interface Software: The touchscreen software shall have the following characteristics:
   1. Non-proprietary, standard, off-the-shelf product of a company other than the Division 17 Contractor.
   2. Nationally distributed.
   3. National software technical support.
   4. Based upon a Microsoft Windows NT operating system.
   5. Provided with documentation, software, and license to allow User Programming.
   6. Software shall be Wonderware Intouch, GE Fanuc Cimplicity, or approved equal.

B. CRT Monitor and Transducer: (Not Used)

C. LCD Monitor and Transducer: Shall be as defined in Section 17030 – Computers.

D. Touchscreen Computer:
   1. The touchscreen computer shall defined in Section 17030 – Computers.
   2. The operation of the touchscreen shall not depend on a keyboard. The keyboard shall be stowed and shall not be normally accessible from the console surface except as required for installation and maintenance purposes. System crashes shall re-boot automatically or require a single push button reset.

E. Touchscreen Training Unit: Approximately 3 months prior to the scheduled project completion date, the Contractor shall provide to the Owner a complete touchscreen training unit. The unit shall include a 19” color LCD touchscreen, CPU, mouse, operational programs, and portable rollcart to house the equipment.

F. Touchscreen Spare Unit: The Contractor shall provide to the Owner a complete touchscreen spare unit. The unit shall include a 19” LCD color touchscreen, CPU, mouse, and operational programs.
G. File Server/Data Logger:

1. The file server/data logger shall include, at a minimum, the following components and features:

   a. Minimum Pentium 4, 2.5 GHz processor.

   b. 1024 MB RAM capacity (minimum).

   c. Configured with a minimum of 512 MB of RAM. Provide additional RAM as necessary to optimize system performance.

   d. Minimum two (2) 36 GB, 7200 RPM hard drives in RAID 1 configuration with minimum 9 msec access time.

   e. Minimum 20 GB (40 GB compressed) tape back-up.

   f. 17", .24 mm dot pitch flat screen color monitor, non-glare.

   g. CPU and monitor shall be powered from a UPS.

   h. Configured with the LAN communications card and LAN file server software.

   i. Furnished with communications cards as required to receive data from the PLC.

   j. Keyboard with a mouse.

   k. Shall be located in the main equipment room.

   l. Shall contain the master clock, accurate to within 5 seconds/month.

   m. Printer - H.P. 4050 Series with toner, or approved equal.

H. Mouse: Each mouse shall be a serial device, ergonomic design, Microsoft Mouse (latest version), or approved equal and shall be equipped with a mouse pad.

I. Local Area Network (LAN) System:

1. Shall be Ethernet, configured in a redundant ring topology as indicated on the drawings.

2. All network communications between switches shall be via fiber optic cable systems. Communications from devices to each switch shall be via fiber optic cable or Category 5e cable as indicated on the drawings.

3. Network switches shall be defined in Section 17030 – Computers.

4. Spare switch. Provide one spare network switch to the Owner.

2.2 SYSTEM PERFORMANCE:
A. The systems shall be configured to effect the following system performance criteria:

1. **CONTROL**: Outputs to field devices such as door locks shall activate within 300 msec of the touchscreen or discrete control switch activation. Activation of any touchscreen icon or control switch shall provide a short audible tone.

2. **SCREEN UPDATES**: Video screen displays shall be refreshed within 300 msec. Screen graphics shall be stored in RAM to effect fast refresh with no moving parts. Storage on disk drive shall be for back-up purposes only.

3. **ANNUNCIATION**: The system shall annunciate alarms including touchscreen display, video graphic alarm display, and audible tone in 500 msec or less from the time the field device is activated. Alarm audibles shall be distinctly discernible from intercom call-in tones and touchscreen audible feedback tones.

4. Touchscreen terminals shall not be interdependent. The failure of one touchscreen terminal shall not affect the operation of other touchscreen terminals.

5. **SYSTEM FAULTS**: System faults or crashes shall not be capable of activating field outputs such as door locks during system failure or reboot.

### 2.3 WIRE AND CABLE

A. Category 5e wire and cable shall be furnished and installed in accordance with the manufacturer’s recommendations. If distances exceed manufacturer or industry recommended standards for Category 5e cables, then fiber optic cable and devices shall be utilized.

### 2.4 IMS MULTI-PORT SWITCH:

A. Multi-port switch shall permit controlling multiple computers with a single keyboard, mouse and monitor. Switch shall have the following features:

1. Controls up to four computers.

2. Video resolution 1600 x 1200 pixels at 65 Hz.

3. Compatible with all system hardware and software.

B. Switch shall be Belkin 4-Port OmniCube, or approved equal.

### 2.5 CONTROL CONSOLES:

A. Table 17170-1 located at the end of this Section is a schedule of the Control Consoles required for this project.
3.1 EXECUTION

A. Division 17 Subcontractor shall develop custom software as required to effect the functions of the system as dictated by the drawings and specifications.

B. Division 17 Subcontractor shall configure equipments with modules as required for the system to support the specific functions or applications.

C. Division 17 Subcontractor shall provide equipment cabinets for installation of the control equipments and cable terminations to the equipments.

D. Division 17 Subcontractor shall be responsible to ensure that the power source for the PLC and operator Touchscreen terminals is from a UPS unit.

E. Ensure cabinets are adequately ventilated for console mounted equipment. Provide exhaust fans in each console section.

F. The mounting of touchscreen and graphic display monitors shall effect a clean custom fit. Coordinate all casework requirements with casework contractor.

3.2 COMPLETION

A. Division 17 Subcontractor shall inspect and test the installation and operations of the entire system prior to initiating acceptance tests.
### TABLE 17170-1

**CONTROL CONSOLE SCHEDULE**

<table>
<thead>
<tr>
<th>SHEET NO.</th>
<th>CONSOLE DESIGNATION</th>
<th>DESCRIPTION</th>
<th>MONITOR SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE200</td>
<td>CP-PC</td>
<td>Property Control</td>
<td>19&quot;</td>
</tr>
<tr>
<td>SE201</td>
<td>CP-PL</td>
<td>Public Lobby</td>
<td>(Hard Panel – See 17300)</td>
</tr>
<tr>
<td>SE201</td>
<td>CP-WC</td>
<td>Watch Commander</td>
<td>19&quot;</td>
</tr>
<tr>
<td>SE202</td>
<td>CP-MC1</td>
<td>Master Control</td>
<td>19&quot;</td>
</tr>
<tr>
<td>SE202</td>
<td>CP-MC2</td>
<td>Master Control</td>
<td>19&quot;</td>
</tr>
<tr>
<td>SE203M</td>
<td>CP-E</td>
<td>East Block Control</td>
<td>19&quot;</td>
</tr>
<tr>
<td>SE203M</td>
<td>CP-W</td>
<td>West Block Control</td>
<td>19&quot;</td>
</tr>
<tr>
<td>SE203M</td>
<td>CP-N</td>
<td>North Block Control</td>
<td>19&quot;</td>
</tr>
<tr>
<td>SE203M</td>
<td>CP-S</td>
<td>South Block Control</td>
<td>19&quot;</td>
</tr>
</tbody>
</table>

*END OF SECTION*
SECTION 17200
CLOSED CIRCUIT TELEVISION SYSTEM

PART 1 - GENERAL

1.1 GENERAL CONDITIONS:

A. The Conditions of the Contract (General, Supplementary and other Conditions) and the General Requirements (Sections of Division 1) are hereby made a part of this Section.

1.2 WORK INCLUDED:

A. Included under this Section of the work shall be the furnishing, installation, connection, aiming and testing of the complete CCTV system including, but not limited to, cameras, housings, mounts, cables, monitors, switchers, and fiber optic systems.

1. Refer to the CCTV Schedule for information on cameras, lenses, mounting, and to Section 17260 for intercom control interface. Camera aim and exact mounting location are the responsibility of the Contractor.

2. CCTV monitors are to be installed in control consoles. Refer to control console elevations, details, and CCTV camera schedules at the end of this section for additional detail.

3. The lenses specified in Table 17200-1 shall be changed as required, at no cost, to provide the Owner with an acceptable field of view.

1.3 RELATED WORK SPECIFIED ELSEWHERE:

A. The work of this Section is related to the work of the following Sections:

1. General Provisions (17000)

2. Wire and Cable (17020)

3. Security Control and Monitoring System (17170)

1.4 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:

A. National Electrical Code

1.5 COOPERATION WITH OTHER TRADES:

A. The Contractor shall coordinate the work of this Section with that of other Sections as required to ensure that the entire work of this project will be carried out in an orderly, complete and coordinated fashion.
1.6 SUBMITTALS:

A. General: Submittals shall be made in accordance with the General Provisions (Section 17000) of these specifications.

B. Specific Requirements:

1. Submit catalog cuts for each piece of equipment, including but not limited to: cameras, lenses, enclosures, mounting brackets, monitors, switchers, fiber optic cable, fiber optic multiplexers, and towers.

2. Submit plan drawings showing location, mounting and viewing angle of each camera.

3. Submit point-to-point wiring diagram for CCTV system.

1.7 SYSTEM DESCRIPTION:

A. The closed circuit television system shall monitor spaces as shown on the drawings and function as shown on the CCTV functional schematic.

B. Video switchers shall be furnished and installed to provide automatic and manual selection of video cameras. Auto-select shall be initiated by acknowledging intercom call-in requests, acknowledging alarms or by inputs from other systems. Switching logic for auto selection of video may be a single logic control unit or may represent logic control signals generated from other systems such as the intercom system or door locking control system. Automatic video selection events are identified in Table 17200-1 or described herein. Manual video selection shall be incorporated into the Security Control and Monitoring System to provide for selection of a specific camera to be monitored by an operator. Where shown on the Drawings, control keypads shall also be provided for programming video displays and manual camera selection.

C. It shall be the responsibility of the Contractor to develop the control signals to effect the functional switching requirements defined in these specifications or referenced drawings.

D. All CCTV cameras shall be equipped with auto-iris lenses.

E. Video Switching:

1. Consoles are equipped with two intercom call-up monitors for movement control. These are designated with a single letter followed by a numerical designation (ex. A1, A2). The first monitor (ex. A1) shall view the secure side of the door. The second monitor (ex. A2) shall view the opposite side of the door. Cameras on both sides of a door will be called up and display simultaneously upon acknowledging an intercom call. If a door has only one CCTV camera viewing it, the monitor displaying the side without a camera shall be blank. Activating an intercom by touching the intercom icon on the touchscreen shall switch the associated cameras to these intercom call-up monitors.

F. Fiber Optic Systems: Where indicated on the drawings, exterior cameras shall be interfaced to fiber optic cable for transmission of the video to the video
switcher in the SEC. Individual fiber optic transmitters/transceivers shall be furnished and installed in interface boxes as shown on the drawings. Rack mounted receivers/transceivers shall be furnished and installed in the SEC.

1.8 SUBSTITUTIONS:

A. Any new systems to be provided and installed for LAPD facilities shall be compatible to the currently existing system to ensure an efficient standard operation. If the product submitted is different from the specified equipment, compatibility testing shall be performed by the Contractor on the proposed system and/or any components thereof from the point of connection to the transmission, processing, recording and display of the data signal to determine compatibility to the satisfaction of LAPD representative at no additional cost to the City. See also GR Section 01630 of the Project Specifications.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Equipment Schedule:

1. CCTV cameras and associated lenses and mounts shall be as described in the CCTV Schedule (Table 17200-1) located at the end of this Section. See equipment descriptions in these specifications for detailed equipment characteristics.

2. CCTV monitor designations, types and locations are described in Table 17200-2 located at the end of this Section. See equipment descriptions in these specifications for detailed equipment characteristics.

B. Mini Camera, Fixed - Type A.

1. Type A – Compact Dome, Surface Mounted, Interior or Exterior

Unit shall have the following characteristics or features:

a. Integral 1/3" or 1/4" CCD color camera with 450 line resolution, 1.2-lux (0.3 fc) minimum f1.2 light sensitivity, electronic iris. Provide low light version (0.04 Lux) for exterior applications.

b. Varifocal Auto-Iris or interchangeable fixed electronic iris lens (as specified in Table 17200-1)

c. Picture elements: 768H X 494V minimum.

d. 24 VAC operation

e. Line-lock module

f. High impact, hard-coated, polycarbonate tinted dome.

g. Manual pan/tilt adjustment of camera with 180 degrees rotation.

h. Hyper HAD Digital signal processing.
i. Video output: 1.0 V p-p composite adjustable.

j. Output impedance: 75 ohms.

k. Weatherproof, sealed, heavy-duty, anodized aluminum alloy enclosure with tamper-resistant screws. Finished installation must not allow an object or person to hang or grip the enclosure.

l. Temperature: Must operate within specifications over ambient range -48°F to +120°F.

m. S/N ratio of greater than 48dB.

n. Connectorized power and video leads.

o. Automatic gain control.


q. Power line phase locking with 180 deg. vertical phase adjustment.

r. Wall or ceiling surface mounted.

s. Where twisted pair cable is utilized, camera shall be provided with an integral twisted pair video transducer.

t. Minimum two year warrantee.

u. Unit shall be Pelco Model ICS-110

2. Mounts shall be provided as follows:


1) Shall accommodate standard micro-lenses autoiris varifocal (4mm to 8mm) or autoiris fixed (2.5mm to 25mm).

2) Shall be semiflush, ceiling mount for suspended ceilings or surface mount style for other locations.

3) Vandal resistant housing.

4) Weather tight.

5) Polycarbonate, optically correct dome.

6) Camera must be capable of being adjusted 180 degrees horizontally to achieve the intended view.

7) Outdoor units shall have a clear dome. Indoor units shall have a smoked dome.
8) Outdoor units shall be equipped with heaters.

9) Equipped with a custom sunshield when not protected from the sun by the building structure.

3. Options shall be provided as follows:
   a. Wall Surface Mount. Option – W
      1) Imager shall be rotated as required to allow direct surface mounting on the wall.
   b. Wall Pendant Attachment. Option - P.
      1) Shall be compatible with and made of the same materials and finish as the dome mount. The attachment shall allow the dome mount to be wall or pole mounted indoors or outdoors.
      2) The pendant attachment shall be the ICS100-PG as manufactured by Pelco or approved equal.

4. Lenses shall be provided as follows:
   a. Fixed Lenses: All fixed lenses shall be auto-iris, minimum f1.2 for narrow to mid-range FOV and f1.6 for wide FOV, with spot filter unless otherwise specified. Wide angle lenses shall be asymmetrical for distortion correction. Lenses shall be available in 2.5mm, 2.9mm, 3.6mm, 6.0mm, 8.0mm, and 12mm, focal lengths.
   b. Variable Focal Lenses: All variable focal lenses shall be auto-iris, minimum f1.4, with spot filter unless otherwise specified. Focal length shall be adjustable from 2.6mm to 6mm and 4mm to 9mm.

C. Pan/Tilt/Zoom Camera System - Type B.
   1. The system shall include a compact high speed unit with an integral receiver, drive unit, camera, and lens. The camera shall have the following characteristics:
      a. 1/4 inch CCD color/Black & White (Day/Night).
      b. Picture Elements: Minimum 768H x 494V picture elements.
      c. Sensitivity: 0.3 LUX at 1/60 sec (B/W)
      d. Resolution: More than 470 TV lines.
      e. Automatic gain control.
      f. Signal to noise: Min. 50dB.
g. Automatic white balance.

h. Power requirements: Less than 70 VA with heater.

i. Where twisted pair cable is utilized, camera shall be provided with an integral twisted pair video transducer.

j. Minimum two year warrantee.

2. The drive unit shall have the following features:

a. Manual adjust pan and tilt speed (not preset speed):
   1) Variable from 1 to 150 deg/sec pan.
   2) Variable from 1 to 40 deg/sec tilt.

b. 360 degree continuous rotation.

c. Shall be compatible with the matrix switcher and controller.

3. Zoom lens shall be provided as follows:

a. Aperture: At least f/1.4.

b. Focal Length: 3.6 to 82 mm (23X) minimum (optical)

c. Zoom Speed: Telephoto to Wide in less than 3.5 sec. (variable)

d. Autoiris.

4. Heaters and Blowers shall be provided on outdoor cameras.

a. Heaters and Blowers shall create an operating temperature range of -40 deg. C to +60 deg. C and an operating humidity range of 0 to 100% relative humidity.

5. Mounts shall be provided as follows:

   1) Polycarbonate, optically correct dome.
   2) Outdoor unit shall have a clear dome. Indoor unit shall have a smoked dome.

   1) Polycarbonate, optically correct dome.
   2) Outdoor unit shall have a clear dome. Indoor unit shall have a smoked dome.
   3) Steel housing with a paintable finish.
4) Outdoor unit shall be weather tight.

   1) Polycarbonate, optically correct dome.
   2) Outdoor unit shall have a clear dome. Indoor unit shall have a smoked dome.
   3) Steel housing with a paintable finish.
   4) Outdoor unit shall be weather tight.

   1) Polycarbonate, optically correct dome.
   2) Outdoor unit shall have a clear dome. Indoor unit shall have a smoked dome.
   3) Steel housing with a paintable finish.
   4) Shall be weather tight.
   5) Mounting arm shall have a load rating of 18kg minimum.
   6) Mounting arm shall be designed to allow equipment to be swiveled in toward the roof for maintenance access.
   7) Mounting arm shall be compatible with the pan tilt zoom camera system.

6. The Pan/Tilt/Zoom camera system shall be the Spectra III SE series as manufactured by Pelco or approved equal.

D. Safety Cell Camera with Infrared Illuminator- Type C.

1. Camera shall be compact with the following features:
   a. Sony CCD 1/3" high resolution monochromatic camera.
   b. Picture elements: 800H X 500V minimum.
   c. Horizontal resolution 420 lines minimum.
   d. Automatic backlight compensation.
   e. Automatic gain control.
   f. Minimum illumination 0.01 LUX at F1.2 (visible range)
   g. Video output: 1.0 V p-p composite adjustable.
   h. Output impedance: 75 ohms.
i. Lens mounting: Standard micro-lenses; autoiris varifocal (4mm to 8mm) or autoiris fixed (2.5mm to 25mm).

j. Power line phase locking with 180 deg. vertical phase adjustment.

k. S/N ratio of greater than 46 dB.

l. Temperature operating range of -10 deg. C to +40 deg. C.

m. Humidity operating range of 0 to 95% relative humidity.

n. Power requirements: Less than 5 watts.

o. Voltage requirements: 24 VAC Unit to be protected by fuse or circuit breaker.

p. Equipped with 24 LED 850nm infrared illuminators.

q. Where twisted pair cable is utilized, camera shall be provided with an integral twisted pair video transducer.

r. Minimum two year warrantee.

2. Enclosure shall be provided as follows:

a. Shall accommodate standard micro-lenses autoiris varifocal (4mm to 8mm) or autoiris fixed (2.5mm to 25mm).

b. Shall be conical shape to prevent persons from hanging on the unit or from hiding contraband on top of the unit.

c. Aluminum housing with a silver anodized finish.

d. Weather tight.

e. Polycarbonate, optically correct dome.

f. Camera must be capable of being adjusted 180 degrees horizontally to achieve the intended view.

g. The mount shall be the EX49N by Extreme CCTV or approved equal.

E. Fixed Day/Night Camera Type D

1. Camera shall be compact with the following features:

a. Sony CCD 1/3" high resolution, color, Day-Night, Digital Signal Processing (DSP) wide dynamic range camera.

b. Picture elements: 768H X 494V minimum.

c. Horizontal resolution 480 lines minimum (color).
d. Automatic backlight compensation.

e. Automatic gain control.

f. Sensitivity:
   Imager Illumination, 100 IRE (Full Video), 1/60 second shutter speed:

   Day mode: 0.05 foot candles or less.

   Night Mode: 0.005 foot candles or less.

Note: Product data must be submitted with imager illumination noted. Submittals with scene illumination only will be rejected. Written verification from the manufacturer shall be acceptable if the information is not on the published data sheet.

g. Video output: 1.0 V p-p composite adjustable.

h. Output impedance: 75 ohms.

i. Lens mounting: C and CS mount

j. Power line phase locking with 180 deg. vertical phase adjustment.

k. S/N ratio: 50dB minimum.

l. Temperature operating range of -10 deg. C to +50 deg. C.

m. Humidity operating range of 0 to 95% relative humidity.

n. Power requirements: Less than 10 watts.

o. Voltage requirements: 24 VAC. Unit shall be protected by fuse or circuit breaker.

2. Fixed Lenses:

a. All fixed lenses shall be variable-focal, 5 to 50mm, 1/3" format, auto-iris, f2.0 or better.

b. Enclosure

c. Enclosure shall be 6" or smaller dome, heavy duty enclosure, clear dome, outdoor rated. Provide with parapet mount.

F. Monitors:

1. Video Monitor - Type A:
   High resolution 8" diagonal LCD

   a. Type: Active Matrix LCD.
b. Viewable Picture Area: 7.9 measured diagonally.

c. Picture Elements: 1400H X 234V minimum.

d. Synchronization: internal.

e. Accept composite Video: 1.0V p-p

f. Impedance: 75 ohms

g. Distortion: Less than 3%.

h. Power consumption less than 30 watts at 120V AC.

i. Brightness: 300cd/m$^2$ minimum.

j. Dual rack mounted configuration.

k. Unit shall be Model V-R82P as manufactured by Marshall or approved equal.

2. Video Monitor - Type B:
High resolution, 15" color flat screen video monitor with the following characteristics or features.

a. Type: TFT LCD.

b. Viewable Picture Area: 38-cm (15 in) measured diagonally.

c. Resolution: 540 TV lines typical, 500 TV Lines minimum.

d. Synchronization: internal.

e. Accept composite Video: 1.0V p-p

f. Impedance: 75 ohms

g. Distortion: Less than 3%.

h. Power consumption less than 30 watts at 120V AC.

i. Temperature: Operate within specifications over ambient temperature range of 10º to 40ºC.

ej. Unit shall be Model PMCL15A as manufactured by Pelco or approved equal.

G. Switchers:

1. Video Switching System - Type A

a. Each video switching and control system shall be a standalone CPU/switcher having capability of user programming and interface with other switchers as indicated on the drawings. Unit
shall include as a minimum the following features and/or functions:

1) Camera Inputs - 1024 minimum capacity
2) Monitor Outputs - 256 minimum capacity
3) Remote Controllers - 64 minimum capacity
4) RS-232 CPU Interface
5) RS-232 Printer Port
6) Camera and Monitor Interface - BNC Connections
7) Looping Video Output
8) Rack Mount Capability
9) Date/Time/Titler
10) Sequential switching on up to 64 monitors.
11) Custom software as required to meet system functional requirements.
12) Rack Mount Remote Video Controllers. Shall provide manual camera to monitor selection, sequencing, and set-up controls. Controller shall be programmable to assign cameras and monitors to be controlled by a specific controller and to prioritize controller access for controlled functions
13) Switch shall be capable of performing the input (camera) to output (monitor) connections in less than 0.25 seconds from the instant that the switching signal is received from the programmable logic controller or other alarm input.

b. Manufacturer: Pelco CM9700 Series

H. Miscellaneous Components:

1. Coaxial Cable:
   a. Coaxial video cables shall have a copper center conductor and a copper shield providing a minimum 93% coverage.
   b. Nominal dc resistance shall not exceed 12 ohms/1000 ft for 59/U-type cables, 8 ohms/1000 ft for 6/U-type cables, and 4 ohms/1000 ft for 11/U-type cables.
   c. Nominal impedance shall be 75 ohms.
   d. Cable runs shall not exceed 1000 ft. for 59/U-type cables, 1500 ft. for 6/U-type cables, and 3000 ft for 11/U-type cables.
   e. All cables installed in exterior conduits shall be moisture proof, direct burial type cable.
f. Cables routed through grade-level slabs shall be rated for use in wet locations.

g. All cable shall be terminated.

h. Contractor shall have option of using two cables (one power, one video) or a single cable suitable for combined use.

2. Hardware:

a. Contractor shall furnish and install miscellaneous hardware and materials as required to effect a complete and functional system.

b. Three-piece, crimp-type BNC connectors that require separate crimps for the center conductor and the shield shall be used for the coaxial cable terminations. The connectors shall be matched to the wire type and the crimping tool shall be specifically designed for crimping the connector.

3. Camera Power Supplies: Provide Class 2 power supplies for cameras as required to comply with NEC Articles 725 and 800.

I. Camera Tester:

1. Provide one hand-held, battery operated, camera tester specially designed for optimizing camera performance.

2. The camera tester shall capable of measuring the following parameters:

   a. Synch pulse amplitude in IRE.

   b. Luminance level in IRE.

   c. Composite video signal level in IRE.

   d. Color burst level in IRE.

   e. Focus.

3. The camera tester shall be as manufactured by FM Systems, model CM-1 Camera Master.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. All equipment shall be installed per the requirements of the manufacturer.

B. All equipment shall be utilized for the purpose to which it was designed and manufactured.

C. CCTV camera lenses and camera locations indicated in the Construction Documents have been selected to provide the desired field of view. However, the drawings are schematic in nature and the camera locations shown are
approximate. Field adjustments shall be made as required to provide or improve the field of view of the area to be monitored. For cameras monitoring doors, the top of the field of view shall be the top of the door. Final alignment shall be the responsibility of this Contractor and any costs related to changing lenses to obtain the desired field of view shall be included in the Contractor's bid price. For housings that have a limited flexibility to align cameras, the contractor is encouraged to install a camera for viewing by the Owner's representative prior to securing the enclosure in its fixed position.

D. Extend power for heaters and blowers from SEC panels to all exterior camera enclosures.

E. Power supplies shall be furnished and installed for all equipment as required and supplies shall have performance characteristics compatible with the unique requirements of the equipment being supplied. Power supplies shall be loaded to a maximum of 60% of the rated power output. Power supply shall be Class 2 listed.

F. Amplifiers, combiners, remote switchers, power supplies, and other support equipments shall be installed in panels designated as "SEC" which shall be furnished and installed under this section of work.

G. Verify, prior to installation of ceiling mounted enclosures, that field of view of camera is not obstructed by breaks in ceiling height, lighting fixtures, fire alarm devices, mechanical fixtures or duct work, or plumbing fixtures. If such conflicts occur, coordinate with engineer prior to installation.

H. Video ground loop isolation transformers shall be installed as required.

I. Precautions shall be taken to ensure that MATV cable is not used for CCTV applications.

J. Contractor shall check the dimensions of all camera housing assemblies to ensure that the cameras, lenses, heaters, blowers, etc. do not exceed the maximum length for the housings. The contractor shall be responsible for any costs associated with installing or restocking any camera system components and purchasing and installing new components, where the assembly of the camera, lens, and other required components do not fit in the camera housing.

K. As applicable, all pan tilt zoom cameras shall automatically adjust, using set points, to view the intended target, when the cameras call-up switching signal is generated for door controls. Set points shall not be used when the camera is called-up for general surveillance.

L. Pan limits shall be set as directed by the owner's representative. Tilt limits shall be set from horizontal to 90 degrees below horizontal.

M. Provide adequate support for all ceiling mounted enclosures to satisfy the specific local seismic requirements.

N. Crimp on connectors shall be used for coaxial cable connectors. Twist on type connectors shall not be acceptable.
O. The date, time, and camera identification shall be displayed at the top of the video monitor.

P. Video call-up shall be effected within 300 milliseconds of receiving switching communications from the PLC.

3.2 CAMERA SETUP, TESTING, AND ADJUSTMENTS:

A. Using a camera tester as specified in this section, adjust each camera for optimum performance. Adjust synch pulse level, auto iris level, slope equalizer, back focus, and focus.

B. Camera back focus shall be set so cameras with manual or motorized zoom lenses remains focused when zooming all the way out or zooming all the way in.

C. All cameras shall be synchronized to prevent rolling when switched on each monitor and adjusted to optimize the video presentation at the display consoles.

D. Record all measurements and submit with test reports.

3.3 COMPLETION:

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat and orderly.

B. Testing: The completed system shall be tested prior to acceptance testing by the Owner or Owner’s representative.
**LEGEND FOR CCTV SCHEDULE - TABLE 17200-1**

**SHEET NUMBER:** Drawing sheet number on which the camera is shown

**CCTV NUMBER:** CCTV number as shown on the drawings

**TYPE:**
- Type A: Fixed Dome
- Type B: PTZ
  - Type B1: PTZ Flush Ceiling
  - Type B2: PTZ Pendant Wall
  - Type B3: PTZ Pendant Ceiling
  - Type B4: PTZ Parapet
- Type C: Cell Camera
- Type D: Exterior Fixed.

See Part 2 of the Specification above for additional information.

**OPTIONS:** The letter listed identifies the required options for the camera if applicable. See Part 2 of the Specification above for additional information.
- Type A Option C: Standard Semi-flush Ceiling Mount
- Type A Option W: Wall Surface Mount
- Type A Option P: Wall Pendant Mount

**FOV (Deg):** Recommended field of view for fixed lens. "VF" indicates a variable-focal length lens. "PH" indicates pinhole lens. "Z" indicates zoom lens.

**REMARKS:**
1. Indicated cameras installed on intercom pedestals.
<table>
<thead>
<tr>
<th>SHEET NO.</th>
<th>CAMERA NO.</th>
<th>TYPE</th>
<th>OPTION</th>
<th>FOV DEG</th>
<th>SEC#</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE100</td>
<td>601</td>
<td>A</td>
<td></td>
<td>90</td>
<td>SEC-B</td>
<td>1</td>
</tr>
<tr>
<td>SE100</td>
<td>602</td>
<td>A</td>
<td></td>
<td>90</td>
<td>SEC-B</td>
<td>1</td>
</tr>
<tr>
<td>SE100</td>
<td>603</td>
<td>A</td>
<td>P</td>
<td>63VF</td>
<td>SEC-B</td>
<td></td>
</tr>
<tr>
<td>SE100</td>
<td>603</td>
<td>A</td>
<td>P</td>
<td>63VF</td>
<td>SEC-B</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>001</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td>SEC-B</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>002</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td>SEC-B</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>003</td>
<td>A</td>
<td>W</td>
<td>46VF</td>
<td>SEC-B</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>004</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td>SEC-B</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>005</td>
<td>A</td>
<td>W</td>
<td>46VF</td>
<td>SEC-B</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>006</td>
<td>A</td>
<td>W</td>
<td>90</td>
<td>SEC-B</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>007</td>
<td>A</td>
<td>W</td>
<td>90</td>
<td>SEC-B</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>008</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td>SEC-B</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>009</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td>SEC-B</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>010</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td>SEC-B</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>011</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td>SEC-B</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>012</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td>SEC-B</td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>013</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td>SEC-B</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>101</td>
<td>A</td>
<td></td>
<td>90</td>
<td>SEC-1</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>102</td>
<td>A</td>
<td></td>
<td>90</td>
<td>SEC-1</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>103</td>
<td>A</td>
<td></td>
<td>90</td>
<td>SEC-1</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>104</td>
<td>A</td>
<td></td>
<td>90</td>
<td>SEC-1</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>105</td>
<td>A</td>
<td></td>
<td>90</td>
<td>SEC-1</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>106</td>
<td>A</td>
<td></td>
<td>46VF</td>
<td>SEC-1</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>107</td>
<td>A</td>
<td></td>
<td>46VF</td>
<td>SEC-1</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>108</td>
<td>A</td>
<td></td>
<td>46VF</td>
<td>SEC-1</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>109</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td>SEC-1</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>110</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td>SEC-1</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>111</td>
<td>A</td>
<td>P</td>
<td>34VF</td>
<td>SEC-1</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>112</td>
<td>A</td>
<td>P</td>
<td>34VF</td>
<td>SEC-1</td>
<td></td>
</tr>
</tbody>
</table>
### TABLE 17200-1

**CCTV SCHEDULE (CONTINUED)**

<table>
<thead>
<tr>
<th>SHEET NO.</th>
<th>CAMERA NO.</th>
<th>TYPE</th>
<th>OPTION</th>
<th>FOV DEG</th>
<th>SEC#</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE201</td>
<td>113</td>
<td>A</td>
<td></td>
<td>34VF</td>
<td>SEC-1</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>114</td>
<td>A</td>
<td></td>
<td>34VF</td>
<td>SEC-1</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>115</td>
<td>A</td>
<td></td>
<td>34VF</td>
<td>SEC-1</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>116</td>
<td>A</td>
<td></td>
<td>46VF</td>
<td>SEC-1</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>117</td>
<td>A</td>
<td></td>
<td>34VF</td>
<td>SEC-1</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>118</td>
<td>A</td>
<td></td>
<td>34VF</td>
<td>SEC-1</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>119</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td>SEC-1</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>120</td>
<td>A</td>
<td></td>
<td>46VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>121</td>
<td>A</td>
<td></td>
<td>90</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>122</td>
<td>A</td>
<td></td>
<td>46VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>123</td>
<td>A</td>
<td></td>
<td>46VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>124</td>
<td>A</td>
<td></td>
<td>46VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>125</td>
<td>A</td>
<td></td>
<td>34VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>126</td>
<td>A</td>
<td></td>
<td>90</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>127</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>128</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>129</td>
<td>A</td>
<td></td>
<td>34VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>130</td>
<td>A</td>
<td></td>
<td>34VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>131</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>132</td>
<td>A</td>
<td>W</td>
<td>90</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>133</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>134</td>
<td>A</td>
<td></td>
<td>90</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>135</td>
<td>A</td>
<td></td>
<td>46VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>136</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>137</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>138</td>
<td>A</td>
<td></td>
<td>36VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>139</td>
<td>A</td>
<td></td>
<td>21</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>140</td>
<td>A</td>
<td></td>
<td>21</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>141</td>
<td>A</td>
<td></td>
<td>46VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>142</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SHEET NO.</td>
<td>CAMERA NO.</td>
<td>TYPE</td>
<td>OPTION</td>
<td>FOV DEG</td>
<td>SEC#</td>
<td>REMARKS</td>
</tr>
<tr>
<td>-----------</td>
<td>------------</td>
<td>------</td>
<td>--------</td>
<td>---------</td>
<td>------</td>
<td>---------</td>
</tr>
<tr>
<td>SE201</td>
<td>143</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>144</td>
<td>A</td>
<td>P</td>
<td>63VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>145</td>
<td>A</td>
<td>P</td>
<td>63VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>146</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>147</td>
<td>A</td>
<td></td>
<td>21</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>148</td>
<td>D</td>
<td></td>
<td>90</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>149</td>
<td>D</td>
<td></td>
<td>90</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>150</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>151</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>152</td>
<td>B3</td>
<td>Zoom</td>
<td></td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>153</td>
<td>B3</td>
<td>Zoom</td>
<td></td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>154</td>
<td>A</td>
<td>P</td>
<td>46VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>155</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>156</td>
<td>A</td>
<td></td>
<td>90</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>201</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>202</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>203</td>
<td>A</td>
<td>W</td>
<td>90</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>204</td>
<td>A</td>
<td></td>
<td>34VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>205</td>
<td>A</td>
<td></td>
<td>90</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>206</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td>SEC-2</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>301</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>302</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>303</td>
<td>A</td>
<td>W</td>
<td>46VF</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>304</td>
<td>A</td>
<td>W</td>
<td>46VF</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>305</td>
<td>A</td>
<td>W</td>
<td>46VF</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>306</td>
<td>A</td>
<td>W</td>
<td>46VF</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>311</td>
<td>A</td>
<td>W</td>
<td>46VF</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>312</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>313</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>314</td>
<td>C</td>
<td></td>
<td>90</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SHEET NO.</td>
<td>CAMERA NO.</td>
<td>TYPE</td>
<td>OPTION</td>
<td>FOV DEG</td>
<td>SEC#</td>
<td>REMARKS</td>
</tr>
<tr>
<td>-----------</td>
<td>------------</td>
<td>------</td>
<td>--------</td>
<td>---------</td>
<td>------</td>
<td>---------</td>
</tr>
<tr>
<td>SE203</td>
<td>315</td>
<td>A</td>
<td>W</td>
<td>46VF</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>316</td>
<td>A</td>
<td>W</td>
<td>46VF</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>317</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>318</td>
<td>A</td>
<td>W</td>
<td>46VF</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>319</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>320</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>321</td>
<td>C</td>
<td></td>
<td>90</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>322</td>
<td>A</td>
<td>W</td>
<td>46VF</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>323</td>
<td>A</td>
<td>W</td>
<td>46VF</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>324</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>325</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>326</td>
<td>C</td>
<td></td>
<td>90</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>327</td>
<td>C</td>
<td></td>
<td>90</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>328</td>
<td>C</td>
<td></td>
<td>90</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>329</td>
<td>C</td>
<td></td>
<td>90</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>se203</td>
<td>330</td>
<td>A</td>
<td></td>
<td>90</td>
<td>SEC-3</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>401</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>402</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>403</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>404</td>
<td>A</td>
<td></td>
<td>46VF</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>405</td>
<td>A</td>
<td>W</td>
<td>46VF</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>406</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>408</td>
<td>A</td>
<td></td>
<td>90</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>409</td>
<td>A</td>
<td></td>
<td>46VF</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>410</td>
<td>A</td>
<td></td>
<td>46VF</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>411</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>412</td>
<td>A</td>
<td>W</td>
<td>46VF</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>413</td>
<td>A</td>
<td>W</td>
<td>46VF</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>414</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>415</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>416</td>
<td>A</td>
<td>W</td>
<td>46VF</td>
<td>SEC-4</td>
<td></td>
</tr>
</tbody>
</table>
TABLE 17200-1

CCTV SCHEDULE (CONTINUED)

<table>
<thead>
<tr>
<th>SHEET NO.</th>
<th>CAMERA NO.</th>
<th>TYPE</th>
<th>OPTION</th>
<th>FOV DEG</th>
<th>SEC#</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE203M</td>
<td>417</td>
<td>A</td>
<td>W</td>
<td>46VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>418</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>419</td>
<td>A</td>
<td>W</td>
<td>90</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>420</td>
<td>A</td>
<td>W</td>
<td>90</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>421</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>422</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>423</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>424</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>425</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>426</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>427</td>
<td>A</td>
<td></td>
<td>90</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>428</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>429</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>430</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>431</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>432</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>433</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>434</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>435</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>436</td>
<td>A</td>
<td></td>
<td>63VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>437</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>438</td>
<td>A</td>
<td>W</td>
<td>90</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>439</td>
<td>A</td>
<td>W</td>
<td>90</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>440</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>441</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>442</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>443</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>444</td>
<td>A</td>
<td>W</td>
<td>63VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>445</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SE203M</td>
<td>446</td>
<td>A</td>
<td>W</td>
<td>34VF</td>
<td></td>
<td>SEC-4</td>
</tr>
<tr>
<td>SHEET NO.</td>
<td>CAMERA NO.</td>
<td>TYPE</td>
<td>OPTION</td>
<td>FOV DEG</td>
<td>SEC#</td>
<td>REMARKS</td>
</tr>
<tr>
<td>-----------</td>
<td>------------</td>
<td>------</td>
<td>--------</td>
<td>---------</td>
<td>------</td>
<td>---------</td>
</tr>
<tr>
<td>SE203M</td>
<td>447</td>
<td>A W</td>
<td></td>
<td>63VF</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>448</td>
<td>A W</td>
<td></td>
<td>34VF</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>449</td>
<td>A W</td>
<td></td>
<td>34VF</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE204</td>
<td>500</td>
<td>A</td>
<td></td>
<td>90</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE205</td>
<td>501</td>
<td>B4</td>
<td></td>
<td>ZOOM</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE205</td>
<td>502</td>
<td>B4</td>
<td></td>
<td>ZOOM</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE205</td>
<td>503</td>
<td>B4</td>
<td></td>
<td>ZOOM</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE205</td>
<td>504</td>
<td>B4</td>
<td></td>
<td>ZOOM</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE205</td>
<td>505</td>
<td>D P</td>
<td></td>
<td>36VF</td>
<td>SEC-4</td>
<td></td>
</tr>
<tr>
<td>SE205</td>
<td>506</td>
<td>D P</td>
<td></td>
<td>36VF</td>
<td>SEC-4</td>
<td></td>
</tr>
</tbody>
</table>
## LEGEND FOR MONITOR SCHEDULE - TABLE 17200-2

<table>
<thead>
<tr>
<th>MONITOR DESIGNATION:</th>
<th>Monitor designation as referenced in Tables and on Control Console details in drawings</th>
</tr>
</thead>
<tbody>
<tr>
<td>MONITOR TYPE:</td>
<td>(See specifications for description of monitor types)</td>
</tr>
<tr>
<td></td>
<td>A - 8&quot; LCD color video monitor</td>
</tr>
<tr>
<td></td>
<td>B - 15&quot; LCD color video monitor</td>
</tr>
<tr>
<td>MONITOR LOCATION:</td>
<td>Control Console where noted CCTV monitor is located. See drawings for console locations.</td>
</tr>
</tbody>
</table>
## TABLE 17200-2

### MONITOR SCHEDULE

<table>
<thead>
<tr>
<th>MONITOR DESIGNATION</th>
<th>MONITOR TYPE</th>
<th>MONITOR LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>A</td>
<td>CP-MC1</td>
</tr>
<tr>
<td>2</td>
<td>A</td>
<td>CP-MC1</td>
</tr>
<tr>
<td>3</td>
<td>B</td>
<td>CP-MC1</td>
</tr>
<tr>
<td>4</td>
<td>B</td>
<td>CP-MC1</td>
</tr>
<tr>
<td>5</td>
<td>A</td>
<td>CP-MC2</td>
</tr>
<tr>
<td>6</td>
<td>A</td>
<td>CP-MC2</td>
</tr>
<tr>
<td>7</td>
<td>B</td>
<td>CP-MC2</td>
</tr>
<tr>
<td>8</td>
<td>B</td>
<td>CP-MC2</td>
</tr>
<tr>
<td>9</td>
<td>A</td>
<td>CP-WC</td>
</tr>
<tr>
<td>10</td>
<td>A</td>
<td>CP-WC</td>
</tr>
<tr>
<td>11</td>
<td>B</td>
<td>CP-WC</td>
</tr>
<tr>
<td>12</td>
<td>B</td>
<td>CP-WC</td>
</tr>
<tr>
<td>13</td>
<td>A</td>
<td>CP-E</td>
</tr>
<tr>
<td>14</td>
<td>A</td>
<td>CP-E</td>
</tr>
<tr>
<td>15</td>
<td>B</td>
<td>CP-E</td>
</tr>
<tr>
<td>16</td>
<td>A</td>
<td>CP-N</td>
</tr>
<tr>
<td>17</td>
<td>A</td>
<td>CP-N</td>
</tr>
<tr>
<td>18</td>
<td>B</td>
<td>CP-N</td>
</tr>
<tr>
<td>19</td>
<td>A</td>
<td>CP-W</td>
</tr>
<tr>
<td>20</td>
<td>A</td>
<td>CP-W</td>
</tr>
<tr>
<td>21</td>
<td>B</td>
<td>CP-W</td>
</tr>
<tr>
<td>22</td>
<td>A</td>
<td>CP-S</td>
</tr>
<tr>
<td>23</td>
<td>A</td>
<td>CP-S</td>
</tr>
<tr>
<td>24</td>
<td>B</td>
<td>CP-S</td>
</tr>
<tr>
<td>25</td>
<td>B</td>
<td>CP-S</td>
</tr>
<tr>
<td>26</td>
<td>B</td>
<td>CP-S</td>
</tr>
<tr>
<td>27</td>
<td>A</td>
<td>CP-PL</td>
</tr>
<tr>
<td>28</td>
<td>A</td>
<td>CP-PL</td>
</tr>
<tr>
<td>29</td>
<td>A</td>
<td>CP-PC</td>
</tr>
<tr>
<td>30</td>
<td>A</td>
<td>CP-PC</td>
</tr>
</tbody>
</table>
END OF SECTION
SECTION 17210
DIGITAL VIDEO RECORDING SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This section covers the digital video recording system as shown on the drawings or as required to support the systems defined in these specifications. The work under this section consists of furnishing materials and equipment, performing labor and services necessary for the installation of the digital video recording system required for the security electronics, communications, and fire alarm system.

B. Related Work Specified Elsewhere: Refer to all other Division 17 specification sections and drawings, and to the specifications and drawings under the General Construction Contract to ascertain the extent of work included.

1.2 SUBMITTALS

A. Since the Division 17 systems must be reviewed by the Engineer as a system, submittals shall be packaged in groups and shall be made in accordance with the General Provisions (Section 17000) of these specifications.

B. When making the submittal as required by Section 17000, include this additional information.

1. Product Data:

a. Total electrical load of the DVRS equipment installed in the central recording area. The calculations should include data from the records/servers, network switches, video displays and all other equipment. The total electrical load shall not exceed 9.0 KVA.

b. Total rack space required for the DVRS equipment in the central recording area. The product data shall be accompanied by rack elevations. The total rack space required shall not exceed the rack space allocated on the floor plans.

c. Total video storage calculations. The calculations shall include average file size, image capture rate, length of storage time, percent motion, and number of cameras.

d. A letter written by the manufacturer stating that all video images are encrypted and stored with a unique digital signature so that tampering with any of the pixels can be detected. The encryption technology shall ensure integrity of the video for legal evidence requirements. The encryption technology shall include a "chain of custody" so that the recorder from which the video originated can be identified. The manufacturer should consult their legal counsel prior to writing the letter.
C. At final completion, submit the following to the Engineer.

1. Training and training documentation:
   
   a. A training program shall be produced specifically for the installed system. The content of the training program shall allow facility personnel to become familiar with the operation and routine maintenance of their complete system. At a minimum training shall include:

      1) Advice on the limitations and trade-off's of the video storage capacities.

      2) Use and programming associated with the dry contact alarm inputs.

      3) Maintenance and care procedures of the complete system including the printers, network, recorders, and storage media.

      4) Set-up and programming procedures of the complete system including the modification of the motion detection settings, image capture rates, and recording schedule features.

      5) Video search, video retrieval, video transfer, video playback, and image printing procedures.

   2. See Section 17000 for additional requirements on training.

1.3 SYSTEM DESCRIPTION:

A. The Digital Video Recording System (DVRS) shall digitize and electronically record and playback analog color and black & white video.

   1. A loop-through video output shall be provided from the CCTV video switching system for each camera in the institution. The video from the loop-through video outputs shall be recorded by the DVRS. As shown on the plans, there shall be video monitors associated with CCTV controllers. These monitors will be used for high priority general surveillance by the Correctional Staff. The video that is displayed on these monitors shall also be recorded by the DVRS.

   2. The DVRS shall have sufficient disk capacity to record each video channel and maintain a rolling record of the video data for 30 days on a first in first out basis. The video capture rate shall be 3.75 frames per second. Recording for the video channels shall be configured with video motion detection so that new images are only recorded when motion is detected, for purposes of calculating recording and storage media requirements, the DVRS shall assume that motion will be detected on each video channel with 50% motion 7 AM to 7 PM and 30% motion 7 PM to 7 AM. Each image shall be stored with a minimum resolution of 640 x 240 pixels. The DVRS shall be equipped with sufficient disk capacity to accommodate an additional 25 percent increase in video storage capacity for every video channel in the institution.
3. Where shown on the drawings provide microphones connected to the DVRS for audio recording.

B. The DVRS shall be configured as multiple centrally located servers on a single network. The central recording area shall be the main equipment room. The system shall not use jukeboxes or any other automated mechanical disk changing technology.

1. The system shall be configured with sufficient servers and/or processor boards so that the video capture rate can be increased by 25 percent for every video channel in the institution.

2. The network shall incorporate multiple remote access stations, as shown on the plans, that provide the user real time viewing and playback capabilities.

3. The network shall utilize a switching hub.

4. The network shall include a single photo quality printer as shown on the plans. The printer shall be connected to the DVRS LAN so that all of the remote access stations on the network have access to the printer.

5. See Section 17900 for the DVRS UPS power requirements.

1.4 SUBSTITUTIONS:

A. Any new systems to be provided and installed for LAPD facilities shall be compatible to the currently existing system to ensure an efficient standard operation. If the product submitted is different from the specified equipment, compatibility testing shall be performed by the Contractor on the proposed system and/or any components thereof from the point of connection to the transmission, processing, recording and display of the data signal to determine compatibility to the satisfaction of LAPD representative at no additional cost to the City. See also GR Section 01630 of the Project Specifications.

PART 2 - PRODUCTS

2.1 DVRS EQUIPMENT DESCRIPTION:

A. Digital Recorder.

1. The Digital Recorder shall be multiple rack mounted computers. Each of the rack mounted computers shall be as defined in Section 17030 - Computers, with these additional physical features:

   a. All RAID hard drives shall be powered from redundant power supplies.

   b. All of the recorders installed in the central recording area may share a keyboard, mouse, and video monitor with the use of a KVM switch.

   c. Communications cards as required to communicate with the DVRS LAN.
d. Shall be mounted in the DVRS cabinets in the central recording area.

e. All composite video connection shall be BNC.

2. The Digital Recorder shall operate under the following parameters:

a. The recorder shall mildly compress video. Over compression shall not be acceptable.

1) There shall be no visible compression artifacts such as blocks, gray areas, raindrops, or edge distortion in the stored video.

2) The compression technique shall not prohibit the video images from being recorded at the specified frame rates, resolution, or image quality regardless of scene activity.

3) The compression technique shall not prohibit random access to any of the individual pre-recorded video images.

4) The compression technique shall not prohibit a video sequence from being stepped through backwards or forwards, one frame at a time, for the specified frame rates.

5) If the Digital Recorder use still-frame codecs JPEG, MJPEG, or Wavelet, the compression ratios shall not exceed 11:1. The average file size shall be 30 Kbytes.

6) If the Digital Recorder use conditional refresh codec MPEG or it variants H263, H320, etc., the compression ratios shall not exceed 33:1. The average file size shall be 7.5 Kbytes.

7) If the Digital Recorder use both a still-frame and conditional refresh codec, the compression ratios shall not exceed 33:1. The average file size shall be 7.5 Kbytes.

b. The recorder shall be equipped with a dry contact alarm input for every video input. These inputs shall be provided for future use by the Government.
1) The recorder shall have the capability of increasing the image capture rate to a user programmable value for any of the video inputs when the associated dry contact alarm input is received by the recorder. If the increased video capture rate exceeds the limitations of the system, the system shall automatically "load balance" to reduce the video capture rate for the other cameras on the system. When the associated dry contact alarm is cleared the load balancing shall be reversed and the system shall return to the image capture rate that was used prior to the alarm.

2) The recorder shall have the capability of pre and post event recording so that video is recorded at a user programmable capture rate for a user programmable time increment before and after an alarm event is triggered by one of the associated dry contact alarm input on the recorder. The system shall be supplied with enough memory to simultaneously capture and store 10 seconds of pre event video data on 35% of the systems video channels.

c. The recorder shall be capable of, but not necessarily set-up to, record individual cameras at a video image capture rate of 30 images per second regardless of the activity in the video scene. See Table 17220-1 to determine the initial image capture rates required at Substantial Completion.

d. From the centrally located recorder, the system operator shall be capable of transferring pre-recorded video to a CD-RW and / or 3.5 inch disk drive for purposes of archiving and / or remote incident investigation.

1) The resolution of the pre-recorded video images shall not be degraded from it's original stored state in the transfer process.

2) The pre-recorded video images shall be capable of being transferred as authenticated video and / or in a format such as AVI or EXE files that can be played on any computer.

3) The transfer of the pre-recorded data shall not degraded the recording or replay process of the system.

e. The DVRS shall be expandable by adding additional recorders and / or servers to the network.

f. The recorder shall have loss of video detection for each video input. The recorder shall monitor each of the recorders video inputs for the presence of video signals. The system shall enunciate the loss of video of any of the video inputs via a software message that "pops-up" on all of the Remote Access Stations.
3. The Digital Recorder shall incorporate the following software features:
   a. All images shall be encrypted and stored with a unique digital signature so that tampering with any of the pixels can be detected. The encryption technology shall ensure integrity of the video for legal evidence requirements. The encryption technology shall include a "chain of custody" so that the recorder from which the video originated can be identified.
   b. The recorder shall be capable of motion detection so that video images are only recorded when activity is present. This feature shall be capable of being activated or deactivated on a per-camera basis. The sensitivity of the motion detection shall be software user changeable on a per-camera basis. Portions of the video scene shall be capable of being masked out so that the system disregards activity in the masked out portion of the video scene. The masked out portion of the screen may be 100% of the screen to 0% of the screen.
   c. The recorder shall have the capability of defining the image capture rate of each camera on a per-camera basis. Decreasing the image capture rate on one camera shall not automatically increase the image capture rate on another camera.
   d. The recorder shall have the capability of recording video on a user-defined schedule. The recording schedule for each camera shall be user changeable on a per-camera basis. The schedule shall include time variables such as minutes, hours, days, date, and month. The schedule shall include recording variables such as image capture rates and motion detection settings.
   e. If power is disrupted to the recorder(s), or the recorder(s) are otherwise shut down, the recorder(s) shall automatically resume recording when the recorder(s) are rebooted. The system operator should only be required to re-start the operating system (OS).

4. The Digital Recorder shall be either the Verint-Loronix, or approved equal.

B. Remote Access Terminal.

1. The Remote Access Terminals shall be a desktop computer as defined in Section 17030 - Computers, with these additional features:
   a. Communications cards as required to communicate with the DVRS LAN.
   b. All composite video connections shall be BNC.
   c. A video card capable of displaying high quality motion video. The video card shall meet the following criteria:
      1) Fill Rate: 4.8 Billion AA Samples.
2) Vertices/sec: 136 Million/Sec.

3) Memory Bandwidth: 10.4GB/Sec.

4) Max Memory: 128MB.

5) Shall be Geforce4 Ti series or approved equal.

d. A single hard drive in the place of the RAID hard drives. Hard drive shall be at least the same size as one of the RAID hard drives specified in Section 17030.

e. Tape back-up can be omitted.

2. The Remote Access Terminals shall operate under the following parameters:

a. Each terminal shall be capable of viewing live and / or pre-recorded images simultaneously without degradation to the recording system. The system operator shall be capable of viewing from one to four video pictures from any of the video cameras in the institution simultaneously. The pictures shall be pre-recorded video and / or live video.

1) The system shall take no longer then five seconds from the time the system operator initiates the "play" command to the time the pre-recorded or live video images are displayed.

2) The system operator shall be capable of using the freeze frame and / or digital zoom feature for any or all of the four video pictures.

3) In any or all of the four video pictures the system operator shall be capable of setting up a guard tour of any of the video cameras in the institution. The dwell of the guard tour shall be as defined by the system operator. The guard tour shall be capable of accommodating a minimum of 160 cameras.

4) The system operator shall be capable of determining the date, time, and origin of the video images being displayed.

a) The date and time of the recorded scene shall be displayed when video is replayed in any of the four video pictures. If video is being viewed live the current date and time shall be displayed.

b) The camera title and number of the video camera associated with the video shall be displayed when video is replayed or viewed live in any of the four video pictures.
b. The operation of all terminals shall be independent. Each terminal shall be capable of viewing the same or different images simultaneously without system degradation. The system shall be capable of display up to nine live or replayed video images from the same server without system degradation.

c. From any of the remote access terminals the system operator shall be capable of transferring pre-recorded video to a CD-RW and / or 3.5 inch disk drive for purposes of archiving and / or remote incident investigation.

1) The pre-recorded video images shall be capable of being transferred as authenticated video and / or in a format such as AVI or EXE files that can be played on any computer.

2) The transfer of the pre-recorded data shall not degrade the recording or replay process of the system.

d. From the remote access terminals in the internal affairs area the system operator shall be capable of transferring pre-recorded video to a consumer grade VCR tape via a composite video output on the remote access terminal. For playback purposes the VCR shall be provided with a playback monitor located adjacent to the remote access terminal.

e. From any of the remote access terminals the system operator shall be capable of stepping forward or backward through pre-recorded video by use of user friendly controls.

f. From any of the remote access terminals the system operator shall be capable of printing photo quality images to the photo quality printer. The photo quality images shall include the time and date that the video image was recorded. The photo quality image shall also include the video camera number that is associated with the video image. The photo quality printer shall be located adjacent to one of the remote access terminals as shown on the plans.

3. The Remote Access Terminals shall incorporate the following software features:

a. User friendly operator controls. The controls shall be similar to those of a consumer grade VCR with play, freeze, stop, step forward, fast forward, step backward, and rewind.

b. From any of the remote access terminals the system operator shall be capable of searching through pre-recorded video by time and date, camera title, camera number, motion event, alarm event or any combination of these criteria.

c. At the remote access terminals the video pictures image quality shall be capable of being enhanced without altering the originally recorded and stored video.
1) Digital Zoom. The user shall be capable of 2x, 4x or 8x zoom factors when viewing stored video images.

2) Image sharpening, smoothing, brightness and contrast adjustment to enhance image presentation.

d. Access to each of the Remote Access Terminals shall be password protected so that the system administrator can prevent the system operator from performing certain functions.

1) From the remote access terminals the system operator shall NOT be capable of modifying the motion detection, image capture rate, or recording schedule features of any of the recorders video inputs. These features shall only be capable of being modified at the centrally located recorder.

C. Photo Quality Printer.

1. The Photo Quality Printer shall be a Photo Quality Printer as defined in Section 17030 - Computers.

D. DVRS Local Area Network (LAN) System:

1. Shall be Ethernet, configured as indicated on the drawings.

2. All network communications between switches and other devices shall be via a Category 5e cable system.

3. The network switch shall be a Local Area Network Switch as defined in Section 17030 - Computers.

E. Playback Monitor.

1. Shall have 181 channel tuning and 420 line resolution.

2. Shall be a Panasonic Model CT-1386VY or other product approved by the Engineer.

F. Ceiling Mounting Microphones:

1. Ceiling mounted microphones in line-up room shall be Cardioid condenser type with phantom power feature, Audio-Technica model ES961P or approved equal.

2. Provide pre-amps as required for connection to the DVRS.

G. Miscellaneous Hardware:

1. Furnish and install miscellaneous hardware and materials as required to effect a complete and functional system.

PART 3 - EXECUTION
3.1 INSTALLATION

A. All equipment shall be installed in keeping with the written recommendations of the manufacturer.

B. All equipment shall be utilized for the purpose to which it was designed and manufactured.

3.2 COMPLETION

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat and orderly.

B. Testing: The completed system shall be tested by the Contractor prior to the acceptance test.

1. The recording system shall be fully operational and fully functional for at least 20 days prior to the "Final Acceptance Test". The intent is to verify that the system has adequate storage capabilities to record the video for the specified duration with the specified overhead. It is acknowledged that this test will not simulate typical conditions of an active institution due to the absence of inmate activity in the living and program areas and the marginal light conditions that are typical of a construction site.

END OF SECTION
SECTION 17250
SITE INTERCOMMUNICATIONS SYSTEM

PART 1 - GENERAL

1.1 GENERAL CONDITIONS:
   A. See the Conditions of the Contract (General, Supplementary and Special Conditions) and the General Requirements (Division 1).

1.2 WORK INCLUDED:
   A. Division 17 shall furnish and install the site intercommunications system equipment for the entire facility.
   B. Equipment shall include site intercom exchange, cable distribution plant from the site intercom exchange, security and communications interface cabinet (SEC), master stations, page interface adapters, flush mounted programming panel, terminal strips/distribution frames, and station connectors.

1.3 WORK EXCLUDED:

1.4 RELATED WORK SPECIFIED ELSEWHERE:
   A. See Section 17000 for Security and Communications Systems General Provisions.
   B. See Section 17020 - Conductors
   C. See Section 17040 - Grounding and Surge Protection.

1.5 REFERENCED SPECIFICATIONS, MATERIALS, AND/OR CODES:
   A. Published specifications standards, tests, or recommended methods of trade, industry or government organizations apply to work in this section and as cited in Section 17000.
   B. Electronic Industry Association (EIA) Standards.

1.6 SUBMITTALS:
   A. Submittals shall be made in accordance with Section 17000.

1.7 SYSTEM DESCRIPTION
   A. The dedicated intercom system equipments shall interface with the Security Control and Monitoring System which provides the control functions for each system.
B. The Intercom System shall provide voice communication capability in “simplex”, “duplex” or “full duplex” mode selectable for each subscriber separately. The system shall also provide extensive group call, all call features and pre-programmable conferences and flexible conferences with an unlimited number of subscribers in each conference.

C. The System shall be microprocessor controlled and shall incorporate modular components. All circuitry and components shall be arranged on slide-in printed circuit boards using SMD-Technology. Each module shall have its own microprocessor and a fault in one module shall not affect the function of the whole system. The modules shall have diagnostic LED’s for maintenance and fault detection.

D. The system shall be able to utilize DSP (digital signal processor) technology for subscriber cards and stations (master stations and substations). It shall be possible to upgrade DSP system features by simply uploading a software upgrade without the need for hardware modifications. Field devices (stations) shall be upgradeable from any location within a networked system. Replacing of firmware chips shall not be acceptable.

E. Line supervision of each station shall be possible and line failure shall be reported to predefined stations. On selected stations (with built in DSP processor) microphone/speaker supervision shall be possible to guarantee station operation and shall immediately report any failure to preprogrammed station(s). Testing interval shall be programmable.

F. The switching of the voice signals shall be digital and the system shall be capable of supporting analog (4-wire) and/or digital (2-wire) stations. The internal processing of the voice signals shall be digital. The architecture of the Intercom System shall support digital networking of several locations by means of fiber optic, LAN/WAN/Ethernet, or 2-wire.

G. The digital networking shall provide at least 4 speech channels between centrals based on a 2Mbit data transmission rate and shall also support remote programming to any central from any central within the network.

H. Ethernet/LAN/WAN networking shall be accomplished with a plug-in networking card for direct access to a 10baseT Ethernet connection without the need of an external modem/interface. No additional programming device or software for configuration shall be required.

I. The system shall be expandable to 32 subscribers in increments of four. Each central shall provide 16 digital audio lines (total non-blocking system) and 12 analog audio lines depending on the selected central model. The system shall automatically assign appropriate speech channel (analog and/or digital) for each conversation.

J. In addition each central shall include one auxiliary external audio input and shall provide 90 group functions and 48 conference channels (radio conference).

1.8 SUBSTITUTIONS:
A. Any new systems to be provided and installed for LAPD facilities shall be compatible to the currently existing system to ensure an efficient standard operation. If the product submitted is different from the specified equipment, compatibility testing shall be performed by the Contractor on the proposed system and/or any components thereof from the point of connection to the transmission, processing, recording and display of the data signal to determine compatibility to the satisfaction of LAPD representative at no additional cost to the City. See also GR Section 01630 of the Project Specifications.

PART 2 - PRODUCTS

2.1 INTERCOM SERVER

A. The INTERCOM SERVER shall be fully digital, microprocessor based, modular design. All programming for each subscriber shall be possible from any central on the network or via RS-232 connection. In addition programming shall be possible utilizing a dial-up connection via modem (dial-up shall be password protected). The configuration of the subscriber features shall be programmed via PC and stored in the internal non-volatile memory of the central – no batteries shall be required to maintain configuration programming. All software required for programming the system shall be provided as part of the central at no extra cost.

B. Subscribers can be added at any time by using additional subscriber boards in the central. Each subscriber board provides 4 subscriber ports. It shall be possible to choose subscriber feature-level (A,B,C,D) by selecting the appropriate subscriber card. The higher-letter cards include features of the lower ones plus additional features. Therefore non-required features do not have to be purchased. All subscriber cards shall be interchangeable within the system. Feature upgrade of specific stations shall be possible by simply replacing the subscriber card with a higher-letter card. Subscriber card shall be changeable without any re-wiring required.

C. Each subscriber shall be capable of calling any other subscriber in the system unless restricted by programming. Unless otherwise specified clear hands-free duplex conversation shall be established upon connection. “Full-Open Duplex” conversations shall be possible hands-free and without the need of handsets or gooseneck-directional/noise canceling microphones utilizing DSP stations.

D. It shall be possible to assign a subscriber dialing numbers of 1-, 2-, 3- or 4 digits in length. The system shall allow programming of direct dialing functions for each subscriber individually.

E. Dialing the all call code shall initiate “All Calls”, announcements can be suspended by pressing the appropriate function key. It shall be possible to restrict via programming any station from initiating or receiving “All Calls”, “Group Calls” and/or “Conference Calls”.

F. Volume control shall be programmable for each type of call for each subscriber individually. Maximum volume level for call types individually shall be assigned to subscriber via programming. Volume may be adjusted on selected models of stations by pressing the “Up” or “Down” key.
G. Personal directory of all programmed stations and features available to a specific subscriber shall be displayed via high-resolution graphic LCD-screen (on master station).

H. A substation can be programmed to call a specific master station, substation or special features such as “All Call” or “Group Call”.

I. Station name and/or number shown on the alphanumeric display at a master station shall identify calls, call requests, emergency calls, alarms and status of inputs.

J. It shall be possible to restrict features and dialing sequences for any subscriber individually.

K. Privacy mode may be selected by simply dialing the appropriate code at the station. This feature may be enabled/disabled individually per subscriber via programming. When in privacy mode incoming calls shall be announced by special tone and flashing red LED. Pressing any button shall start conversation.

L. The system shall allow up to 2 conferences with unlimited numbers of subscribers in each group. Conference stations can be programmed as “listen only”.

M. The system shall allow up to 10 programmable group calls with unlimited numbers of subscribers in each group.

N. The system shall be equipped for a wide area network connection for interface to the agency’s Central Command Center. The system shall be programmed so that unanswered calls are automatically transferred to the Central Command Center intercom exchange.

O. System shall be Commend GE 200 series and shall be compatible with the City of LA’s GSD Central Command Center intercom exchange.

2.2 MASTER STATIONS

A. Shall provide a large graphic LCD-display with 8 lines x 14 characters or a single line 6-character alphanumeric display depending on selected model. The Master station shall incorporate ergonomic design being no larger than 3” x 10” x 3”.

B. All master stations shall have a “handset function” enabling user to switch from loudspeaking operation to handset mode by simply lifting station and placing to ear (exception: desktop models with gooseneck microphone).

C. Master station shall provide RJ-11 connector for standard CAT5-cabling connection and shall be available in analog (4-wire), digital (2-wire) and digital-DSP (2-wire) configuration.

D. Digital version shall interface to the appropriate version of subscriber card in the INTERCOM SERVER; connection shall be established by using 1 twisted pair cable.

E. Station shall incorporate high sensitive microphone to provide clear conversation from a maximum range of at least 20 ft.
F. The minimum frequency range shall be 200-7000Hz.

G. Unit shall be Commend EE 372 Series.

2.3 MISCELLANEOUS

A. Wire and Cable: Provide wire and cable of the type and size recommended by the equipment manufacturer. Unless prohibited by the manufacturer, all cable shall be minimum 20 gauge, single or multiple twisted pairs. All audio conductors shall be shielded.

B. Lightning Protection: All cables entering or leaving a building shall be protected with gas tube protection devices. These devices shall be installed in the appropriate enclosure and grounded to the grounding system.

C. In Master Control, the Division 17 Contractor shall furnish and install a printed site intercom and paging directory. The directory shall be provided with a clear, angled, lexiglass, slotted, free-standing frame constructed such that the directory can be removed, revised, and reinserted.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. Division 17 Contractor shall install the site intercommunications exchange at the locations shown on the plans. Exchange shall be installed in accordance with the manufacturers recommendations.

B. Division 17 Contractor shall furnish and install cabling between the exchange and the site intercom backboard on which the outside cable distribution plant is terminated. Cross connects shall be by the Division 17 Contractor on punchblocks equipped with gas tube protectors. Punchblocks shall be furnished and installed by the Division 17 Contractor.

C. Furnish and install site cable plant as described in these specifications and on the plans.

D. Furnish and install one spare cable from the central exchange to each SEC. The spare cable shall be terminated at the site intercom backboard and at each respective SEC and labeled at each end. Do not exceed NEC permissible fill of conduits provided.

3.2 SYSTEM PROGRAMMING:

A. Division 17 Contractor shall provide station and system programming in accordance with station functions defined by the Owner. Contractor shall submit request for Owner data a minimum of 90 days prior to programming. After a period of 60 days of facility operation, Division 17 Contractor shall modify the program to reflect Owner requested changes.

3.3 SPARES:

A. Furnish one (1) spare of each of the following Site Intercom System components:
1. Desk master station.

2. Exchange circuit boards (each type).

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL CONDITIONS:
A. See the Conditions of the Contract (General, Supplementary and Special Conditions) and the General Requirements (Division 1).

1.2 WORK INCLUDED:
A. Furnish all materials and labor necessary to complete the installation of a functional dedicated intercom system and general paging system as indicated on the drawings, specified herein or both. The work of this Section includes, but is not limited to:
   1. Dedicated intercom
   2. General paging system

1.3 RELATED WORK SPECIFIED ELSEWHERE:
A. The work of this Section is related to the work of the following Sections:
   1. General Provisions (17000)
   2. Wire and Cable (17020)
   3. Door Control Systems (17150)
   4. Security Monitoring and Control System (17170)

1.4 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:
A. National Electrical Code

1.5 COORDINATION WITH OTHER TRADES:
A. The Contractor shall coordinate the work of this Section with that of other Sections as required to ensure that the entire work of this project will be carried out in an orderly, complete and coordinated fashion.

1.6 SUBMITTALS:
A. General: Submittals shall be made in accordance with the General Provisions (Section 17000) of these specifications.
1.7 SYSTEM DESCRIPTION:

A. The dedicated intercom system equipments shall interface with the Security Control and Monitoring System which provides the control functions for each system.

B. Dedicated Intercom: The dedicated intercom system provides two-way communication between the master stations and the selected slave station.

1. Table 17260-1 is a schedule which identifies the intercom and/or paging stations associated with each of the control stations.

2. The Programmable Logic Controllers shall provide outputs to the video switcher via a data communications link to display the appropriate video camera on the control panel's monitor while an intercom link is connected.

Shown in Table 17200-1 is a column titled "Camera Function" which includes an intercom function. This column designates the specific CCTV camera which is to be switched to a monitor upon acknowledging a call-in request of the specified intercom station at the console.

3. Master-to-Slave Operation:

By depressing the appropriate STATION SELECT switch associated with the slave station being called, the operator may activate the channel to that station. Once depressed, that slave station can be monitored or the individual at that station can talk to the calling master hands free. When the STATION SELECT switch is initially depressed, its associated green CALL-IN INDICATOR shall light. Master station can talk to slave by the operator depressing and holding the PUSH-TO-TALK button.

Depressing the STATION SELECT switch at the calling master a second time shall disconnect the intercom channel and turn the associated green LED off.

4. Slave-to-Master Operation: In this situation, there is a call button adjacent to or in the same room as the slave intercom station.

By depressing the call button, the individual at the slave station initiates a call which shall cause the associated green CALL-IN indicator at the master station to flash and a tone to sound.

The master station may respond by depressing the appropriate STATION SELECT switch which shall cause the flashing CALL-IN indicator to illuminate continuously, cause the tone to cease and activate the intercom channel. At this point the individual at the slave station can talk to the master station.

The master station may talk to the slave station by depressing and holding the PUSH-TO-TALK button.

At completion of the conversation or monitoring, the operator at the master station shall depress the STATION SELECT switch a second
time which shall turn off the CALL-IN indicator and turn off the intercom
channel.

5. CCTV Monitors:

For conditions where two CCTV cameras are identified to be viewed
upon selection of the intercom, video shall be displayed on adjacent
movement control monitors. When a single camera is associated with
the intercom selection, CCTV video shall be displayed on one monitor
and the adjacent monitor shall be blank.

C. General Paging Intercom: The general paging intercom provides the
amplification, control, and termination capabilities required between specified
consoles and paging speakers (divided into zones as shown on the drawings
and as described in Tables 17260-1) for one-way voice paging. Access for
paging shall be from the operator touchscreen terminals as delineated in Table
17260-2, Paging Zones.

D. Intercom stations shall be transferred when control and monitoring is transferred
via the Security Monitoring and Control System.

E. Line-Up Room Intercom

1. A master/remote intercom system shall provide two-way communications
   between the Line-up room and the Viewing room.

2. The master intercom control station shall be wall mounted at a location
   as shown on the drawings. The master station shall provide the
   following controls and/or features:

   a. ON/OFF switch with LED to denote status.

   b. Volume control to control audio level in the viewing room of the
      received signal from the line-up room.

3. Hand microphone with cord and wall mount.

4. Ceiling mounted speakers and microphones shall be located in the line-
   up and viewing rooms as shown on the plans.

5. System shall be configured as shown on the "Line-Up Audio System
   Functional Diagram" and control panel detail titled "Line-Up Audio
   System - Wall Control Unit."

F. Inmate TV Audio:

1. The Dedicated Intercom System shall interface with the MATV system to
distribute audio from the selected channel through the intercom stations
located in the cells. Refer to the SE series drawings for an functional
schematic of this system.
2. A VCR shall be provided in each housing control room for each cell block. Dormitory spaces do not have the MATV/intercom audio interface.

3. The VCR RF output shall be distributed to the TV jacks in the associated cell block. The VCR audio output shall be connected to the intercom system so that the VCR audio is broadcast over the associated cell intercoms. Individual intercoms shall be capable of being connected to the master intercom while the remaining intercoms are still connected to the VCR audio source.

4. There shall be an ON/OFF function to disable the audio for each cell individually.

5. The associated touchscreen terminal shall have an icon for each cell block labeled “TV AUDIO” (ON/OFF) to enable and disable the VCR audio source.

G. Safety Cell Audio Monitoring:

1. The safety cells shall be provided with an audio monitoring system to allow the associated control room to monitor the sound in the safety cells. Operational requirements do not permit call buttons in these rooms.

2. The system shall consist of a speaker-microphone unit in the ceiling of each cell connected to the input of a mixer-amplifier to combine and amplify the audio signals from the cells. One to three safety cells are monitored by each control room.

3. The mixer-amplifier shall drive a speaker mounted on the ceiling of the associated control room. The speaker volume shall be controlled by a wall mounted volume control. The volume control shall have a minimum level setting so that normal speech in the cell shall be distinguishable.

4. The safety cell speaker-microphone shall be capable of connection to the intercom system. After the connection is reset, the station shall return the audio monitoring mode.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Dedicated Intercom Master Stations: Each dedicated intercom master station shall be equipped and wired as required to effect the functions as described herein. Each system shall include the following:

1. Programmable Logic Controller (PLC) based audio switching system to perform the functions described herein.

2. Custom signal and switching interfaces as required to execute the functions defined herein.
3. Equipments necessary to effect balanced audio switching.

4. All software and programming necessary to perform the functions described herein.

5. Custom interface to integrated door locking/PA intercom panels.

6. All power supplies and amplifiers required.

7. Each master intercom station shall consist of a remote intercom amplifier with separate microphone and speaker. Master intercom amplifiers shall be Dukane Model 9A1875 or approved equal. The amplifier shall accept microphone, speaker and push-to-talk inputs from remotely located control panel. The volume level of a monitor speaker connected to the amplifier shall be adjustable from the control panel. Unit shall utilize audio compander circuitry.

8. All consoles shall have a gooseneck type, microphone with cardioid pattern, permanently mounted to the top of the console panel. Microphone shall be as manufactured by Astatic Conneaut Technologies, Inc. Model 827-17 or approved equal.

9. All consoles shall have volume control for the intercom monitor speaker.

10. Master Control panels and Watch Commander panel (CP-MC1, CP-MC2, and CP-WC) shall be furnished with a foot operated push to talk switch which parallel the operation of the panel push to talk switch. The foot switch shall be as manufactured by Communications Company, Inc. Model FS-77. Footswitch cable and console base shall be configured with a plug-in jack so that the foot switch can be removed and stored.

11. All consoles shall be furnished with a headset with microphone and plug-in jack which shall override the built-in panel microphone. The jack shall be located below the counter top. The single ear headset with microphone shall be Telex Model PH-8 or approved equal.

B. Dedicated Intercom Slave Station:

1. Each slave station shall be flush mounted where shown on the drawings with push button call origination to the master station.

   a. Type A - Intercom station shall consist of a flush-mounted, horn type, water and flame resistant speaker/microphone with flared sound projection. The unit shall have a momentary call-in switch, protected by a weatherproof rubber boot, stainless steel tamperproof hardware, and a backbox. Unit shall be Atlas/Soundolier WPVT-F Series (flush mounted) or WPVT-S Series (surface mounted) or approved equal. Mount unit in intercom pedestal where indicated. Mount unit 48" AFF to centerline.

   
   Intercom Station, Flush Atlas/Soundolier (with call-in):

   WPVT-F
Intercom Station, Surface (with call-in):

- Atlas/Soundolier WPVT-S

Speaker/Microphone:

- High efficiency compression driver. Water and flame resistant.

Frequency Response:

- 400-4000 Hz

Sound Level:

- 109.5 dBA (4'/1 kHz, 15W)

Microphone Sensitivity:

- -26 dBm

Magnet:

- Alnico V

Speaker Transformer:

- 710-3092, 25/70V, 1/2, 1, 2, W, @25V plus 4W @, 70V

Call-in Switch:

- Momentary, push button 3A/300W AC, abuse and jamming resistant in call position.

Faceplate:

- 6” square

Backbox (surface):

- Atlas/Soundolier SE series

b. Type B - Intercom station shall consist of a flush-mounted, cone speaker type, water resistant speaker/microphone. The cone shall be protected against tampering, flame, and liquids by means of a metal acoustically transparent baffle. The unit shall have a vandal-proof momentary call-in switch, an 11 gauge stainless steel faceplate, stainless steel tamperproof hardware, and a backbox. Unit shall be Atlas Soundolier VPCS-3GPB or approved equal. Mount unit 48” AFF to centerline.

Speaker/Microphone:

- High efficiency cone driver. Water and flame resistant.

Microphone Sensitivity:

- -33 dBm

Speaker Transformer:

- 1/4W, 1/2W, 1W taps @ 25V

Call-in Switch:

- Momentary, push button 3A AC, abuse and jamming resistant in call position.
### Master Building Specification: Dedicated Intercom and General Paging System

| Faceplate: | 11 gauge stainless steel. 7½" x 5½". Speaker extends 2-1/4" behind faceplate. |
| Backbox: | Standard 3 gang. |
| c. Type C - Not Used |
| d. Type D - Call Push Button. Shall be wall mounted as shown on the plans and be incorporated into a single gang 11 gauge stainless steel face plate. The switch mechanism shall be a momentary pushbutton, 3A AC, abuse and jam resistant. Delta-Rex AV148-12L1 or approved equal. |
| e. Type E - Intercom station shall consist of a flush, ceiling-mounted, 8" speaker/microphone with a flush-mounted call-in switch. The call-in switch shall either have a narrow faceplate for installation in a door mullion or a standard single-gang faceplate. The faceplate shall be a minimum of 11 gauge Type 302 stainless steel with a satin finish. Call-in switch shall be equipped with contacts, as required, for CCTV activation or other functions. Call-in switch shall be mounted 48" AFF. Speaker shall be flush mounted with backbox as required for the ceiling type. Speaker baffle shall be vandal-proof, constructed of cast aluminum and stainless steel and shall be secured with tamper-proof screws. |
| Flush Vandal Proof | Atlas/Soundolier VP60-R |
| Housing: | 11 gauge, cast tempered aluminum. Tensile strength 44,000 P.S.I. Tamper proof screws. |
| Dimensions: | 12-3/4" dia. |
| Loudspeaker: | Atlas/Soundolier C5W Series |
| Backbox: | Atlas/Soundolier 96-8 |
| Remote Call-In Switch: | VPB-1 |
| Switch: | Momentary, SPST |
| Faceplate: | 11 gauge stainless steel with tamper-proof hardware |
| Backbox: | Standard single gang box |
| f. Type F – Paging speaker shall be 8" ceiling-mounted with backbox as required for ceiling type. Baffle shall be secured to backbox with tamperproof hardware. |
Loudspeaker: Atlas/Soundolier C5W, or approved equal.

Flush Backbox: Atlas/Soundolier 96-8, or approved equal.

Flush-Mounted Baffle Atlas/Soundolier VP60-R, or approved equal. Baffle to be constructed of 11 gauge, cast tempered aluminum with a tensile strength of 55,000 P.S.I.


Surface-Mounted Baffle Atlas/Soundolier VP161-R8, or approved equal.

g. TYPE G - Paging speaker shall be 8" ceiling-mounted with recessed, screw-type volume control and backbox as required for ceiling type. Baffle shall be secured to backbox with tamperproof hardware.

h. TYPE H - Same as Type F except configured as a speaker/microphone to allow two-way intercom. The speaker will be selected by the control room operator and the operator will talk using the microphone and push-to-talk switch on the control panel. The individual in the corridor can talk hands free.

i. TYPE I - Paging speaker shall be all metal, double re-entrant, waterproof loudspeaker for recessed installations. Speaker shall be rated at 15 watts RMS and be equipped with built-in transformer. Unit shall be Atlas Model APF-15T or approved equal. Baffle shall be of tamperproof, cast aluminum and steel construction. Baffle shall be Lowell FMS-SQ or approved equal.

Speaker: Atlas/Soundolier APF-15T

Power: 15 Watts (Continuous)
        20 Watts (Equalized)

Frequency: 475-14,000 Hz

Sound Level: 121 dB

Dispersion: 95°

Impedance (Ohms): 5000, 2500, 1300, 666, 333, 89, 45

Power Selector (Watts): 70V; .9, 1.8, 3.8, 7.5, 15
                      25V; .48, .94, 1.8, 7.5, 15
Dimensions: 5-5/8" diameter x 5-3/16" deep

Weight: 3-1/2 lbs.

Baffle: Lowell FMS-SQ

Backbox: 5-1/2" deep, minimum

j. TYPE J - NOT USED

k. TYPE K - Paging speaker shall be double re-entrant, waterproof loudspeaker for surface mounting. Speaker shall be rated at 30 watts RMS and be equipped with built-in transformer. Unit shall be Atlas/Soundolier Model AP-30T or approved equal. Baffle shall be of tamperproof, cast aluminum and steel construction. Baffle shall be Lowell FMS-SQ or approved equal.

Speaker: Atlas/Soundolier AP-30T

Power: 30 Watts (Continuous)

Frequency: 300-12,000 Hz

Sound Level: 126 dB

Dispersion: 60°

l. Type L – Safety Cell Intercom station shall consist of a ceiling-mounted, 8" speaker/microphone. Speaker shall be flush or surface mounted with backbox as required for the ceiling type. Speaker baffle shall be vandal-proof, constructed of cast aluminum and stainless steel and shall be secured with tamper-proof screws. Provide security caulk around device at the mounting surface. Speaker/microphone shall be used for connection to the audio monitoring system and the intercom system. When the station is not in the intercom mode, it shall be connected to the audio monitoring system.

Loudspeaker: Atlas/Soundolier C5W, or approved equal.

Flush Backbox: Atlas/Soundolier 96-8, or approved equal.

Flush-Mounted Baffle Atlas/Soundolier VP60-R, or approved equal. Baffle to be constructed of 11 gauge, cast tempered aluminum with a tensile strength of 55,000 P.S.I.

Surface-Mounted Baffle
Atlas/Soundolier VP161-R8, or approved equal.

C. General Paging System:

1. The paging system shall be configured into zones as described in Table 17260-2 and on the drawings. Each designated zone shall be accessed as described herein with muting functions.

2. Mixer Power Amplifiers:
   a. Each paging zone will be driven by a mixer power amplifier which shall have multiple mixer input ports and shall be equipped with input modules as required to interface with the intercom system.
   b. Power output shall be as required to support the zones specified herein. Amplifiers shall be loaded to no more than 75 percent of their rated power output.
   c. At rated power output, THD shall be less than 0.5% from 20Hz to 20KHz.
   d. Load impedance shall be 40.8 ohms for 70 volt line.
   e. Amplifier shall be 19" rack mount type.
   f. Amplifier shall be TOA 900 Series or approved equal. Modules shall be as required to interface with specified systems.

D. Line-Up Audio System:

1. Amplifiers shall be mixer/amplifiers having the following characteristics or features:
   a. Integrated mixer, power amplifier, and output transformers.
   b. 6 input mic/line mixer.
   c. Power rating: 35 watts
   d. Remote control of master level.
   e. 24 volt phantom power on each input channel.
   f. Integral output compressor.
   g. Preamp Out/Amp In jacks.
   h. Frequency Response - 20 Hz - 20 kHz
   i. Rack mount..
j. Power source: 120V - 6 Hz.

k. Amplifier shall be Biamp Systems MXA series or approved equal.

2. Graphic Equalizer shall provide 2/3 octave and 1/3 octave frequency control - 15 band (25 Hz - 16 kHz) having the following characteristics and/or features:
   a. Filters switchable for either $\pm 12$ dB or $\pm 6$ dB gain range.
   b. Front panel equalizer by-pass switch.
   c. Balanced inputs and outputs on rear panel.
   d. RFI filtering.
   e. Each filter shall have a 20 mm slide control with Center detent.
   f. Dual channel equalizer.
   g. Unit shall be Biamp Systems Model Micro EQ152 or approved equal.

3. Hand Microphone - Hand microphone at viewing control panel shall be Shure Model 514B with wall mount or approved equal.

4. Ceiling mounted microphones in line-up room shall be Cardioid condenser type with phantom power feature, Audio-Technica model ES961P or approved equal.

5. Speaker in line-up room shall be the paging Type A speaker with 8 ohm interface.

6. Speakers in the viewing room shall have the following characteristics and/or features:
   a. Mini loudspeaker system: Compact
   b. Power rating: 30 Watts
   c. Frequency response: 120 Hz - 20 kHz
   d. SPL: 84 dB
   e. Impedance: 84 dB
   f. Bracket mounted to ceiling
   g. Speakers shall be Atlas/Soundolier Model AS130 W or approved equal.
E. Line-Up Audio System:

1. Mixer-amplifier shall be same type as the paging system amplifier specified in this section.

2. Ceiling mounted safety cell speaker-microphone shall be Type L intercom station.

3. Ceiling mounted control room monitor speaker shall be Type F paging speaker.

4. Wall mounted volume control shall be a attenuator as described in this section.

F. Wire and Cable: Provide wire and cable of the type and size recommended by the equipment manufacturer. Unless prohibited by the manufacturer, all cable shall be minimum 20 gauge, single or multiple twisted pairs. All audio conductors shall be shielded.

G. Lightning Protection: All cables entering or leaving a building shall be protected with gas tube protection devices. These devices shall be installed in the appropriate enclosure and grounded to the grounding system.

H. Attenuators:

1. Wall mounted attenuators shall be auto-transformer type Soundolier AT-10 series with 1-1/2 dB/step increments and stop, or other product approved by the Contracting Officer. Attenuators shall be equipped with wall plates identical to plates furnished by Division 16 for receptacles and light switches.

I. MATV Audio Distribution Amplifiers:

1. Shall be same type as general paging mixing amplifiers using 25V line output.

2.2 SCHEDULES:

A. General:

1. The "Intercom Schedule" (Table 17260-1) delineates the intercom type required at each location and the associated control location(s) and requirements.

2. The "Paging Schedule" (Table 17260-2) delineates, for each paging zone, the zone description and zone access requirements as well as other specialized control requirements.

3. All Schedules and Tables are located at the end of this Section.
PART 3 - EXECUTION

3.1 EXECUTION

A. General:

1. Contractor shall verify that conduit shown on the plans is adequate to support the proposed system. If additional conduits are required or changes are required in size, Contractor shall make required changes. All changes in the conduit facilities shall be made at no additional cost to the Owner.

2. All equipments shall be rack mounted and installed in "SEC" cabinets to be furnished and installed under this Section of work.

3. Refer to drawings for placement of equipment and panels. Coordinate with other trades which impact installation of these systems. Refer to schematic diagrams and point schedules for system interconnections.

4. Cables shall be furnished and installed as required to support the systems as specified.

5. Contractor shall verify door swings and install intercom stations on strike side of door.

6. Provide gaskets and stainless steel hardware for all intercom station mounted outside.

3.2 COMPLETION:

A. General: Upon completion of the work remove excess debris, materials, equipment, apparatus, tools and the like and leave premises clean, neat and orderly.

B. Testing: Contractor shall test system completely prior to acceptance tests.

1. Acceptance tests shall be conducted by the Owner or Owner's representative to ensure compliance with plans and specifications.

2. The Owner shall establish the test date.
TABLE 17260-1
INTERCOM SCHEDULE

LEGEND

SHEET: Sheet where station is located.

STATION: Intercom stations are identified on drawings by door numbers with a lower case alpha character indicating specific station where two or more are shown per door.

TYPE: Intercom types are described under "MATERIALS" in this section of the specifications.

CONTROLS: See Table 17170-1 for control panel designations and locations.

SEC#: Security Equipment Cabinet to which device is routed. See drawings for locations.

Door Frame: Where indicated as “PB” coordinate installation on pushbutton in the door frame with Division 11 or Division 8 supplier.

REMARKS:
1. Install indicated intercom on pedestal. For vehicle entrance locations, include auxiliary call pushbutton at lower elevation to accommodate various vehicle heights. See drawings for placement.

2. Provide Type D pushbutton and utilize speaker from adjacent intercom when selecting audio connection.

3. Install indicated intercom in elevator car. Coordinate location with elevator contractor.

4. For indicated intercom, provide additional icon on CP-WC main screen labeled “Paper Pass” to provide quick access to this intercom.

5. For indicated segregation cells, provide intercom stations without call pushbuttons. Provide all, wiring, electronics, and programming to allow future connection by changing out the intercom station.

6. Indicated station is associated with Watch Commander window pass.

7. Video Visitation rooms in cell blocks to have an intercom on the exterior and an alternate call button on the interior that shall activate the same intercom call as the pushbutton on the exterior station.
TABLE 17260-1

INTERCOM SCHEDULE

<table>
<thead>
<tr>
<th>SHEET</th>
<th>STATION</th>
<th>TYPE</th>
<th>CONTROL</th>
<th>SEC#</th>
<th>FRAME</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE100</td>
<td>1SY01Aa</td>
<td>A</td>
<td>CP-MC</td>
<td>SEC-B</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>SE100</td>
<td>1SY01Ba</td>
<td>A</td>
<td>CP-MC</td>
<td>SEC-B</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>SE100</td>
<td>1SY01Bb</td>
<td>A</td>
<td>CP-MC</td>
<td>SEC-B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE100</td>
<td>1SY01Ca</td>
<td>A</td>
<td>CP-MC</td>
<td>SEC-B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE100</td>
<td>1SY01Cb</td>
<td>A</td>
<td>CP-MC</td>
<td>SEC-B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>B05Aa</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>B05Ab</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>B05Ba</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>B05Bb</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>BP01A</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>BP17</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>BP21A</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>BS01A</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>EL3-B</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE200</td>
<td>EL5-B</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1.01a</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1.01b</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1.05C</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B01Aa</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B01Ab</td>
<td>E</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td>PB</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B01Ba</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B01Bb</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B06</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B07</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B08</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B09</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B10</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B105Aa</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B105Ab</td>
<td>D</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B11</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEET</td>
<td>STATION</td>
<td>TYPE</td>
<td>CONTROL</td>
<td>SEC#</td>
<td>DOOR FRAME</td>
<td>REMARKS</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>------</td>
<td>---------</td>
<td>------</td>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>SE201</td>
<td>1B12</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B13</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B14</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B15</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B16</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B17</td>
<td>D</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B18</td>
<td>D</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B21a</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B21b</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1B22</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1J01a</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1J01b</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1J02</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1J03</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1L01A</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>SE201</td>
<td>1L04Aa</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1L04Ab</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1L04Ba</td>
<td>E</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td>PB</td>
</tr>
<tr>
<td>SE201</td>
<td>1L04Bb</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1L04Ca</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1L04Cb</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1M01a</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1M01b</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1PB04</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1PB05</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1PB06Aa</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1PB06Ab</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1PB06Ba</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1PB06Bb</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1PB06Bc</td>
<td>B</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>SE201</td>
<td>1PB06Ca</td>
<td>E</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td>PB</td>
</tr>
<tr>
<td>SHEET</td>
<td>STATION</td>
<td>TYPE</td>
<td>CONTROL</td>
<td>SEC#</td>
<td>DOOR FRAME</td>
<td>REMARKS</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>------</td>
<td>---------</td>
<td>------</td>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>SE201</td>
<td>1PB06Cb</td>
<td>E</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td>PB</td>
<td>4</td>
</tr>
<tr>
<td>SE201</td>
<td>1SR01</td>
<td>A</td>
<td>CP-WC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1T01Aa</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1T01Ab</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1T01Ba</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1T01Bb</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1T03</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1T04</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1T05</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1T12</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1T13</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1T14</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1VS01A</td>
<td>A</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1VS01Ba</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1VS01Bb</td>
<td>A</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>1VS01D</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>EL1</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>EL1-1</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>EL2</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>EL3</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>EL3-1</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>EL4</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>EL5</td>
<td>B</td>
<td>CP-PC</td>
<td>SEC-B</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>SE201</td>
<td>EL5-1</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>2.15Aa</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>2.15Ab</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>2.15Ba</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>2.15Bb</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>2MC01Aa</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>2MC01Ab</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>2MC01B</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEET</td>
<td>STATION</td>
<td>TYPE</td>
<td>CONTROL</td>
<td>SEC#</td>
<td>FRAME</td>
<td>REMARKS</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>------</td>
<td>---------</td>
<td>------</td>
<td>-------</td>
<td>---------</td>
</tr>
<tr>
<td>SE202</td>
<td>2SA04</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>EL1-2</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>EL3-2</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE202</td>
<td>EL5-2</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3.02a</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3.02b</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3.09</td>
<td>L</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3.10</td>
<td>L</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3ST01</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3ST02</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3ST03</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3ST04</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3ST05B</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>3ST06B</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>E100Aa</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>E100Ab</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>E100Ba</td>
<td>E</td>
<td>CP-E</td>
<td>SEC-3</td>
<td>PB</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>E100Bb</td>
<td>E</td>
<td>CP-E</td>
<td>SEC-3</td>
<td>PB</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>E100Ca</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>E100Cb</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>E100Da</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>E100Db</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>E100Ea</td>
<td>E</td>
<td>CP-E</td>
<td>SEC-3</td>
<td>PB</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>E100Eb</td>
<td>E</td>
<td>CP-E</td>
<td>SEC-3</td>
<td>PB</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>E101</td>
<td>L</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>E200</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EA101</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>SE203</td>
<td>EB101</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EB102</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EB103</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EB104</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEET</td>
<td>STATION</td>
<td>TYPE</td>
<td>CONTROL</td>
<td>SEC#</td>
<td>FRAME</td>
<td>REMARKS</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>------</td>
<td>---------</td>
<td>-------</td>
<td>-------</td>
<td>---------</td>
</tr>
<tr>
<td>SE203</td>
<td>EB105</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EB106</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EB107</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EB108</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EB111</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EC101</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EC102</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EC103</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EC104</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EC105</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EC106</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EC107</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EC108</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EC111</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>ED101</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EL1-1</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>EL1-3</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>N100Aa</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>N100Ab</td>
<td>E</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td>PB</td>
</tr>
<tr>
<td>SE203</td>
<td>N100Ba</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>N100Bb</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>N100Ca</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>N100Cb</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>N101</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA101</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA102</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA103</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA104</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA105</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA106</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA107</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### TABLE 17260-1

**INTERCOM SCHEDULE (CONTINUED)**

<table>
<thead>
<tr>
<th>SHEET</th>
<th>STATION</th>
<th>TYPE</th>
<th>CONTROL</th>
<th>SEC#</th>
<th>FRAME</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE203</td>
<td>NA108</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA109</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA110</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA111</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA112</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA113</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA114</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA115</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA116</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NA120</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>SE203</td>
<td>NB101</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB102</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB103</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB104</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB105</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB106</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB107</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB108</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB109</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB110</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB111</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB112</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB113</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB114</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB115</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB116</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>NB119</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>SE203</td>
<td>NB120</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-3</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>SE203</td>
<td>S100Aa</td>
<td>E</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td>PB</td>
</tr>
<tr>
<td>SE203</td>
<td>S100Ab</td>
<td>E</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td>PB</td>
</tr>
<tr>
<td>SE203</td>
<td>S100Ba</td>
<td>E</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEET</td>
<td>STATION</td>
<td>TYPE</td>
<td>CONTROL</td>
<td>SEC#</td>
<td>DOOR FRAME</td>
<td>REMARKS</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>------</td>
<td>---------</td>
<td>------</td>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>SE203</td>
<td>S100Bb</td>
<td>E</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S100Ca</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S100Cb</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S100Da</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S100Db</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S100Ea</td>
<td>E</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td>PB</td>
</tr>
<tr>
<td>SE203</td>
<td>S100Eb</td>
<td>E</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td>PB</td>
</tr>
<tr>
<td>SE203</td>
<td>S101</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S103A</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S104A</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>S200</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SA101</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>SE203</td>
<td>SB101</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>SE203</td>
<td>SB102</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB103</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB104</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB105</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB106</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB107</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB108</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB109</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB110</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB111</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB112</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB113</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB114</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB115</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB116</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SB117</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>SE203</td>
<td>SC101</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>SE203</td>
<td>SC102</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEET</td>
<td>STATION</td>
<td>TYPE</td>
<td>CONTROL</td>
<td>SEC#</td>
<td>FRAME</td>
<td>REMARKS</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>------</td>
<td>---------</td>
<td>------</td>
<td>-------</td>
<td>---------</td>
</tr>
<tr>
<td>SE203</td>
<td>SC103</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC104</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC105</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC106</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC107</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC108</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC109</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC110</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC111</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC112</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC113</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC114</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC115</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC116</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SC117</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>SD101</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>W100Aa</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>W100Ab</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>W100Ba</td>
<td>E</td>
<td>CP-W</td>
<td>SEC-3</td>
<td></td>
<td>PB</td>
</tr>
<tr>
<td>SE203</td>
<td>W100Bb</td>
<td>E</td>
<td>CP-W</td>
<td>SEC-3</td>
<td></td>
<td>PB</td>
</tr>
<tr>
<td>SE203</td>
<td>W100Ca</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>W100Cb</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>W100Da</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>W100Db</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>W100Ea</td>
<td>E</td>
<td>CP-W</td>
<td>SEC-3</td>
<td></td>
<td>PB</td>
</tr>
<tr>
<td>SE203</td>
<td>W100Eb</td>
<td>E</td>
<td>CP-W</td>
<td>SEC-3</td>
<td></td>
<td>PB</td>
</tr>
<tr>
<td>SE203</td>
<td>W101</td>
<td>L</td>
<td>CP-W</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>W200</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>WA101</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>WB101</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>WC101</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203</td>
<td>WD101</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEET</td>
<td>STATION</td>
<td>TYPE</td>
<td>CONTROL</td>
<td>SEC#</td>
<td>REMARKS</td>
<td></td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>------</td>
<td>---------</td>
<td>------</td>
<td>---------</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>3M02a</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>3M02b</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>3MST05B</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>3MST06B</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E201Aa</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E201Ab</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E201Ba</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E201Bb</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E201Ca</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E201Cb</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E202Aa</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E202Ab</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E202Ba</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E202Bb</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-3M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E203Aa</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E203Ab</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E203Ba</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>E203Bb</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EA201</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EB201</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EB202</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EB203</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EB204</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EB205</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EB206</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EB207</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EB208</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EB212</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EC201</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EC202</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EC203</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**TABLE 17260-1**

**INTERCOM SCHEDULE (CONTINUED)**
<table>
<thead>
<tr>
<th>SHEET</th>
<th>STATION</th>
<th>TYPE</th>
<th>CONTROL</th>
<th>SEC#</th>
<th>DOOR FRAME</th>
<th>REMARKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE203M</td>
<td>EC204</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EC205</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EC206</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EC207</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EC208</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EC212</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>ED201</td>
<td>B</td>
<td>CP-E</td>
<td>SEC-4</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>SE203M</td>
<td>EL1-4</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>EL3-4</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA201</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA202</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA203</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA204</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA205</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA206</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA207</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA208</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA209</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA210</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA211</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA212</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA213</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA214</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA215</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA216</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NA219</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>SE203M</td>
<td>NA220</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>SE203M</td>
<td>NB201</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB202</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB203</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB204</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEET</td>
<td>STATION</td>
<td>TYPE</td>
<td>CONTROL</td>
<td>SEC#</td>
<td>DOOR FRAME</td>
<td>REMARKS</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>------</td>
<td>---------</td>
<td>------</td>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>SE203M</td>
<td>NB205</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB206</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB207</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB208</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB209</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB210</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB211</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB212</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB213</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB214</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB215</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB216</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB217</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB218</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB219</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>NB220</td>
<td>B</td>
<td>CP-N</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>S201A</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>S202A</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SA201</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB201</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB202</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB203</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB204</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB205</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB206</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB207</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB208</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB209</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB210</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB211</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB212</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB213</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB214</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEET</td>
<td>STATION</td>
<td>TYPE</td>
<td>CONTROL</td>
<td>SEC#</td>
<td>DOOR FRAME</td>
<td>REMARKS</td>
</tr>
<tr>
<td>-------</td>
<td>---------</td>
<td>------</td>
<td>---------</td>
<td>------</td>
<td>------------</td>
<td>--------</td>
</tr>
<tr>
<td>SE203M</td>
<td>SB215</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB216</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SB216</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC201</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC202</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC203</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC204</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC205</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC206</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC207</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC208</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC209</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC210</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC211</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC212</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC213</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC214</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC215</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC216</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SC217</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>SD201</td>
<td>B</td>
<td>CP-S</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>W201Aa</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>W201Ab</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>W201Ba</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>W201Bb</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>W201Ca</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>W201Cb</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>W202Aa</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>W202Ab</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>W202Ba</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>W202Bb</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHEET</td>
<td>STATION</td>
<td>TYPE</td>
<td>CONTROL</td>
<td>SEC#</td>
<td>DOOR FRAME</td>
<td>REMARKS</td>
</tr>
<tr>
<td>--------</td>
<td>---------</td>
<td>------</td>
<td>---------</td>
<td>------</td>
<td>------------</td>
<td>---------</td>
</tr>
<tr>
<td>SE203M</td>
<td>W203Aa</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>W203Ab</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>W203Ba</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>W203Bb</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>WA201</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE203M</td>
<td>WB201</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-4</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>SE203M</td>
<td>WC201</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-4</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>SE203M</td>
<td>WD201</td>
<td>B</td>
<td>CP-W</td>
<td>SEC-4</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td>SE204</td>
<td>PST05a</td>
<td>B</td>
<td>CP-MC</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SE204</td>
<td>PST05b</td>
<td>A</td>
<td>CP-MC</td>
<td>SEC-4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### TABLE 17260-2

#### PAGING ZONES

<table>
<thead>
<tr>
<th>ZONE #</th>
<th>DESCRIPTION</th>
<th>CONTROL CONSOLES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>Public</td>
<td>CP-PL, CP-MC</td>
</tr>
<tr>
<td>1B</td>
<td>Booking</td>
<td>CP-WC, CP-MC</td>
</tr>
<tr>
<td>1C</td>
<td>Booking &amp; Release Staff</td>
<td>CP-WC, CP-MC</td>
</tr>
<tr>
<td>1D</td>
<td>Level 1 General</td>
<td>CP-MC, CP-MC</td>
</tr>
<tr>
<td>1E</td>
<td>Garage</td>
<td>CP-MC, CP-MC</td>
</tr>
<tr>
<td>1F</td>
<td>Medical</td>
<td>CP-WC, CP-MC</td>
</tr>
<tr>
<td>2A</td>
<td>Staff</td>
<td>CP-MC</td>
</tr>
<tr>
<td>2B</td>
<td>Level 2 General</td>
<td>CP-MC</td>
</tr>
<tr>
<td>3</td>
<td>Level 3 General</td>
<td>CP-MC</td>
</tr>
<tr>
<td>4A</td>
<td>Level 4 General</td>
<td>CP-MC</td>
</tr>
<tr>
<td>4EA</td>
<td>East Block A</td>
<td>CP-E, CP-MC</td>
</tr>
<tr>
<td>4EB</td>
<td>East Block B</td>
<td>CP-E, CP-MC</td>
</tr>
<tr>
<td>4EC</td>
<td>East Block C</td>
<td>CP-E, CP-MC</td>
</tr>
<tr>
<td>4ED</td>
<td>East Block D</td>
<td>CP-E, CP-MC</td>
</tr>
<tr>
<td>4NA</td>
<td>North Block A</td>
<td>CP-N, CP-MC</td>
</tr>
<tr>
<td>4NB</td>
<td>North Block B</td>
<td>CP-N, CP-MC</td>
</tr>
<tr>
<td>4NC</td>
<td>North Block C</td>
<td>CP-N, CP-MC</td>
</tr>
<tr>
<td>4ND</td>
<td>North Block D</td>
<td>CP-N, CP-MC</td>
</tr>
<tr>
<td>4SA</td>
<td>South Block A</td>
<td>CP-S, CP-MC</td>
</tr>
<tr>
<td>4SB</td>
<td>South Block B</td>
<td>CP-S, CP-MC</td>
</tr>
<tr>
<td>4SC</td>
<td>South Block C</td>
<td>CP-S, CP-MC</td>
</tr>
<tr>
<td>4SD</td>
<td>South Block D</td>
<td>CP-S, CP-MC</td>
</tr>
<tr>
<td>4WA</td>
<td>West Block A</td>
<td>CP-W, CP-MC</td>
</tr>
<tr>
<td>4WB</td>
<td>West Block B</td>
<td>CP-W, CP-MC</td>
</tr>
<tr>
<td>4WC</td>
<td>West Block C</td>
<td>CP-W, CP-MC</td>
</tr>
<tr>
<td>4WD</td>
<td>West Block D</td>
<td>CP-W, CP-MC</td>
</tr>
<tr>
<td>B</td>
<td>Basement General</td>
<td>CP-MC</td>
</tr>
<tr>
<td>PC</td>
<td>Property Control</td>
<td>CP-PC, CP-MC</td>
</tr>
</tbody>
</table>
Notes: 1. Provide “All Call” function on each panel to select all zones associated with the panel.

2. Provide paging screens on each panel to allow selection of multiple zones by toggling zones on and off into the group to be paged. “Reset All” icon to turn off all zones.

3. Provide an icon on CP-MC labelled “Detention” to automatically select Zone 2B and all Zones on levels 3 and 4.

4. Provide an icon on CP-MC labelled “Watch Commander” to automatically select Zones 1C, 1D, 1E, & 1F.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL CONDITIONS:

A. See the Conditions of the Contract (General, Supplementary and Special Conditions) and the General Requirements (Division 1).

1.2 WORK INCLUDED:

A. The Division 17 Contractor shall furnish, install, and be responsible for the following to effect a complete and functional security and communication system.

   1. Design and construct operator consoles and control panels as described or identified in these specifications and drawings.
   2. Coordinate the panel installation with other equipments located in the control console.
   3. Provide labor and materials.
   4. The Contractor shall be responsible for the interfacing and integration of all devices and systems with the work under the General Construction Contract and other security systems, such as but not limited to all hardware and locking systems, embedded conduit stub-ups, etc.

1.3 RELATED WORK SPECIFIED ELSEWHERE:

A. The work of this Section is related to the work of the following sections:

   1. General Provisions (17000)
   2. Wire and Cable (17020)
   3. Systems Description and Integrations (17100)
   4. All other Division 17 sections

1.4 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:

A. National Electrical Code
B. EIA Standards
C. ANSI Standards
D. NEMA Standards
1.5 COOPERATION WITH OTHER TRADES:

A. The Contractor shall coordinate the work of this Section with that of other sections as required to ensure that the entire work of this Project will be carried out in an orderly, complete and coordinated fashion.

1.6 SUBMITTALS:

A. General: Submittals shall be made in accordance with the General Provisions (Section 17000) of these specifications and shall include detailed dimensional drawings for each control panel.

1.7 SYSTEM DESCRIPTION:

A. Consoles - General:

1. Consoles shall be furnished and installed at locations as shown in Table 17170-1. Subpanels shall be as described on the drawings and shall be located in the console as shown.

2. Each console base section on which terminals or other cabled equipments are or may be located shall be equipped with cable grommets to facilitate the transition of cables from the desk top to the lower section.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Control Panels:

1. Except as noted otherwise on the drawings, all control panel dimensions shall conform to EIA standards. Panel widths may vary depending on control panel functions; however, EIA standard dimensions shall be used for panel fabrication.

2. Division 17 shall furnish and install pre-tapped (standard EIA) mounting supports in all millwork turrets.

3. Division 17 shall furnish and install blank plates and panel trim to effect a finished console installation.

4. All control panels shall be constructed with a cable and connector or cable terminations which will allow the panel to be readily removed and/or installed in the console.

5. Division 17 shall furnish and install terminal blocks and/or connectors in the lower section of the console to interconnect control panels with equipment cabinets. Panels and/or hardware required in the lower section of the console shall be furnished and installed by Division 17.

6. System equipments such as amplifiers, relay cabinets and control cabinets shall not be mounted in the lower section of the consoles but shall be mounted in cabinets located in equipment rooms.
7. Control panels shall have a uniform finish and appearance. Custom finishes shall be included where required to effect a uniform and/or color coordinated control panel. Colors shall be as selected by the Architect.

8. Switches-Membrane:
   a. Switches shall be normally open, momentary contact, push button membrane type. Switch shall be constructed of layers of insulating materials, conductive coatings and adhesives to form a completely sealed switch. Multiple contacts shall be integrated into the switch as required to effect the control functions.
   b. Switches shall be rated for 30 VDC, 100 ma. with contact material being silver-to-silver. Switch travel shall be .006" to .008" typical with an operating force of 4 to 8 oz with a faceplate installed.
   c. The switches shall be mounted beneath the surface of the graphic panel to ensure a continuous flush surface exposed to the operator.
   d. Switches shall be designed to incorporate indicator lamps as specified herein. Lamps shall backlight the switch.
   e. Switches shall be replaceable without destruction of the graphic overlay.
   f. Membrane switches shall effect positive actuation feedback to the operator in the form of an audible tone when pressed. The tone shall be 3.0 +/- 1.0 KHz for a duration of 0.20 +/- 0.05 seconds. The tone shall occur within 0.1 seconds of switch actuation.

9. Graphic Panels:
   a. Provide low voltage type control panels as shown and specified with LED's and operating switches. These switches shall be grouped in numerical order with the door number or function written under each switch. Symbols shall be used wherever possible to facilitate easier operation of control panel. Background colors over the switches shall be keyed to match those on the graphic panel. Colors over switches in control rooms without floor plan graphic panels shall be selected by the architect. Switches shall be provided with LED indicators within each switch, and the LED shall be installed identical to the method used in the graphic panel construction. Switches and lamps shall be recessed below the graphic film to ensure an easily cleaned and waterproof panel face as well as protection for LED's and switches.
   b. The working surface (face) of the graphic shall be of a textured and non-glare nature, non-yellowing, durable, scratch resistant, and made of synthetic polymers. All graphics shall be applied to the underside of the working surface. All areas, shapes or spots
that are to transmit light are to be translucent. The illumination of any indicator must be clearly visible from any angle in front of the working surface of the graphic in 100 foot candles of general room illumination.

c. All legends shall be photographically produced using architecturally approved font. The graphic film display of the area to be monitored shall be photo-graphically reproduced to a scale suitable to accommodate standard turret dimensions and annunciation requirements.

d. The working surface shall be adhered to a metallic substrate by a magnetic lamination process. The construction shall achieve 100% bonding without any creases, humps or blemishes on the film working surface. The film shall be accurately aligned on the substrate, and all holes in the substrate shall be accurately sized, so that the metallic substrate shall not be visible at any of the translucent openings.

10. Lamp indicators shall be equivalent to Hewlett-Packard #HLMP series, type T-1, 3 to 5 mm miniature ultra-bright LED. Components shall be rated for normal operation at 20 MA of current and shall be capable of handling current overloads of up to 70 MA without effecting life expectancy. Luminous intensity (IV) shall be between 100 to 300 mcd. The unit shall be sealed against moisture and dust and shall have minimum 45 degree viewing angle (on axis to ½ IV). The body and lens shall be constructed of high impact Lexan plastic. Lens shall be colored to identify the light color and shall be diffused.

11. LED indicators are to be installed in sockets mounted in the 3/16" metallic panel in the graphic systems annunciator panel and shall be easily replaceable with all wiring terminations made with sockets for replacement without disassembly of graphic annunciator panel.

12. The indicators shall be mounted behind the film to provide back lighting at door and device locations. No indicators, light sources, or other items will be permitted to protrude through the front graphic panel film surface, thus ensuring an easily cleaned and waterproof panel face as well as protection for lamps and switches.

13. For colors not realized by LED devices, or with lens filters, ultra-miniature lamps shall be furnished and installed. Lamps shall be Type T-1, rated for 24 volt operation and shall consume no more than 25 MA of current at 24 VDC and shall have a minimum rated operating life of 100,000 hours at 24 volts. The unit shall be sealed against moisture and dust and shall have a 180 degree viewing angle. The body and lens shall be constructed of high impact butyrate plastic.

14. Switches-Surface Mounted:

a. Switches shall be manual, surface mounted, push button and rocker-type, long-life switches. Switches shall be microswitch AML series or approved equal.
b. Switches shall be provided with LED's (or lamps where required) and LED covers where required. For switches furnished with lamps, lamps shall be replaceable from the switch front.

c. Switches shall be installed from the front of the control panel.

15. D.C. power supplies shall be furnished and installed as required for locking controls, indicators, and signal devices. Power supplies shall be rated at least 150 percent of demand load on the supply. Output voltage regulation shall be at least plus or minus 5% from no load to full load. Power supply shall be U.L. rated. Where required, multiple power supplies shall be provided.

B. Control Consoles:

1. Control consoles shall be furnished in each control area for the mounting of security electronics and communications equipment. Millwork base cabinets shall be provided by the millwork contractor in all areas.

2. Millwork CCTV monitor cabinets shall be provided by the Millwork Contractor where shown on the Drawings. Division 17 shall provide to the Millwork Contractor EIA-spaced mounting rails and a dual CCTV monitor rack-mount kit to use in fabricating these cabinets. Coordinate requirements with the Millwork Contractor.

3. Metal prefabricated turrets shall be provided by Division 17 as shown on the drawings. Custom paint finishes are required to match the color scheme of the surrounding millwork. Color to be designated and approved by the Architect.

   a. Desk turrets shall be constructed of 16 gauge steel with solid sides and fixed panel mounting angles in all openings with 0.281 diameter holes spaced in EIA pattern. Provide a hardware kit with each frame for each 3-1/2" of front slope panel space.

   b. Turrets shall be supplied with open bottom and securely attached to cabinet tops for secure mounting over access openings for wiring cables. Division 17 shall be responsible for cutting access and equipment clearance holes in millwork bases as necessary for the equipment supplied.

   c. Back panel shall be louvered. Front panel shall be left open for console control panel units.

   d. Turrets shall be manufactured by Equipto Electronics Corporation or approved equal.
PART 3 - EXECUTION

3.1 EXECUTION:

A. General:

1. Furnish and install all materials and equipment as required to construct control panels and consoles to support the requirements of these drawings and specifications.

2. Contractor shall coordinate installation of all equipment which is to be installed in console whether included in this section or under the General Construction Contract.

3. Contractor shall coordinate electrical requirements for equipment and review project electrical drawings to determine if electrical services are adequate to support the proposed systems. In the event additional electrical service is required the Contractor shall be responsible for obtaining the service or conduit facilities and the cost of these facilities shall be included in the base bid for these systems. Approval for additional services shall be submitted to the Architect for coordination purposes only.

4. Contractor shall furnish and install electrical power strips in console base section to accommodate console plug-in type equipment.

5. Contractor shall coordinate stub-ups with the Electrical Contractor.

3.2 COMPLETION:

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus tools and the like and leave the premises clean, neat and orderly.

B. Testing:

1. Contractor shall test system completely prior to acceptance tests.

2. Acceptance tests shall be conducted by the Owner or Owner's representative to ensure compliance with plans and specifications.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL CONDITIONS:
A. See the Conditions of the Contract (General, Supplementary and Special Conditions) and the General Requirements (Division 1).

1.2 WORK INCLUDED:
A. The Division 17 Contractor shall furnish labor, equipment, and materials for the following systems in this Section of the specification:
   3. Security controls, panels, CPU, terminals and software programs for completely integrated, on-line, real-time, self-contained, security management systems as shown on the plans and specified herein, achieving completely effective and fully operational detention and security monitoring and control systems.
B. The Contractor shall coordinate with the General Contractor and Electrical Contractor for sizing, location and installation of all conduit required to complete the installation of all equipment specified in this section.
C. The Contractor shall be responsible for interfacing and integrating all devices and systems with the General Contractor or Construction Manager and other security systems, such as but not limited to all hardware and locking systems.
D. This Section consists of furnishing and installing a card access system as part of the Security Monitoring and Control System to include the following:
   1. Card Sensors
   2. Remote Interfaces and Processors
E. The following system components are specified as part of the Security Monitoring and Control System:
   1. Data Storage Medium
   2. Operators Terminal
   3. Printer
   4. Annunciator Modules
1.3 RELATED WORK SPECIFIED ELSEWHERE:
A. The work of this Section is related to the work of the following sections:
   1. General Provisions (17000)
   2. Wire and Cable (17020)
   3. Security Monitoring and Control System (17170)

1.4 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:
A. National Electrical Code
B. EIA Standards

1.5 COOPERATION WITH OTHER TRADES:
A. The Contractor shall coordinate the work of this Section with that of other Sections as required to ensure that the entire work of this project will be carried out in an orderly, complete and coordinated fashion.

1.6 SUBMITTALS:
A. GENERAL: Submittals shall be made in accordance with the General Provisions (Section 17000) of these specifications.

1.7 SYSTEM DESCRIPTION:
A. Card Access System:
   1. The card access system shall provide a means to control access.
   2. Each system shall consist of sensor devices, status input devices, output control devices, control processor(s), interface modules, software and programming.
   3. Devices shall be located as shown on the drawings.
   4. Hardware and software to interface the card access system with the Security Monitoring and Control System.
   5. The operator terminal for programming the card access system security functions shall be located in Master Control. No other terminal shall be capable of entering or modifying the card access system.

1.8 SYSTEM OPERATION:
A. Each security management system provides the following functions:
   1. Access control via the use of card sensors
   2. Monitoring of door alarms
B. System activity and alarms are logged on the file server/data logger.

C. Presenting an authorized card to a card sensor shall shunt the alarm associated with the door position switch and activate the electric lock associated with the door or gate.

D. Push buttons may be used to allow exit from a space where a card sensor is required for entry. A press-to-exit command is generated which energizes the respective door or gate lock and shunts the alarm associated with the door position switch.

E. Alarms from card access doors shall be annunciated on the Master Control operator terminals.

F. Any door or alarm point may be placed in an "Access" mode to allow use of the door without generating alarms. "Access" may be accomplished via the Touchscreen at any time by authorized personnel or it may be programmed on a real-time basis into the system. The system shall have a minimum of three (3) levels of authorization for modification of the system program.

1.9 SUBSTITUTIONS:

A. Any new systems to be provided and installed for LAPD facilities shall be compatible to the currently existing system to ensure an efficient standard operation. If the product submitted is different from the specified equipment, compatibility testing shall be performed by the Contractor on the proposed system and/or any components thereof from the point of connection to the transmission, processing, recording and display of the data signal to determine compatibility to the satisfaction of LAPD representative at no additional cost to the City. See also GR Section 01630 of the Project Specifications.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Access Cards: RF-programmable, Proximity Access Control Card.

1. Access Card shall be 13.56 MHz Contactless Smart Card and shall be compatible with the Card Readers.

2. Provide 1000 cards.

3. Access Card cards shall be HID I-Class Corporate 1000 (LA City proprietary).

4. Provide one CP400 Contactless Smart Card Programmer.

5. Provide one access card photo ID printer and laminator with material to laminate 1200 cards.


1. Wiegand protocol output shall be capable of supporting distances of at least 350 feet between the Card Reader and the Wiegand protocol.
interface and shall be compatible with HID I-Class Corporate 1000 (LA City proprietary) 13.56 MHz Contactless Smart Card.

2. LED flash and audible tone sounds when a proximity card is presented to the reader.

3. Designed for use indoor and outdoors. Unit shall have a NEMA 4X rating.

4. Unit shall be housed in a vandal resistant black polycarbonate housing.

5. Recognizes 26 bit Wiegand card formats with over 65,536 unique codes.

6. Lifetime warranette against defects in materials and workmanship.

7. Shall have a read range of approximately 4 inches.

8. Card Readers shall be compatible with the I-Class Access Cards and Remote Processor.

9. Power requirements shall be less than 100 mA @12 VDC. A linear power supply shall be provided.

10. Shall operate in temperatures between -22 deg F to +150 deg F, 0-90% relative humidity non-condensing.

11. Type A unit shall mount on a single gang electrical box. Unit shall be less than 6 inches W x 6 inches H x 1 inch D. Unit shall be model R40 by HID or approved equal.

12. Type B unit shall mount directly to a door mullion. Unit shall be less than 1.7 inches W x 6 inches H x 1 inch D. Unit shall be R10 by HID or approved equal.

13. Type C units shall incorporate a pin keypad and biometric fingerprint reader. Unit shall be RWKLB575 Reader or approved equal.

14. Type D units shall incorporate a pin keypad. Unit shall be RK40 Reader or approved equal.

15. Provide one additional each Type B and Type C readers for enrollment.

C. Door Control Units: Wiegand protocol processor.

1. Unit shall communicate with the Card Readers via standard Wiegand protocol at distances of at least 325 feet. All external hardware and software shall be provided. Read time shall not exceed one second from presentation of the card to contact closure.

2. Unit shall communicate with the Key Pads via digital transmission code compatible with the key pads at distances of at least 325 feet. Read time shall not exceed one second from presentation of a valid PIN code to contact closure.
3. Unit shall communicate with other Remote Processors and with the Controller via RS-485. All external hardware and software shall be provided.

4. Unit shall accommodate a combination of a minimum of four completely independent Card Readers or Key Pads. Relay Output pairs. A combination of four card readers or key pads each with an independent output relay.

5. Unit shall be compatible with the Card Readers, Key Pads, and Host Computer.

6. Unit shall include eight UL grade AA supervised inputs and one unsupervised input for tamper.

7. The Unit shall recognize 26 bit Wiegand Card Reader formats.

8. Unit shall support a total of 4,000 users.

9. Unit shall include an on board battery for backing up the processor.

10. Unit shall be housed in a NEMA enclosure with conduit knockouts. Enclosure shall not exceed 14 inches H x 14 inches W x 6 inches D.

11. Unit shall operate in temperatures between +32 deg F to +140 deg F, 0-90% relative humidity non-condensing.

12. Unit shall be AMAG M2100 series.

D. Controller

1. The controller shall support the operation, communications, and data storage for remote processors.

2. Shall support eight readers (ACU2) or 16 readers (ACU2/16) on two RS-485 communication ports.

3. Shall support magnetic stripe, wiegand, barium ferrite, infrared bar code, proximity and smart card technologies.

4. Shall include 12 fully supervised four-state alarm inputs configurable for door contacts, request-to-exit, intrusion detection or general alarms.

5. Shall include 12 relay outputs configurable for door locks, local annunciation, or auxiliary outputs.

6. Shall support remote processors to a maximum of 172 fully configurable supervised four state inputs and 156 fully configurable Form C outputs.

7. Shall provide local and global alarm masking capabilities initiated from card readers, keypads or operators.

8. Shall include full system database and parameters downloaded for real-time local processing and control.
9. All panels should be equipped with sufficient memory to accommodate 20,000 cardholders and 50,000 off-line transactions.

10. Shall provide local and timed antipassback

11. Shall communicate with the host computer with LAN communications using 10/100 TCP/IP ethernet.

12. Unit shall be AMAG M2100 series.

E. Host Computer:

1. The Host Computer shall be an industry standard computer running software that allows the System Operator to manage the system and allows effective communications between the Host Computer and the Remote Processors. The Host Computer shall communicate with the Remote Processors via 10/100 TCP/IP Ethernet. All external hardware and software shall be provided. The Host Computer shall have a printer to allow the System Operator to print reports. The Host Computer shall be a desktop computer as defined in Section 17030 - Computers, with these additional features:

   a. Communications cards as required to communicate with the Remote Processors over the SMCS LAN.

   b. Additional serial ports for the Access Card Enrollment Station and other hardware.

   c. Additional hardware as recommended by the Manufacturer.

2. The Host Computer monitor shall be a desktop monitor without transducer as defined in Section 17030 - Computers.

3. The Host Computer laser printer shall be as defined in Section 17030 - Computers.

4. The Host Computer shall include an Access Card Enrollment Station. The Enrollment Station shall include a Card Reader that allow new Access Cards to be added to the system. The Enrollment Station shall allow fast, error free, enrollment of new cards. The Enrollment Station shall also verify that the Access Cards are operating properly. All required hardware and software shall be furnished and installed.

5. The Host Computer software shall allow the System Operator to manage the system. The software shall provide the following functions at a minimum:

   a. Add and delete new Access Cards or Personal Identification Numbers (PIN code) to the system. Each Access Card or PIN code in the system shall be identified by the staff member's first name, last name, employee number, and bit code associated with the Access Card. The System Operator shall be able to enroll new Access Cards by use of the Access Card Enrollment
Station or by simply typing in the bit code associated with the Access Card.

b. Assign individual Access Cards in the system to any of the Card Readers in the system. Any Access Card in the system must have the capability of being assigned to any number of Card Readers in the system. When an Access Card that has been assigned to a Card Reader is presented to the Card Reader, the Remote Processor shall close a dry contact closure.

c. Assign individual PIN codes in the system to any of the Key Pads in the system. Any PIN code in the system must have the capability of being assigned to any number of Key Pads in the system. When a PIN code that has been assigned to a Key Pad is presented to the Key Pad, the Remote Processor shall close a dry contact closure.

d. Maintain a log of all valid card reads and key pad entries in the system. The log shall be a first in first out log. The log shall maintain a minimum of the last 1 million reads. The software shall print reports as defined by the System Operator that includes different parameters such as which doors were accessed by a card holder in a given time period, the last door that the card holder accessed, a list of card holders that accessed a door in a given time period, the last card holder to access a door, the credentials of each Card Holder.

e. The Host Computer software shall be the latest version of the application software

1) AMAG 725 Global Edition – Cluster Aware

2) Microsoft SQL Clustering with SQL 2000 Enterprise Edition

2.2 DATA OPTICAL TRANSMITTER/RECEIVER (RS-422)

A. Fiber Optic transmitter, receiver, and repeater units to effect RS-422 communication links for CCTV system remote controllers shall have the following features or characteristics:

B. Data - RS-422; Data Rate - DC - 100 Kbaud

C. Wavelength: 850 nm

D. Number of fibers: 2

E. Operating temperature: -20°C to +70°C

F. Connectors: ST

G. Power: 12VDC
H. Transformers, power supplies, and racks shall be furnished and installed as required.

I. Units shall be International Fiber Systems, Inc. D1110-R3 series rack mounted units, or approved equal.

2.3 HARDWARE COMPONENT MAINTENANCE:

A. The system shall utilize only components which are supported by national service agencies offering high priority service contracts where desired.

2.4 COMMUNICATIONS LINE SUPERVISION:

A. The system shall poll the state of the communications lines at least once every second to detect compromises to system communication. When communications problems are detected, the system shall log appropriate messages periodically until the problems are fixed or until a privileged operator reconfigures the system hardware.

The system shall minimally detect the following cases of compromise through tampering:

1. Break in the communications path (e.g. cut wire).
2. Loopback in communications path (e.g. shorted cable).
3. Lost device (i.e. power removed to a remote device).

B. Provide modules as necessary.

2.5 SYSTEM SOFTWARE REQUIREMENTS:

A. After the installation, the system will be under complete control of the Owner, who shall be able to perform all supported operations without aid of the manufacturer or installer. The required system operation set is described as follows:

1. Operating System:

   The system shall use a standard operating system in common use for real-time applications, and which is supported by the equipment manufacturer through a software maintenance program.

2. Security management system software shall include but not be limited to the following:
   a. Password access to system
   b. System reconfiguration by user
   c. Remote control of doors from console
   d. Alarm delay - programmable
2.6 SYSTEM INSTALLATION AND PROGRAMMING:

A. Division 17 shall be responsible for the system installation, programming, start-up and Owner training. Data inputs for system programming shall be from the Owner and coordinated by the Architect.

2.7 WIRE AND CABLE:

A. Wire and cable shall be furnished and installed and shall be of the type and size as recommended by the manufacturer.

2.8 SYSTEM DOCUMENTATION REQUIREMENTS:

A. Documentation shall be furnished by the manufacturer in printed form. The documentation complement shall provide as a minimum the following:

1. Comprehensive user's guide.
   
   The user's manual shall contain sufficient information to enable the use of the system, according to specification, by an unknowledgeable person.

2. Installation guide.
   
   The installation guide shall contain sufficient information to enable the installation of the system and its customizations with minimal consultation with the manufacturer. In addition, the installation guide shall explain technical details of hardware and interface installation.

3. As-built system drawings.
   
   Documentation shall include system functional diagrams, system wiring drawings and operation and maintenance manuals. This documentation shall be such as to provide for a trained technician to operate and maintain the system to a module level.

2.9 POWER SUPPLY BACK-UP:

A. All processors shall be powered from a UPS to prevent loss of memory in the event of primary power failure.
PART 3 - EXECUTION

3.1 GENERAL:

A. Equipment shall be installed at locations as shown on the drawings. Remote processors, input monitors, and control output devices shall be installed in the SEC's to be furnished and installed under this Division of work.

B. Programming of the system shall be performed by the Contractor. Control and/or reporting functions shall be coordinated with the hardware requirements and with the Owner selected options.

C. Where noted on the drawings, Contractor shall locate and mount card readers on glazing such that card readers will read cards from either side of door. Coordinate mounting locations with details provided under the General Construction Contract.

D. Access control system connections to door control and monitoring shall be via the programmable logic controllers and Security Monitoring and Control System.

E. Where indicated on the drawings, high security storage area doors shall require subsequent card reads from separate card holders within five (5) seconds. Provide all software, programming, and hardware necessary to perform this function.

3.2 COMPLETION:

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat and orderly.

B. Testing: The entire system shall be tested by the Contractor prior to acceptance tests by the Owner or the Owner's representative.

C. Training: The Contractor shall provide complete operating training for the Owner's personnel as a part of this contract.

END OF SECTION
SECTION 17360
WATCHTOUR SYSTEM

PART 1 - GENERAL

1.1 GENERAL CONDITIONS
A. The Conditions of the Contract (General, Supplementary and other Conditions and the General Requirements (Sections of Division 1) are hereby made a part of this Section.

1.2 WORK INCLUDED:
A. Furnish all materials and labor necessary to complete the installation of the watchtour system as shown on the plans or specified herein.

1.3 RELATED WORK SPECIFIED ELSEWHERE:
A. The work of this Section is related to the work of the following Sections:
   1. General Provisions (17000)
   2. Wire and Cable (17020)
   3. Security Management System (17350)

1.4 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:
A. National Electrical Code

1.5 COOPERATION WITH OTHER TRades:
A. The Contractor shall coordinate the work of this Section with that of other Sections as required to ensure that the entire work of this project will be carried out in an orderly, complete and coordinated fashion.

1.6 SUBMITTALS:
A. General: Submittals shall be made in accordance with the General Provisions (Section 17000) of these specifications.

1.7 SYSTEM DESCRIPTION:
A. Watch Tour routes shall be as designated in Table 17361-1.
B. The first station of each tour (card reader mounted on the control console) shall act as a reporting device as well as "enabling" the remainder of the devices on that particular tour. When the first station (card reader) of each tour is accessed, the system will record station location, time accessed, who accessed (data from card), enable the remaining stations on that particular tour and illuminate the LED's on these stations, and activate an icon on the housing touchscreen to indicate that the watchtour is "Active." As the remaining stations (push buttons) are accessed, the PLC system will monitor the push button inputs as well as extinguishing the LED at the station when the push button is depressed. When all of the push buttons have been activated, the PLC will send a "tour completed" signal to the Security Management System" and illuminate the watchtour "Complete" icon on the touchscreen.

At the end of the Watch Tour, the first station (card reader) will again be accessed and the system will record station location, time accessed, who accessed, and disable the tour.

All of this data shall be logged into the system memory for retrieval and review at a later time. No "alarms" will be associated with the watch tour system.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Watch tour card sensors shall be the narrow profile, door mullion-type proximity reader as described in Section 17350.

B. Watch tour push button stations shall be as shown on the drawings and have the following characteristics or features:

1. 11-gauge stainless steel faceplate.
2. Flush-mounted in a single-gang backbox.
3. Stainless steel push button, abuse and jamming resistant.
4. Red LED.

PART 3 - EXECUTION

3.1 EXECUTION:

A. Contractor shall verify that conduit shown on the plans is adequate to support the proposed system. If additional conduits are required or changes are required in size, Contractor shall install required conduit facilities at no additional cost to the Owner.

B. Coordinate with other trades which impact installation of these systems.

C. Cables shall be furnished and installed as required to support the system requirements.

3.2 COMPLETION:

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat and orderly.
B. Testing:

1. Contractor shall test system completely prior to acceptance tests.

2. Acceptance tests shall be conducted by the Owner or Owner's Representative to ensure compliance with plans and specifications.

TABLE 17361-1

WATCH TOUR DESIGNATIONS

<table>
<thead>
<tr>
<th>TOUR</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>EA</td>
<td>Housing Block EA</td>
</tr>
<tr>
<td>EB</td>
<td>Housing Block EB</td>
</tr>
<tr>
<td>EC</td>
<td>Housing Block EC</td>
</tr>
<tr>
<td>ED</td>
<td>Housing Block ED</td>
</tr>
<tr>
<td>NA</td>
<td>Housing Block NA</td>
</tr>
<tr>
<td>NB</td>
<td>Housing Block NB</td>
</tr>
<tr>
<td>WA</td>
<td>Housing Block WA</td>
</tr>
<tr>
<td>WB</td>
<td>Housing Block WB</td>
</tr>
<tr>
<td>WC</td>
<td>Housing Block WC</td>
</tr>
<tr>
<td>WD</td>
<td>Housing Block WD</td>
</tr>
<tr>
<td>SA</td>
<td>Housing Block SA</td>
</tr>
<tr>
<td>SB</td>
<td>Housing Block SB</td>
</tr>
<tr>
<td>SC</td>
<td>Housing Block SC</td>
</tr>
<tr>
<td>SD</td>
<td>Housing Block SD</td>
</tr>
<tr>
<td>BK</td>
<td>Booking Holding</td>
</tr>
<tr>
<td>TH</td>
<td>Transfer Holding</td>
</tr>
<tr>
<td>JV</td>
<td>Juvenile</td>
</tr>
</tbody>
</table>

END OF SECTION
SECTION 17380
VIDEO VISITATION SYSTEM

PART 1 - GENERAL

1.1 GENERAL CONDITIONS:
   A. The Conditions of the Contract (General, Supplementary and other Conditions) and the General Requirements (Sections of Division 1) are hereby made a part of this Section.

1.2 WORK INCLUDED:
   A. Included under this Section of the work shall be the furnishing, installation, connection, aiming and testing of the complete Video Visitation system including, but not limited to, cameras, housings, mounts, cables, monitors, switchers, audio handsets, audio switcher, and fiber optic systems.
      1. System to be interfaced with the Security Monitoring and Control System for control of the video and audio switching.

1.3 RELATED WORK SPECIFIED ELSEWHERE:
   A. The work of this Section is related to the work of the following Sections:
      1. General Provisions (17000)
      2. Wire and Cable (17020)
      3. Security Control and Monitoring System (17170)

1.4 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:
   A. National Electrical Code

1.5 COOPERATION WITH OTHER TRADES:
   A. The Contractor shall coordinate the work of this Section with that of other Sections as required to ensure that the entire work of this project will be carried out in an orderly, complete and coordinated fashion.

1.6 SUBMITTALS:
   A. General: Submittals shall be made in accordance with the General Provisions (Section 17000) of these specifications.
   B. Specific Requirements:
      1. Submit catalog cuts for each piece of equipment, including but not limited to: cameras, lenses, enclosures, mounting brackets, monitors, switchers, audio stations, audio switchers, audio power supplies.
      2. Submit detailed fabrication detail of visitor visitation station.
1.7 SYSTEM DESCRIPTION:

A. The video visitation system shall provide two way video and audio communications between the visitor position and the selected inmate visitation stations.

B. The visitor’s station shall consist of a camera, flat screen monitor, and handset installed in a tamper proof enclosure.

C. The inmate’s station shall consist of a camera, flat screen monitor, and hands-free, vandal proof intercom installed in a tamper proof enclosure.

D. Each of the housing control stations shall include a touchscreen screen as part of the Security Control and Monitoring System to control the communications path. The Public Lobby control position shall include a screen to view the connections. Each of these touchscreen terminals shall also include a video capture card(s) to simultaneously display the visitor’s video image and the inmate’s video image to properly manage the connection. No audio of the session shall be provided at the console. The touchscreen shall not be dedicated to the video visitation function and shall also perform other functions as described in Section 17170 Security Control and Monitoring System.

E. Video Switching: A visitation video switcher shall be dedicated to the task of switching the camera to monitor assignments as selected by the touchscreen.

F. Audio Switching: An audio switch shall be provided to connect the selected inmate station to the visitor station as selected by the touchscreen.

G. The Site Intercom System and the telephone system shall support communication between the Public Lobby attendant and the housing control rooms.

H. Housing Touchscreen:
   1. The housing control terminal visitation screen shall include the following:
      a. A select icon for each of the eight associated inmate stations.
      b. A selected visitor station for each of the eight associated inmate stations.
      c. Intercom select for each of the eight associated visit rooms.
      d. Door unlock and status icon for each of the eight associated visit rooms.
      e. A select icon for each of the 16 visitor stations.
      f. A bar or X between the inmate station and selected visitor station indicating connection or no connection.
      g. Connect and Disconnect icons.
      h. A video window for the selected inmate and visitor cameras.
2. Selecting the inmate icon and then a visitor icon shall display the visitor station number below the inmate station icon. Visitor stations already selected will display an X at the associated visitor select icon. The visitor station selection can be changed until the connection is made. The associated video image shall be displayed on the video window as soon as the inmate station and visitor station icons are selected.

3. Selecting the “Connect” icon shall make the inmate to visitor connection by having the PLC to connect the associated inmate camera to the visitor monitor, connect the visitor camera to the associated inmate monitor, and connect the associated inmate intercom and visitor handset. A solid bar shall be displayed between the inmate station and the selected visitor station. A preset timer shall start.

4. One minute before the session times out, the text “one minute remaining” shall be displayed on the visitor and inmate intercom monitors for 3 seconds. Text shall be in English and Spanish.

5. When the session times out, the video and audio connections shall be terminated and the power to the video monitors disconnected. The selected visitor icon shall flash “Time Out” and an X shall be displayed between the inmate station and the selected visitor station and a soft warning tone shall repeat every five seconds to notify the operator that the visit session has ended. If the touchscreen is not on the visit screen, the visit icon at the bottom of the screen shall flash.

6. Selecting the selected visitor icon with “Time Out” displayed shall change the icon to an X and silence the tone.

7. Selecting the “Disconnect” icon shall disconnect the inmate station from the visitor station video and audio and shall disconnect power to the inmate and visitor monitors. An X shall be displayed between the inmate station and the selected visitor station.

8. Selecting the “Main Screen” icon shall return the main control and monitoring screen.

9. The administrator shall be able to set the default time for visit sessions from 5 minutes to 60 minutes.

H. Public Lobby Touchscreen:

1. The Public Lobby terminal visitation screen shall include the following:
   a. A select icon for each of the 16 visitor stations to display the associated video images.
   b. A selected inmate station icon for each of the 16 visitor stations.
   c. A bar or X between the visitor station and selected inmate station indicating connection or no connection.
   d. A video window for the selected inmate and visitor cameras.
2. The Public Lobby terminal does not have any visitation control functions other than selecting the connection for video viewing.

3. Selecting the visitor station icon shall display the associated video images from the inmate station and visitor station.

4. When the housing control terminal makes the inmate station to visitor station assignment the appropriate inmate station number shall be displayed the station number below the visitor station icon.

5. When connected, a solid bar shall be displayed between the visitor station and the inmate station.

6. When the session times out, the inmate icon shall flash “Time Out” and an X shall be displayed between the inmate station and the selected visitor station and a soft warning tone shall repeat every five seconds to notify the operator that the visit session has ended. If the touchscreen is not on the visit screen, the visit icon at the bottom of the screen shall flash.

7. Selecting the inmate icon with “Time Out” displayed shall change the icon to an X and silence the tone.

I. TTY Station:

1. Phone jacks are provided at the #1 Visitor Station and each of the inmate stations for connection of TTY compatible stations for communication with the hearing impaired. TTY stations to be provided by the owner.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Cameras:

1. Camera shall be compact with the following features:

   a. Sony CCD 1/3” high resolution color DSP camera.
   b. Picture elements: 768H X 494V minimum.
   c. Horizontal resolution 480 lines minimum.
   d. Automatic backlight compensation.
   e. Automatic gain control.
   f. Minimum illumination 2.0 Lux at F1.2.
   g. Video output: 1.0 V p-p composite adjustable.
   h. Output impedance: 75 ohms.
i. Lens mounting: Standard micro-lenses; autoiris varifocal (4mm to 8mm) or autoiris fixed (2.5mm to 25mm).

j. Power line phase locking with 180 deg. vertical phase adjustment.

k. S/N ratio of greater than 50dB.

l. Temperature operating range of -40 deg. C to +50 deg. C.

m. Humidity operating range of 0 to 95% relative humidity.

n. Power requirements: Less than 5 watts.

o. Voltage requirements: 24 VAC Unit to be protected by fuse or circuit breaker.

p. Where twisted pair cable is utilized, camera shall be provided with an integral twisted pair video transducer.

2. Visitor and Inmate Station Mount:

a. Standard board camera enclosure with adjustable mount to be installed in the

3. Lenses shall be provided as follows:

a. Fixed Lenses: All fixed lenses shall be auto-iris, minimum f1.2 for narrow to mid-range FOV and f1.6 for wide FOV, with spot filter unless otherwise specified. Wide angle lenses shall be asymmetrical for distortion correction. Patient Room Lenses shall be 16mm focal length.

b. Variable Focal Lenses: All variable focal lenses shall be auto-iris, minimum f1.4, with spot filter unless otherwise specified. Focal length shall be adjustable from 4-8mm. Visitor Station Lens shall be 4-8mm.

B. Monitor:

High resolution, 15" color flat screen video monitor with the following characteristics or features.

1. Type: TFT Active Matrix LCD.

2. Viewable Picture Area: 38-cm (15 in) measured diagonally.

3. Resolution: 1024 × 768 pixels; 540 TV lines typical, 500 TV Lines minimum.

4. Backlight: Cold cathode fluorescent tubes, rated life at minimum 50,000 hours, at 50% brightness.

5. Accept composite Video: 1.0V p-p
6. Impedance: 75 ohms

7. Distortion: Less than 3%.

8. Power: 12VDC with separate 120VAC power supply, 30W max.

9. Temperature: Operate within specifications over ambient temperature range of 0º to 40ºC.

10. Synchronization: internal.

11. Patient room monitors to be provided with VESA standard bracket installed with 9” secured pedestal for ceiling mount or swivel wall mount as required. Pedestal to be brushed aluminum and shall provide and tilt adjustments (+/- 20 degrees minimum) for optimal viewing angle. GCX Model FLP-0001-40 are approved equal.

12. Visitor and Inmate station monitor to be provided with VESA standard bracket installed swivel wall mount.

C. Visitor Station Intercom Handsets: Intercoms shall be furnished and installed on the video visitation enclosure. Intercoms shall be of the armored cable handset type. Each talk circuit shall be configured with two handsets on the visitor's side and one handset on the inmate's side. Mounting hardware shall be tamperproof. Intercom shall be Commend Model ET 808 HS with 11 gauge stainless steel faceplate or approved equal. Individual power supplies shall be furnished and installed for each talk circuit.

1. Handset: Transmitter; Carbon Receiver; Dynamic Handset ear and mouth pieces are non-removable. Black, hi-impact plastic.

2. Handset Cord: Armored, 4-conductor with strain relief.

3. Faceplate: 11 gauge stainless steel

4. Backbox: Standard 2 gang

D. Inmate Station Intercom

1. Each Intercom substation shall be equipped with microphone, loudspeaker and in-use LED, all housed in one unit (no call pushbutton)

2. All substations shall be weather resistant, equipped with minimum 12 gauge stainless steel faceplate. Units shall be tamperproof and shall have a second protective plate between faceplate and speaker/microphone.

3. Unit shall incorporate digital signal processing.

4. Units shall utilize one twisted pair wire.

5. Unit shall be capable of operating up to 4,000 ft from the central with 22 AWG wire.
6. Unit shall be Commend model ES831.

7. Unit shall be secured with torx with pin tamperproof screws. Screws shall be torqued to manufacturers recommendations.

E. Visitor and Inmate Station Enclosure:

1. The visitor and inmate station enclosure shall be custom made 14 gauge steel enclosure with a ¼” Lexan window. The enclosure shall house and protect the monitor and the camera. The cover shall be secured with security screws. The enclosure size shall not exceed 6” deep by 20” high by 18” wide. The enclosure shall be installed over the conduit back box to conceal and protect all cables. Obtain color sample from the architect for enclosure exterior color. Paint to match the sample. Provide vandal proof vents on the sides and bottom as required to provide adequate ventilation. The visitor station shall include a flange for flush mounting.

F. Video Switcher:

1. Each video switching and control system shall be a standalone CPU/switcher having capability of user programming and interface with other switchers as indicated on the drawings. Unit shall include as a minimum the following features and/or functions:
   a. Camera Inputs – 64 maximum
   b. Monitor Outputs - 12 maximum
   c. RS-232 CPU Interface for SCMS integration.
   d. RS-232 Printer Port
   e. Camera and Monitor Interface - BNC Connections
   f. Looping Video Output
   g. Rack Mount Capability
   h. Date/Time/Titler
   i. Custom software as required to meet system functional requirements.

2. Manufacturer:
   a. Pelco CM9700 Series.

G. Audio Switching:

1. Audio switching shall be by a digital audio switch as specified in Section 17250 and shall support at least 32 simultaneous talk paths. There shall be a dedicated digital audio switch for the video visitation system. The system shall have a data port and Ethernet LAN port to interconnect to
the programmable logic system to receive commands from the Security
Monitoring and Control System touchscreens.

H. Miscellaneous Components:

1. Cable shall comply with the requirements of Section 17200.

2. Hardware:
   
   a. Contractor shall furnish and install miscellaneous hardware and
      materials as required to effect a complete and functional system.

   b. Three-piece, crimp-type BNC connectors that require separate
      crimps for the center conductor and the shield shall be used for
      the coaxial cable terminations. The connectors shall be matched
      to the wire type and the crimping tool shall be specifically
      designed for crimping the connector.

3. Camera Power Supplies: Provide Class 2 power supplies for cameras
   as required to comply with NEC Articles 725 and 800.

PART 3 - EXECUTION

3.1 INSTALLATION:

A. All equipment shall be installed per the requirements of the manufacturer.

B. All equipment shall be utilized for the purpose to which it was designed and
   manufactured.

C. CCTV camera lenses and camera locations indicated in the Construction
   Documents have been selected to provide the desired field of view. However,
   the drawings are schematic in nature and the camera locations shown are
   approximate. Field adjustments shall be made as required to provide or improve
   the field of view of the area to be monitored. Final alignment shall be the
   responsibility of this Contractor and any costs related to changing lenses to
   obtain the desired field of view shall be included in the Contractor's bid price. For
   housings that have a limited flexibility to align cameras, the contractor is
   encouraged to install a camera for viewing by the Owner's representative prior to
   securing the enclosure in its fixed position.

D. Power supplies shall be furnished and installed for all equipment as required and
   supplies shall have performance characteristics compatible with the unique
   requirements of the equipment being supplied. Power supplies shall be loaded
   to a maximum of 60% of the rated power output.

E. Amplifiers, combiners, remote switchers, power supplies, and other support
   equipments shall be installed in panels designated as "SEC" which shall be
   furnished and installed under this section of work.

F. Verify, prior to installation of ceiling mounted enclosures, that field of view of
   camera is not obstructed by breaks in ceiling height, lighting fixtures, fire alarm
   devices, mechanical fixtures or duct work, or plumbing fixtures. If such conflicts
   occur, coordinate with engineer prior to installation.
G. All cameras shall be adjusted to optimize the video presentation at the display consoles.

H. Provide required interfaces to the Security Control and Monitoring System and all appropriate programming to effect the described functionality.

3.2 COMPLETION:

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat and orderly.

B. Testing: The completed system shall be tested prior to acceptance testing by the Owner or Owner's representative.

END OF SECTION
PART 1 - GENERAL

1.1 GENERAL CONDITIONS:

A. General: The Conditions of the Contract (General, Supplementary and other Conditions) and the General Requirements (Sections of Division 1) are hereby made a part of this Section.

1.2 WORK INCLUDED:

A. Provide materials, labor, equipment and services necessary to furnish, deliver and install a security metal detector system and Package X-Ray equipment as shown on the Drawings, as specified herein, and/or as required by job conditions.

1.3 RELATED WORK SPECIFIED ELSEWHERE:

A. The work of this Section is related to the work of the following Sections:

1. General Provisions (17000)
2. Wire and Cable (17020)
3. Systems Description and Integrations (17100)

1.4 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:

A. National Electrical Code

1.5 COOPERATION WITH OTHER TRADES:

A. The Contractor shall coordinate the work of this Section with that of other sections as required to ensure that the entire work of this Project will be carried out in an orderly, complete and coordinated fashion.

1.6 SUBMITTALS:

A. General: Submittals shall be made in accordance with the General Provisions (Section 17300) of these specifications.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Walk-Through Security Metal Detector: Walk-through security metal detectors shall be furnished and installed at locations as shown on the plans and units shall have the following features or performance characteristics:
1. Security metal detector shall be low-error, high throughput, programmable walk-through portal type of metal detector designed to sense and indicate the presence of metal concealed on a person or in a non-metallic container. Unit shall be in the form of a knock-down archway with a processor console.

2. Unit shall be field programmable by the user to allow changes in sensitivity level.

3. Unit shall require no balancing and shall not be sensitive to fixed metal in the surrounding area.

4. Unit shall be essentially immune to EMI and RFI types of interference by design.

5. Alarm contact shall be available for remote alarm indications. Contact shall automatically reset.

6. Power Requirements: 120V - single phase, 100VA max.

7. Environmental: 0 degrees C to +55 degrees C up to 95% relative humidity.

8. Unit opening shall be a minimum of 30" wide.


10. Unit shall be Magnascanner MT5000 as manufactured by Garrett, Metor 120 as manufactured by Metorex, or Sentrie LC as manufactured by PerkinElmer Instruments, or approved equal.

B. PARCEL X-RAY EQUIPMENT: Parcel X-Ray equipment shall be furnished and located as shown on the plans and shall have the following performance characteristics:

1. X-Ray shall be package conveyor type with minimum tunnel opening of 18" high x 24" wide.

2. Penetration: penetrate 29 millimeters of steel guaranteed with 31 mm typical.


4. Resolution: 38 gauge solid copper wire.

5. Power Requirements: 15A max. @120VAC, 60Hz.

6. TV Monitors with minimum 800 line resolution.

7. Digital Storage Unit with 1024 X 1024 X 16 bit capacity displaying 256 gray tones.

8. Unit shall be Linescan System 215E III as manufactured by L-3 Security & Detection Systems.
9. Organic/Inorganic Identification: The unit must have two monitors with one monitor dedicated to the black and white density-based image analysis and the other dedicated to the image processing capability which, by means of four (4) color assignment, enables the operator to distinguish between organic and inorganic material. After identifying a material as organic (orange) or inorganic (blue) the unit must color the item according to density, i.e., the more dense the item the darker the color.

10. Inorganic And Organic Stripping Capability: The unit must be capable of allowing the operator to strip from the screen any organic or inorganic information by means of a single button without stopping the conveyor belt, leaving only the important organic or inorganic information highlighting the potential threat areas.

PART 3 - EXECUTION

3.1 EXECUTION

A. Metal detectors and package X-Ray equipment shall be installed at location as shown on the drawings.

B. Coordinate installation with Electrical Contractor for proper location of electrical service.

3.2 COMPLETION:

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat and orderly.

B. Alignment and Testing: Contractor shall align and test detector system prior to acceptance testing by the Owner or Owner's representative. Alignment and testing shall be in accordance with the manufacturer's recommendations.

END OF SECTION
SECTION 17600
PERSONAL ALARM SYSTEM

PART 1 - GENERAL

1.1 GENERAL CONDITIONS:

A. See the Conditions of the Contract (General, Supplementary and Special Conditions) and the General Requirements (Division 1).

1.2 WORK INCLUDED:

A. Furnish all materials and labor necessary to complete the installation of a functional personal alarm system as indicated on the drawings, specified herein or both. The Work of this Section includes, but is not limited to:

1. Personal alarm ultrasonic transmitters
2. Personal alarm receivers
3. Power Supplies and cables.

1.3 RELATED WORK SPECIFIED ELSEWHERE:

A. The work of this Section is related to the work of the following Sections:

1. General Provisions (17000)
2. Wire and Cable (17020)
3. Systems Description and Integration (17100)
4. Security Monitoring and Control System (17170)

1.4 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:

A. National Electrical Code
B. EIA Standards

1.5 COOPERATION WITH OTHER TRADES:

A. The Contractor shall coordinate the work of this Section with that of other Sections as required to ensure that the entire work of this Project will be carried out in an orderly, complete and coordinated fashion.

1.6 SUBMITTALS:

A. General: Submittals shall be made in accordance with the General Provisions (Section 17000) of these specifications.

1.7 SYSTEM DESCRIPTION:
A. Personal alarm receivers shall be furnished and installed at locations as shown on the drawings. Exact location of the receiver shall be as recommended by the manufacturer. If receivers are relocated, or additional receivers are required, due to recommendation by the manufacturer, the Architect/Engineer shall be notified of these changes.

B. The personal alarm receivers and duress push buttons shall act as inputs to the PLC. Alarms shall be reported on the appropriate Security Monitoring and Control System video display.

C. The Division 17 Contractor shall be responsible for providing and installing all power supplies, components, and circuitry required to functionally accomplish system operation as described herein and as shown on the drawings.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. System shall utilize modulated ultrasonic signals to transmit duress alarms.

2. All equipment shall be Perimeter Products PA-RTS Personal Alarm System or approved equal.

B. Personal Alarm Ultrasonic Transmitters – Detention Type:

1. Shall be constructed of molded Lexan with the alarm button designed to prevent accidental activation.

2. Shall have a latching alarm button that continually transmits the alarm until the alarm button is depressed a second time.

3. Shall have a battery capable of transmitting an alarm for approximately 30 hours.

4. Shall have internal test circuitry to detect and annunciate low battery.

5. Shall have a clip attachment that can be attached to either side of the transmitter to facilitate either left for right-handed activation of the unit.

6. Shall utilize a modulated ultrasonic signal.

7. Shall have the “man-down” feature with 4-second pre-alarm warning tone.


9. Specifications:

   a. Circuit components: 100% solid state, conformal coated circuit boards
b. Dimensions: 2.4" x .9" x 3.8"

c. Weight: 4 oz.

d. Battery life: 30 hours of transmitting time

e. Activation: Latching, push/push switch

f. Battery type: Carbon/lithium

g. Battery access: Compartment accessible with tool provided by manufacturer

C. Personal Alarm Ultrasonic Transmitters – Miniature Type for Civilian Staff:

1. Shall be constructed of molded Lexan with the alarm button designed to prevent accidental activation.

2. Shall have a latching alarm button that continually transmits the alarm until the alarm button is depressed a second time.

3. Shall have a battery capable of transmitting an alarm for approximately 10 hours.

4. Shall have internal test circuitry to detect and annunciate low battery.

5. Shall have a loop keeper with lanyard that shall activate the unit when pulled and shall have a steel pocket clip.

6. Shall utilize a modulated ultrasonic signal.


8. Specifications:

   a. Circuit components: 100% solid state, conformal coated circuit boards

   b. Dimensions: 1.6"W x 2.5"W x 0.9"D Maximum

   c. Weight: 1.6 oz maximum

   d. Battery life: 30 hours of transmitting time

   e. Activation: Latching, push/push switch and keeper loop pull pin

   f. Battery type: Lithium

   g. Battery access: Compartment accessible with tool provided by manufacturer

D. Personal Alarm Receivers:
1. Shall receive and decode the modulated ultrasonic signal from the transmitter and activate a normally closed dry contact relay. The relay shall latch in the alarm state for one second. The sensor shall then automatically reset itself and be ready to receive the next alarm. A control output from the monitoring system shall not be required to reset the receiver.

2. Shall have a red LED on the faceplate that illuminates when the receiver is activated by a transmitter.

3. Shall have adjustable receiving range to a minimum of 50 feet (100 ft. diameter).

4. Shall be monitored and annunciated by the Security Monitoring and Control System.

5. Indoor receivers shall be Perimeter Products personal alarm independent receiver module PAR 03RM or approved equal. Exterior receivers shall be Perimeter Products PAR 03RM/WPH or approved equal, equipped with a thermostatically controlled heater to permit operation down to a temperature of -40°F. Exterior units shall be mounted in a flush, weatherproof backbox.

6. Specifications:
   a. Circuit components: 100% solid state, conformal coated circuit boards
   b. Size: Dual gang electrical box - 3-1/2 inches deep
   c. Mounting: Tamper-proof screws (furnished)
   d. Power requirement: 12 VDC @ 40 mA, noise +/- 0.5 Vpp
   e. Connection: Removable plug-in terminal block
   f. Alarm output: Isolated and supervised relay contact
   g. Normally open or normally closed with 0.5 ampere rating
   h. Range: Variable - up to 50 ft.
   i. Finish: Stainless steel
   j. Wiring: 2 - Twisted pair #22 AWG

E. Test Fixtures:
   1. Shall test calibration and battery strength of personal alarm transmitters.
   2. Two (2) test units shall be furnished.

F. Duress Alarm Pushbutton Stations:
1. Type A (detention grade wall mounted pushbutton):

Unit shall have the following features and/or characteristics:

a. Single gang standard electrical box mounting.

b. 11 ga. stainless steel faceplate with security screws. Nominal faceplate size, 4.5"H x 2.75"W.

c. Vandal resistant switch with red mushroom push-pull pushbutton.

d. Red LED status indicator.

e. The designation "Emergency" shall be engraved on the faceplate with red backfill.

PART 3 - EXECUTION

3.1 EXECUTION:

A. Contractor shall verify that conduit shown on the plans is adequate to support the proposed system. If additional conduits are required or changes are required in size, Contractor shall install required conduit facilities at no additional cost to the Owner.

B. Power supplies shall be furnished and installed as required.

C. Refer to drawings for placement of receiver heads. Coordinate with other trades which impact installation of this system.

D. Cables shall be furnished and installed as required to support the system requirements.

E. System shall be configured in zones as shown on the drawings.

F. Contractor shall provide relays and PLC outputs as required to effect local console disable controls.

G. Receiver units shall be served by a UPS to effect 1 hour power reserve on loss of primary power.

H. Each PAR shall provide a dedicated input to the PLC and shall not be connected in groups for a "zone".

3.2 COMPLETION:

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus tools and the like and leave the premises clean, neat and orderly.

B. Testing:

1. Contractor shall test system completely prior to acceptance tests.
2. Acceptance tests shall be conducted by the Owner or Owner's representative to ensure compliance with plans and specifications.

3. Owner's tests shall be performed in the presence of artificially generated background noise.

END OF SECTION
SECTION 17700
TELEVISION DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. This section covers the master antenna television system as shown on the drawings or as required to support the systems defined in these specifications. The work under this section consists of furnishing materials and equipment, performing labor and services necessary for the installation of the master antenna television system required for the security electronics, communications, and fire alarm system.

B. Related Work Specified Elsewhere: Refer to all other Division 17 specification sections and drawings, and to the specifications and drawings under the General Construction Contract to ascertain the extent of work included.

1.2 SUBMITTALS

A. Since the Division 17 systems must be reviewed by the Engineer as a system, no individual, specific submittal shall be made for this section. Submittals shall be packaged in groups and shall be made in accordance with the General Provisions (Section 17000) of these specifications.

B. When making the submittal as required by Section 17000, include this additional information.

1. A system riser diagram.
   a. The riser shall include high frequency and low frequency calculated signal values at each trunk line tap, wall tap, splitter, and equipment input and output. The calculations shall assume a +3 dBmv input from the City furnished input as shown on the plans. To be coordinated with the testing requirements defined in Part three below, high frequency shall be considered 350 MHz and low frequency shall be considered 50 MHz.
   b. The riser shall include calculated sub-band return signal values at each trunk line tap, splitter, and equipment input and output.
   c. The riser shall be prepared and/or reviewed by the MATV equipment manufacturer.

1.3 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:

A. National Electrical Code

B. EIA Standards

1.4 SYSTEM DESCRIPTION

A. General:
1. The MATV system shall have provisions for interconnection to the local cable carrier. Surge protection and a one-way amplifier shall be provided as shown on the plans to condition the signal from the local cable carrier. A channel elimination filter shall be provided for each of the local origination channels described below.

2. The housing unit control rooms shall have the ability to control the channel and the audio on the associated TV’s via connection to a VCR with integral modulator located in the control room. TV audio shall be distributed on the cell intercom stations.

B. Distribution of video signals to specific buildings or floors shall be as shown on the riser diagrams. Each remote equipment room shall be equipped with a broadband distribution amplifier, splitters, taps, and outlets as required to maintain required wall tap levels.

C. The system shall be configured with amplifiers, taps, cable and other equipments having variable gain or loss to meet the performance requirements specified in this specification.

D. System bandpass shall be 50 MHz to 450 MHz with a DC to 50 MHz sub-channel return bandpass.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Distribution Amplifiers: Broadband distribution amplifiers shall be provided as required to maintain desired signal levels. Distribution amplifiers shall be Blonder-Tongue BIDA series or other product approved by The Engineer equipped with all necessary optional equipment and shall have the following features.

1. VHF Forward
   a. Gain: Available in 32 or 43 dB. Controls accessible from the front panel.
   b. Bandwidth: Compatible with system bandwidth.
   c. Input / Output Return Loss: 16dB

2. Slope Control: 8dB continuous, accessible from the front panel.

3. Attenuation Control: Pads in one dB increments from 1 to 20 dB.

4. Test ports for both the input and output signals.


B. Miscellaneous Equipment: Following list of miscellaneous equipment to be provided as required to effect a complete and functional system.

1. Indoor Splitters and Combiners
   a. Frequency Range: 5-450 MHz
   b. Input Return Loss: Greater than 18 dB between 50-450 MHz.
c. Isolation Between Outputs: Greater than 25 dB between 50-450 MHz.

d. RF Shielding 120 dB

e. Input and output ports shall accept "F" type connectors.

f. Blonder Tongue solder back SXRS series or another product approved by the Engineer.

2. Indoor Directional Couplers and Taps

a. Frequency Range: 5-450 MHz

b. Input Return Loss: Greater than 11 dB between 50-450 MHz.

c. Isolation Output to Tap: Greater than 17 dB between 50-450 MHz.

d. RF Shielding 120 dB

e. Input, output, and tap ports shall accept "F" type connectors.

f. Blonder Tongue solder back SCW, SRT, and SDC series or another product approved by the Engineer.

3. Trunkline Taps

a. Frequency Range: 5-450 MHz

b. Input Return Loss: Greater than 17 dB between 50-450 MHz.

c. Isolation Output to Tap: Greater than 24 dB at 500 MHz.

d. RF Shielding

e. Input and output ports shall accept trunkline cable without the use of reducers. Tap port shall accept "F" type connectors.

f. Blonder Tongue outdoor DMT series or another product approved by the Engineer.

4. Wall Taps:

a. Frequency Bands: Sub band, VHF, CATV, and UHF.

b. RF Shielding From 4 to 30 dB.

c. Input, output, and tap port shall accept "F" type connectors.

d. Input and output ports shall be on the back side of the wall plate. The tap port shall be on the front side of the wall plate.
e. Blonder Tongue versa tap series or another product approved by the Engineer.

5. Cover plates for the wall taps shall be in conformance with the cover plate requirements for duplex receptacles furnished and installed under Division 16.

C. Cable:

1. MATV Riser Cable:
   a. Coaxial broadband distribution cables shall have a solid copper center conductor and a shield coverage 100% foil and minimum 60% aluminum braid.
   b. Nominal attenuation at 400 MHz shall not exceed: 8.6 dB/100m for RG-11/U-type cables.
   c. Nominal impedance shall be 75 ohms.
   d. All cables installed in exterior conduits shall be gel filled moisture proof, direct burial type cable.

2. MATV Distribution Cable:
   a. Coaxial broadband distribution cables shall have a solid copper center conductor and a shield coverage 100% foil and minimum 60% aluminum braid.
   b. Nominal attenuation at 400 MHz shall not exceed SCTE Maximum Attenuation Standards or:
      1) 14.1 dB/100m for RG-6/U-type cables.
      2) 9.3 dB/100m for RG-11/U-type cables.
   c. Nominal impedance shall be 75 ohms.
   d. All cables installed in exterior conduits shall be gel filled moisture proof, direct burial type cable.

D. Video Cassette Recorder:
   1. Consumer grade 4 head VHS.
   2. Provide 4" LCD video monitor to view the VCR video output.

E. Enclosure:
   1. A custom enclosure shall be provided to enclose the VCR, 4" LCD monitor, audio volume control and associated equipment.
2. A power strip shall be included with a 3000 mm cord and a strain relief where the cord exits the enclosure. Power strip is not required to be supplied in the isolated ground configuration.

PART 3 - EXECUTION

3.1 GENERAL

A. Verify that conduit shown on the drawings is adequate to support the proposed system. If additional conduits are required or changes are required in size, make the required changes to the drawings. All changes in the conduit facilities shall be made at no additional cost to the Owner.

B. All headend equipment shall be rack mounted as shown on the drawings.

C. Refer to drawings for placement of equipment and panels. Coordinate with other trades which impact installation of these systems. Refer to functional and riser diagrams for system interconnections.

D. All trunking, riser and distribution cables shall be furnished and installed as required to support the system as specified.

E. All outlets (taps) shall be wall mounted as shown on the drawings and located adjacent to the duplex power convenience receptacle(s) in each space.

F. System shall be designed and installed to provide the nominal signal level at any outlet. Nominal signal level is 9 dBmv +/- 6dB with a +3dBmv signal input at the Owner furnished input as shown on the plans. It is recognized the signal level from local cable TV carrier may be greater than 3 dBmv and may vary from channel to channel.

G. Coordinate interface of facility system to the local cable carrier. The Owner or the Owner's local cable carrier will provide all level adjustment and other equipment that is necessary to make the local cable TV feed compatible with the MATV system.

H. Major trunking-to-distribution equipment such as distribution amplifiers, directional couplers, splitters, etc. shall be located in cabinets in equipment rooms as shown on the drawings.

I. Crimp on connectors shall be used for coaxial cable connectors. Twist on type connectors shall not be acceptable.

J. Set Attachment Cables: For each walltap outlet in the system, provide a set attachment cable consisting of a length of RG59/U coaxial cable with an "F" type connector at each end. The cables supplied shall be 1000 mm in length.

K. Riser cable shall be continuous from equipment room to equipment room.

L. Precautions shall be taken to ensure that CCTV cable is not used for MATV applications.

3.2 SURGE PROTECTION
A. Install surge protection on coaxial cables at all points the cables enter a building from the exterior in accordance with Section 17040 Grounding and Surge Protection.

3.3 COMPLETION

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat and orderly.

B. Testing: The completed system shall be tested by the Contractor prior to the acceptance test.

1. The signal level shall be tested at each jack for channel 2 (50 MHz) and channel 45 (350 MHz) with a +3 dBmv test signal input at the Owner furnished input as shown on the plans. Test results shall be recorded and compared to the calculated values required in the system drawings described in Section 17000. Test results and comparisons shall be submitted to the Contract officer as part of the complete test plan described in Section 17000.

2. Local origination shall be tested from the last walltap on each distribution run.

END OF SECTION
SECTION 17800
VEHICLE DETECTORS

PART 1 - GENERAL

1.1 GENERAL CONDITIONS

A. See the Conditions of the Contract (General, Supplementary and Special Conditions) and the General Requirements (Division 1).

1.2 WORK INCLUDED:

A. Furnish all materials and labor necessary to complete the installation of functional motion and vehicle detector systems as shown on the plans or specified herein.

1.3 RELATED WORK SPECIFIED ELSEWHERE:

A. The work of this Section is related to the work of the following Sections:

1. General Provisions (17000)

2. Wire and Cable (17020)

1.4 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:

A. National Electrical Code

1.5 COOPERATION WITH OTHER TRADES:

A. The Contractor shall coordinate the work of this Section with that of other Sections as required to ensure that the entire work of this project will be carried out in an orderly, complete and coordinated fashion.

1.6 SUBMITTALS:

A. General: Submittals shall be made in accordance with the General Provisions (Section 17000) of these specifications.

1.7 SYSTEM DESCRIPTION:

A. Vehicle detectors shall be furnished and installed at locations as shown on the drawings. Exact location of the detector shall be as recommended by the manufacturers of the vehicle detector.

B. Vehicle detectors used for an intercom "call-in" shall provide a momentary contact closure.

It shall be the responsibility of the Division 17 Contractor to extend relay contact circuits and to furnish and install any vehicle detector interface that may be required. Relay contact rating shall be compatible with system requirements.
PART 2 - PRODUCTS

2.1 MATERIALS:

A. Buried Sensor (Type A): (Not Used)

B. Loop Sensor (Type B):

1. Sensor shall be a loop inductance type with loop conductors installed in a saw cut.

2. Sensor unit shall be located in a weatherproof enclosure within 100 feet of the detention loop.

3. Sensor shall be solid state with relay outputs.

4. Relay A output shall indicate the presence of a vehicle.

5. Relay B output shall be capable of being programmed to provide an output either for the presence of a vehicle or pulsed for the entry or exit of a vehicle. Entry or exit modes shall be selectable.


7. Loop delay to inhibit output for rapidly moving vehicle.

8. Sensor shall be equipped with lightning protection devices.

9. Technical specifications for the vehicle detector shall be as follows:

<table>
<thead>
<tr>
<th>Specification</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Input:</td>
<td>24 VAC</td>
</tr>
<tr>
<td>Power:</td>
<td>4 watts</td>
</tr>
<tr>
<td>Output Relay Rating:</td>
<td>6A @ 150 VDC</td>
</tr>
<tr>
<td>Selectable Loop Frequencies:</td>
<td>4</td>
</tr>
<tr>
<td>Operating Temperature:</td>
<td>-40°F to 180°F</td>
</tr>
<tr>
<td>Mounting:</td>
<td>Relay Socket</td>
</tr>
</tbody>
</table>

10. Unit shall be Reno A and E Model B series or approved equal.

C. Photoelectric Sensors (Type C):

1. Photoelectric sensors shall be installed at each gate. Detection of a vehicle in the door opening when the door is closing shall cause the door to stop. The door shall continue to close when the obstruction is removed.

2. The units shall be constructed of aluminum with a weather-proof & tamperproof design for exterior use.
3. The units shall include a viewfinder alignment system.

4. The units shall be designed to filter out sunlight and extraneous light sources so that only the pulsed infrared signal from the transmitter is received.

5. The photo beam shall be vertically and horizontally adjustable for optimum focusing of the signal.

6. The response time for activation shall be adjustable.

7. Technical specifications for the photoelectric vehicle detector shall be as follows:
   - Input Power: 10-18 VAC-DC
   - Alarm Output: Form C contact rated for 0.1A at 50V AC or DC.
   - Operating Temperature: -20 degrees to 125 degrees F.

8. Vehicle detector shall be Aleph HA series or approved equal.

D. Microwave Vehicle Detector (Type D):

1. Shall utilize stereo Doppler microwave at 10.525MHz as the vehicle detection technology.

2. Shall have a weather tight enclosure.

3. The system shall be solid state with isolated form C relay outputs to perform the functions noted in the specifications.

4. Adjustable relay reset time of 1 second to 15 seconds.

5. Adjustable detection range of 5 to 40 feet in width and 5 to 80 feet in length.

6. Detection of vehicle moving at a rate of 1 to 30 mph.

7. Shall have selectable direction control to only detect vehicles approaching, vehicles receding, or vehicles approaching and receding.

8. The circuits shall be optimized for lightning protection including sensor, line and ground circuits.

9. System shall be furnished complete with power supplies and protection fuses.

10. Technical specifications for the vehicle detector shall be as follows:
    - Power Input: 10 to 14 VAC or 12 to 18 VDC
    - Current Requirement: 200 mA maximum
    - Output Relay Rating: Minimum 2 Amp SPDT at 24 VAC
Operating Temperature: -30° to 130° F

11. Vehicle detector shall be Protech model HT100VD or approved equal.

PART 3 - EXECUTION

3.1 EXECUTION:

A. Contractor shall verify that conduit shown on the plans is adequate to support the proposed system. If additional conduits are required or changes are required in size, Contractor shall install required conduit facilities at no additional cost to the Owner.

B. Refer to drawings for placement of equipment and panels. In general, vehicle detector equipment shall be mounted in the base of the intercom pedestal or in the vehicle detector cabinet where shown on the drawings. Coordinate with other trades which impact installation of these systems.

C. Cables shall be furnished and installed as required to support the system requirements.

D. Each vehicle detector output shall be connected as an individual input to the PLC to allow the control and monitoring logic to be revised as required to effect the desired results. For example, a vehicle detector used for intercom calls may need to be disabled while the gate is open to eliminate nuisance calls. Provide all programming necessary to ensure that vehicles do not initiate nuisance calls.

3.2 COMPLETION:

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat and orderly.

B. Testing:

1. Contractor shall test system completely prior to acceptance tests.

2. Acceptance tests shall be conducted by the Owner or Owner's Representative to ensure compliance with plans and specifications.

END OF SECTION
SECTION 17850
ELEVATOR CONTROL INTERFACE

PART 1 - GENERAL

1.1 GENERAL CONDITIONS:

A. General: The Conditions of the Contract (General, Supplementary and other Conditions) and the General Requirements (Sections of Division 1) are hereby made a part of this Section.

1.2 WORK INCLUDED:

A. Included in this Section of the Work shall be the furnishing, installation, connection and testing of the Security/Elevator Control Interface system for elevators which service the facility. The Security/Elevator Control Interface shall include console controls, programmable logic controllers (PLCs), relay interfaces, card readers, and Security Management System outputs, as required to effect the system described herein. Division 17 shall be responsible for mounting and terminating Security and Communications Systems devices located in the elevator cars as shown on drawings.

1.3 WORK EXCLUDED:

A. Elevator control system including master elevator controls, car and lobby indicator lights and push buttons shall be provided by Division 14. Cabling for Security and Communications Systems devices located in the elevator cars shall be provided by Division 14 from the termination cabinet to the elevator car. Division 17 shall be responsible for the wire terminations for these devices. Division 14 shall be responsible for furnishing wiring and labor for terminations from the elevator controls to the Security/Elevator Control Interface terminal blocks.

1.4 RELATED WORK SPECIFIED ELSEWHERE:

A. The work of this Section is related to the work of the following Divisions and Sections:

1. Division 14 - Elevators
2. Division 16 - Conduits
3. Section 17020 - Conductors
4. Section 17160 - Programmable Logic Controllers
5. Section 17200 - Closed Circuit Television System
6. Section 17260 - Dedicated Intercom and General Paging
7. Section 17300 - Control Panels
8. Section 17350 - Security Management System
9. Section 17600 - Personal Alarm System

1.5 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:
A. National Electric Code
B. NFPA

1.6 COOPERATION WITH OTHER TRADES:
A. The Contractor shall coordinate the work of this Section with that of other Sections as required to ensure that the entire work of this Project will be carried out in an orderly, complete and coordinated fashion.
   1. Coordinate with Division 14 for providing Security System inputs and outputs to Security/Elevator Controls Interface terminal blocks.
   2. Coordinate with Division 14 for providing software programming to effect system operation as described in this Section.
   3. Coordinate with Division 14 for providing cabling for elevator car mounted security system devices.
   4. Coordinate with Division 14 for locating and mounting security devices associated with elevator system controls.
   5. Coordinate with Division 14 and Division 16 for providing conduits for security devices associated with elevator system controls.

1.7 SUBMITTALS:
A. General: Submittals shall be made in accordance with the General Provisions (Section 17000) of these specifications.
B. Specific Requirements:
   1. Submit catalog cut sheets for all equipment and devices furnished under this section.
   2. Submit shop drawings showing mounting details for devices mounted in the cars and in the elevator lobbies.
   3. Submit point-to-point wiring diagrams for the complete security system elevator controls up to the interface to the elevator control system.

1.8 SYSTEM DESCRIPTION:
A. Definitions:
   The following definition of function or indications shall apply to the descriptions contained herein.
1. "CAR CALL" - Push button for each elevator car to select destination floor(s). May be push button in car or on remote panel.

2. "INSPECTION MODE" - Mode of operation typically used by maintenance personnel to override normal controls and capture local control of the car via a switch typically located on top exterior of the elevator car.

3. "CALL CANCEL" – Clears any existing calls and stops the elevator so that the control position can re-direct the elevator at anytime.

4. "MANUAL MODE SELECT" – Disables panel in the car and hall pushbuttons and enables remote manual operation from Master Control.

5. "LOCAL MODE SELECT" – Disables remote manual operation from Master Control and enables panel in the car and hall pushbuttons and/or keyswitches.

6. "HALL CARD READER" – Closes contact for five seconds when an valid card is read in the elevator lobby to enable the call pushbutton(s). (Elevator 5 Only)

7. "CAR CARD READER" – Closes contact for five seconds when an valid card is read in the elevator car to enable the floor select pushbutton(s). (Elevator 5 Only)

1.9 SYSTEM DESCRIPTION:

A. Remote Console Controls: Push buttons and indicators shall be integrated into the Master Control panels and connected to the Security/Elevator Control interface as required to effect remote elevator control as described in Section 14211 and as shown on Division 17 drawings.

B. Card Access System: Card Readers shall be provided in elevator cars as described in Section 17350 and connected to the Security/Elevator Control interface as required to effect card access control to effect the elevator control scheme as described in Section 14211.

C. Security/Elevator Control Interface: A termination cabinet shall provided to effect an interface point between the Security System and the Elevator Control System. Table 17850-1 describes the minimum outputs and inputs required from the Security and Communications System to the Elevator Controls to effect the Elevator System operation as described in Section 14211. All outputs to the Elevator Control System shall be discrete dry contact closures. Provide additional outputs and inputs necessary to effect complete control and monitoring.
D. Elevators 1, 2, 3, & 4 General Operation: Master Control shall have complete control of the elevators in the Manual Mode. Intercoms shall be provided in each car and on each floor to facilitate the Manual Mode. In Manual Mode, the control panel shall mimic the switches and indicators available on the car panel. The car panel and the hall call select switches shall be active in the Local Mode and the Master Control control functions shall be disabled. Monitoring functions at Master Control shall remain active when in the Local Mode so that Master Control can observe the elevator location and floor selections.

E. Elevator 5 General Operation: To direct visitor movement, remote manual operation from CP-PL (Public Lobby) shall always be active (unless transferred to Master Control). Intercoms shall be provided in each car and on each floor to facilitate the Manual Mode. To facilitate staff movement, card readers shall be provided on each floor and in the elevator car. The reader on each floor shall activate the hall call pushbutton(s). The card reader in the car shall enable the switches on the control panel in the car.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Interface Cabinet: Shall be installed by the Division 17 Contractor and located near the elevator control cabinet. The interface cabinet shall be constructed as described in Section 17050. Sliding link terminal blocks shall be provided for all terminations to interface with the elevator controls. The sliding links shall provide electrical isolation of the Security System and the Elevator System controls for maintenance and troubleshooting.

B. CCTV Cameras: Shall be furnished and installed in the elevator cars by Division 17 as described in Section 17200 and as shown on the drawings.

C. Paging Speakers: Shall be furnished and installed in the elevator cars by Division 17 as described in Section 17260 and as shown on the drawings.

D. Intercom Stations: Shall be furnished and installed in the elevator cars by Division 17 as described in Section 17260 and as shown on the drawings.

E. Card Readers: Shall be furnished and installed in the elevator cars by Division 17 as described in Section 17350 and as shown on the drawings.

F. Miscellaneous Hardware: Contractor shall furnish and install miscellaneous hardware and materials as required to effect a complete and functional system up to and including the Security/Elevator Interface Cabinet.

PART 3 - EXECUTION

3.1 EXECUTION:

A. Interface Input and Outputs:

1. Provide outputs to the Security/Elevator Control Interface as described in Table 17850-1.
2. Connect to inputs from the Security/Elevator Control Interface as described in Table 17850-1.

B. System Cabling:

1. Furnish electrical cables for Security and Communications System devices installed in elevator cars. The cables shall be integrated into the elevator electrical wiring harness by Division 14.

2. Division 17 shall be responsible for terminating the cabling to the Security and Communications Systems devices.

3. Division 16 shall be responsible for furnishing and installing the conduits and raceways from the Security/Elevator Control Interface cabinets to the elevator equipment cabinets.

C. Terminal Labeling: All terminals provided as Input/Output points to the Elevator Controls shall be clearly labeled for termination by the Division 14 systems.

3.2 COMPLETION:

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat and orderly.

B. Testing: The completed system shall be tested prior to acceptance testing by the Owner or Owner’s representative.
### TABLE 17850-1

**ELEVATOR CONTROL INTERFACE**

**INPUTS/OUTPUTS**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>LEVEL</th>
<th>ELEV</th>
<th>INPUT/OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car Call</td>
<td>1</td>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td>Car Call</td>
<td>2</td>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td>Car Call</td>
<td>3</td>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td>Car Call</td>
<td>4</td>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>1</td>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>2</td>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>3</td>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>4</td>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>1</td>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>2</td>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>3</td>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>4</td>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td>Door Open</td>
<td>N/A</td>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td>Door Close</td>
<td>N/A</td>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td>Call Cancel</td>
<td>N/A</td>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td>Manual Mode Select</td>
<td>N/A</td>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td>Manual Mode Indication</td>
<td>N/A</td>
<td>1</td>
<td>Input</td>
</tr>
<tr>
<td>Local Mode Select</td>
<td>N/A</td>
<td>1</td>
<td>Output</td>
</tr>
<tr>
<td>Local Mode Indication</td>
<td>N/A</td>
<td>1</td>
<td>Input</td>
</tr>
<tr>
<td>DESCRIPTION</td>
<td>LEVEL</td>
<td>ELEV</td>
<td>INPUT/OUTPUT</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------</td>
<td>------</td>
<td>--------------</td>
</tr>
<tr>
<td>Car Call</td>
<td>1</td>
<td>2</td>
<td>Output</td>
</tr>
<tr>
<td>Car Call</td>
<td>2</td>
<td>2</td>
<td>Output</td>
</tr>
<tr>
<td>Car Call</td>
<td>3</td>
<td>2</td>
<td>Output</td>
</tr>
<tr>
<td>Car Call</td>
<td>4</td>
<td>2</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>1</td>
<td>2</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>2</td>
<td>2</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>3</td>
<td>2</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>4</td>
<td>2</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>1</td>
<td>2</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>2</td>
<td>2</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>3</td>
<td>2</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>4</td>
<td>2</td>
<td>Output</td>
</tr>
<tr>
<td>Door Open</td>
<td>N/A</td>
<td>2</td>
<td>Output</td>
</tr>
<tr>
<td>Door Close</td>
<td>N/A</td>
<td>2</td>
<td>Output</td>
</tr>
<tr>
<td>Call Cancel</td>
<td>N/A</td>
<td>2</td>
<td>Output</td>
</tr>
<tr>
<td>Manual Mode Select</td>
<td>N/A</td>
<td>2</td>
<td>Output</td>
</tr>
<tr>
<td>Manual Mode Indication</td>
<td>N/A</td>
<td>2</td>
<td>Input</td>
</tr>
<tr>
<td>Local Mode Select</td>
<td>N/A</td>
<td>2</td>
<td>Output</td>
</tr>
<tr>
<td>Local Mode Indication</td>
<td>N/A</td>
<td>2</td>
<td>Input</td>
</tr>
</tbody>
</table>
TABLE 17850-1

ELEVATOR CONTROL INTERFACE

INPUTS/OUTPUTS

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>LEVEL</th>
<th>ELEV</th>
<th>INPUT/OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car Call</td>
<td>B</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Car Call</td>
<td>1</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Car Call</td>
<td>2</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Car Call</td>
<td>3</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Car Call</td>
<td>4</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>B</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>1</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>2</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>3</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>4</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>B</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>1</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>2</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>3</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>4</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Door Open</td>
<td>N/A</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Door Close</td>
<td>N/A</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Call Cancel</td>
<td>N/A</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Manual Mode Select</td>
<td>N/A</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Manual Mode Indication</td>
<td>N/A</td>
<td>3</td>
<td>Input</td>
</tr>
<tr>
<td>Local Mode Select</td>
<td>N/A</td>
<td>3</td>
<td>Output</td>
</tr>
<tr>
<td>Local Mode Indication</td>
<td>N/A</td>
<td>3</td>
<td>Input</td>
</tr>
<tr>
<td>DESCRIPTION</td>
<td>LEVEL</td>
<td>ELEV</td>
<td>INPUT/OUTPUT</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-------</td>
<td>------</td>
<td>--------------</td>
</tr>
<tr>
<td>Car Call</td>
<td>B</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Car Call</td>
<td>1</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Car Call</td>
<td>2</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Car Call</td>
<td>3</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Car Call</td>
<td>4</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>B</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>1</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>2</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>3</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>4</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>B</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>1</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>2</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>3</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>4</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Door Open</td>
<td>N/A</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Door Close</td>
<td>N/A</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Call Cancel</td>
<td>N/A</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Manual Mode Select</td>
<td>N/A</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Manual Mode Indication</td>
<td>N/A</td>
<td>4</td>
<td>Input</td>
</tr>
<tr>
<td>Local Mode Select</td>
<td>N/A</td>
<td>4</td>
<td>Output</td>
</tr>
<tr>
<td>Local Mode Indication</td>
<td>N/A</td>
<td>4</td>
<td>Input</td>
</tr>
</tbody>
</table>
### TABLE 17850-1

**ELEVATOR CONTROL INTERFACE**

**INPUTS/OUTPUTS**

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>LEVEL</th>
<th>ELEV</th>
<th>INPUT/OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car Call</td>
<td>B</td>
<td>5</td>
<td>Output</td>
</tr>
<tr>
<td>Car Call</td>
<td>1</td>
<td>5</td>
<td>Output</td>
</tr>
<tr>
<td>Car Call</td>
<td>2</td>
<td>5</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>B</td>
<td>5</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>1</td>
<td>5</td>
<td>Output</td>
</tr>
<tr>
<td>Call Indication</td>
<td>2</td>
<td>5</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>B</td>
<td>5</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>1</td>
<td>5</td>
<td>Output</td>
</tr>
<tr>
<td>Car Location</td>
<td>2</td>
<td>5</td>
<td>Output</td>
</tr>
<tr>
<td>Hall Card Reader</td>
<td>B</td>
<td>5</td>
<td>Output</td>
</tr>
<tr>
<td>Hall Card Reader</td>
<td>1</td>
<td>5</td>
<td>Output</td>
</tr>
<tr>
<td>Hall Card Reader</td>
<td>2</td>
<td>5</td>
<td>Output</td>
</tr>
<tr>
<td>Door Open</td>
<td>N/A</td>
<td>5</td>
<td>Output</td>
</tr>
<tr>
<td>Door Close</td>
<td>N/A</td>
<td>5</td>
<td>Output</td>
</tr>
<tr>
<td>Call Cancel</td>
<td>N/A</td>
<td>5</td>
<td>Output</td>
</tr>
<tr>
<td>Car Card Reader</td>
<td>N/A</td>
<td>5</td>
<td>Output</td>
</tr>
</tbody>
</table>

*END OF SECTION*
PART 1 - GENERAL

1.1 GENERAL CONDITIONS:
   A. General: The Conditions of the Contract (General, Supplementary and other Conditions) and the General Requirements (Sections of Division 1) are hereby made a part of this Section.

1.2 WORK INCLUDED:
   A. Included in this Section of the Work shall be the furnishing, installation, connection and testing of the utility control interfaces for the facility.

1.3 WORK EXCLUDED:
   A. Division 16 shall be responsible for the lighting system.

1.4 RELATED WORK ELSEWHERE:
   A. The work of this Section is related to the work of the following Divisions and Sections:
      1. Section 17160 - Programmable Logic Controllers
      2. Section 17170 - Security Monitoring and Control System
      3. Section 17300 - Control Panels

1.5 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:
   A. National Electric Code

1.6 COOPERATION WITH OTHER TRADES:
   A. The Contractor shall coordinate the work of this Section with that if other Sections as required to ensure that the entire work of this Project will be carried out in an orderly, complete and coordinated fashion.
      1. Coordinate with Division 16 for providing interface terminal blocks.

1.7 SUBMITTALS:
   A. General: Submittals shall be made in accordance with the General Provisions (Section 17000) of these specifications.
   B. Specific Requirements:
      1. Submit catalog cut sheets for all equipment and devices furnished under this section.
2. Submit shop drawings showing mounting details for interface cabinets.

3. Submit point-to-point wiring diagrams for the complete control system.

1.8 SYSTEM DESCRIPTION:

A. Definitions:

1.9 SYSTEM DESCRIPTION:

A. Cell lights and dayroom lights, shall be controlled from the touchscreens. Division 16 shall provide Low Voltage Termination Lighting Relay Panels. Division 17 shall extend control circuits from the SEC’s to the Low Voltage Termination Lighting Relay Panels. See drawings for equipment locations and specific requirements. The following controls shall be interfaced to the Division 16 Low Voltage Termination Cabinets. See drawings for circuit configurations and number of circuits.

1. Cell Lighting:
   a. Switch cell light by groups on bypassing the switch in the cell.
      Label control icon ON and NORMAL.

2. Dayroom Lighting:
   a. Switch ON and OFF dayroom lights.

3. Other area Lighting:
   a. Switch ON and OFF.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. Interface Cabinet: Shall be installed by the Division 17 Contractor and located near the lighting control cabinet. The interface cabinet shall be constructed as described in Section 17050. Sliding link terminal blocks shall be provided for all terminations to interface with the elevator controls. The sliding links shall provide electrical isolation of the Security System and the Lighting System controls for maintenance and troubleshooting.

B. Miscellaneous Hardware: Contractor shall furnish and install miscellaneous hardware and materials as required to effect a complete and functional system up to and including the Lighting Interface Cabinet.

PART 3 - EXECUTION

3.1 EXECUTION:

A. Interface Input and Outputs:

1. Provide outputs to the Lighting Control Interface as described in Table 17860-1.
2. Outputs shall be dry contacts rated at 2A, 300VAC. Contacts shall be closed for "lights on" condition and open for "lights off" condition.

B. System Cabling:

1. Furnish all electrical cables between the interface cabinet and the control panels.

2. Division 17 shall be responsible for terminating the cabling to the Security and Communications Systems devices.

3. Division 16 shall be responsible for furnishing and installing the conduits and raceways from the Lighting Control Interface cabinets to the light fixtures.

C. Terminal Labeling: All terminals provided as Input/Output points to the lighting controls shall be clearly labeled for termination by the Division 16 systems.

3.2 COMPLETION:

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and the like and leave the premises clean, neat and orderly.

B. Testing: The completed system shall be tested prior to acceptance testing by the Owner or Owner's representative.
<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>CONTROL PANEL</th>
<th>LOCATION</th>
<th>INPUT/OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Booking, Holding Cells</td>
<td>CP-WC</td>
<td>Rm 1.08 &amp; 1.04</td>
<td>Output</td>
</tr>
<tr>
<td>Front Lobby</td>
<td>CP-LC &amp; CP-MC</td>
<td>Rm 1.08</td>
<td>Output</td>
</tr>
<tr>
<td>Parking Lot</td>
<td>CP-MC</td>
<td>Rm. B.03</td>
<td>Output</td>
</tr>
<tr>
<td>EA Dayroom</td>
<td>CP-E</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>EA Sleeping Upper</td>
<td>CP-E</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>EA Sleeping Lower</td>
<td>CP-E</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>EB Dayroom</td>
<td>CP-E</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>EB Cells Upper</td>
<td>CP-E</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>EB Cells Lower</td>
<td>CP-E</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>EC Dayroom</td>
<td>CP-E</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>EC Cells Upper</td>
<td>CP-E</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>EC Cells Lower</td>
<td>CP-E</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>ED Dayroom</td>
<td>CP-E</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>ED Sleeping Upper</td>
<td>CP-E</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>ED Sleeping Lower</td>
<td>CP-E</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
</tbody>
</table>

Note: Five contactors operated by one function.
TABLE 17860-1  
LIGHTING CONTROL INTERFACE  
(Continued)  

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>CONTROL PANEL</th>
<th>CONTACTER LOCATION</th>
<th>INPUT/OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>NA Dayroom ON/OFF</td>
<td>CP-N</td>
<td>Rm 3.12</td>
<td>Output</td>
</tr>
<tr>
<td>NA Cells Upper ON/LOCAL</td>
<td>CP-N</td>
<td>Rm 3.12</td>
<td>Output</td>
</tr>
<tr>
<td>NA Cells Lower ON/LOCAL</td>
<td>CP-N</td>
<td>Rm 3.12</td>
<td>Output</td>
</tr>
<tr>
<td>NB Dayroom ON/OFF</td>
<td>CP-N</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>NB Cells Upper ON/LOCAL</td>
<td>CP-N</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>NB Cells Lower ON/LOCAL</td>
<td>CP-N</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>DESCRIPTION</td>
<td>CONTROL PANEL</td>
<td>CONTACTOR LOCATION</td>
<td>INPUT/OUTPUT</td>
</tr>
<tr>
<td>----------------------</td>
<td>---------------</td>
<td>--------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>WA Dayroom ON/OFF</td>
<td>CP-W</td>
<td>Rm 3.12</td>
<td>Output</td>
</tr>
<tr>
<td>WA Sleeping Upper ON/OFF</td>
<td>CP-W</td>
<td>Rm 3.12</td>
<td>Output</td>
</tr>
<tr>
<td>WA Sleeping Lower ON/OFF</td>
<td>CP-W</td>
<td>Rm 3.12</td>
<td>Output</td>
</tr>
<tr>
<td>WB Dayroom ON/OFF</td>
<td>CP-W</td>
<td>Rm 3.12</td>
<td>Output</td>
</tr>
<tr>
<td>WB Sleeping Upper ON/OFF</td>
<td>CP-W</td>
<td>Rm 3.12</td>
<td>Output</td>
</tr>
<tr>
<td>WB Sleeping Lower ON/OFF</td>
<td>CP-W</td>
<td>Rm 3.12</td>
<td>Output</td>
</tr>
<tr>
<td>WC Dayroom ON/OFF</td>
<td>CP-W</td>
<td>Rm 3.12</td>
<td>Output</td>
</tr>
<tr>
<td>WC Sleeping Upper ON/OFF</td>
<td>CP-W</td>
<td>Rm 3.12</td>
<td>Output</td>
</tr>
<tr>
<td>WC Sleeping Lower ON/OFF</td>
<td>CP-W</td>
<td>Rm 3.12</td>
<td>Output</td>
</tr>
<tr>
<td>WD Dayroom ON/OFF</td>
<td>CP-W</td>
<td>Rm 3.12</td>
<td>Output</td>
</tr>
<tr>
<td>WD Sleeping Upper ON/OFF</td>
<td>CP-W</td>
<td>Rm 3.12</td>
<td>Output</td>
</tr>
<tr>
<td>WD Sleeping Lower ON/OFF</td>
<td>CP-W</td>
<td>Rm 3.12</td>
<td>Output</td>
</tr>
</tbody>
</table>
### TABLE 17860-1

**LIGHTING CONTROL INTERFACE**
(Continued)

<table>
<thead>
<tr>
<th>DESCRIPTION</th>
<th>CONTROL PANEL</th>
<th>CONTACTOR LOCATION</th>
<th>INPUT/OUTPUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>SA Dayroom ON/OFF</td>
<td>CP-S</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>SA Sleeping Upper ON/OFF</td>
<td>CP-S</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>SA Sleeping Lower ON/OFF</td>
<td>CP-S</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>SB Dayroom ON/OFF</td>
<td>CP-S</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>SB Cells Upper ON/LOCAL</td>
<td>CP-S</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>SB Cells Lower ON/LOCAL</td>
<td>CP-S</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>SC Dayroom ON/OFF</td>
<td>CP-S</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>SC Cells Upper ON/LOCAL</td>
<td>CP-S</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>SC Cells Lower ON/LOCAL</td>
<td>CP-S</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>SD Dayroom ON/OFF</td>
<td>CP-S</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>SD Sleeping Upper ON/OFF</td>
<td>CP-S</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
<tr>
<td>SD Sleeping Lower ON/OFF</td>
<td>CP-S</td>
<td>Rm 3.07</td>
<td>Output</td>
</tr>
</tbody>
</table>

Note: Include a single icon for each control panel to for “ALL ON” and “ALL OFF/LOCAL” to affect all lighting contactors for blocks A, B, C, & D.

**END OF SECTION**
PART 1 - GENERAL

1.1 GENERAL CONDITIONS:
A. See the Conditions of the Contract (General, Supplementary and Special Conditions) and the General Requirements (Division 1).

1.2 WORK INCLUDED:
A. Furnish all materials necessary to complete the installation of a functional, stand-alone, Uninterruptible Power System (UPS) as indicated on the drawings, specified herein or both. The work of this Section includes, but is not limited to:
   1. Inverter/charger with automatic transfer.
   2. Battery pack.
   3. UPS by-pass switch.
   4. UPS distribution panel
   5. Options that may be required to achieve a fully operational system.

1.3 RELATED WORK SPECIFIED ELSEWHERE:
A. The work of this Section is related to the work of the following sections.
   1. General Provisions (17000)
   2. All Division 17 Sections

1.4 REFERENCE SPECIFICATIONS, MATERIALS, AND/OR CODES:
A. National Electrical Code

1.5 COORDINATION WITH OTHER TRADES:
A. The Contractor shall coordinate the work of this Section with that of other sections as required to ensure that the entire work of this Project will be carried out in an orderly, complete and coordinated fashion.

1.6 SUBMITTALS:
A. General: Submittals shall be made in accordance with the General Provisions (Section 17000) of these specifications.
B. Specific Requirements:
1. Submit catalog cuts for all equipment and devices being furnished under this Section.

2. Submit system diagram of UPS power distribution including size and location of UPS units and description of size and type of load for each UPS unit.

3. Load summary of each UPS unit. Load summary shall identify the actual measured loads or calculated loads for each specific load. Loads shall be based on equipment to be furnished and installed.

1.7 SYSTEM DESCRIPTION:

A. General:

1. The primary function of the uninterruptible power systems (UPS) is to ensure that critical security electronics and communications systems elements remain operational and without errors caused by power line disturbances or interruptions.

2. All security electronics and communications systems, including door locks, shall be powered from the facility emergency power bus and therefore the UPS is intended to bridge relatively short power interruptions of the emergency power source.

3. During periods when the emergency power source is not available, such as during generator power start and transfer, the UPS will ensure that critical system elements are powered from the UPS and will ensure integrity of the system upon return of emergency power.

B. Operation:

System operations shall be as follows:

1. Normal - The critical load is continuously controlled by the inverter. The inverter charger derives power as needed from the commercial ac source and supplies filtered ac power to the critical load. In addition, simultaneous float charging of the battery occurs.

2. Emergency - Upon failure of the commercial ac power the critical load continues to be supplied by the inverter, which without any manual switching, obtains its power from the storage battery. There shall be no interruption to the critical load upon failure or restoration of the commercial ac source.

3. Recharge - Upon restoration of the commercial ac source, the inverter charger recharges the battery. This is an automatic function and causes no interruption to the critical load.

C. System Configuration:

1. Run time - Each UPS units shall be equipped with a battery system to facilitate a full load run time of one hour (minimum) based on the rated capacity of the installed unit.
2. Due to the variation of equipment types which the Division 17 Contractor may furnish, it shall be the Contractor's responsibility to submit detail sizing calculations to the engineer for review prior to equipment purchase. Supporting technical data for electrical loads shall be submitted with the sizing calculations. If the power requirements of the equipment selected by the Division 17 contractor exceeds the capacity of the electrical distribution system, the contractor shall be responsible for the costs associated with increasing the capacity of the electrical distribution system.

D. Alarm Reporting:

1. UPS alarms shall be annunciated on the operator terminal located in Central Control.

2. All UPS alarms shall be logged on the data logger. A report titled "UPS Alarms" shall be generated as part of the alarm reporting system.

PART 2 - PRODUCTS

2.1 MATERIALS:

A. UPS System:

1. UPS systems shall be manufactured by APC, Liebert UPStation S Series, or approved equal.

2. Each UPS unit shall be sized as described herein.

3. Supply voltage to the UPS shall be either 120 or 240 volt, single phase, 60 Hz. Division 17 shall provide and install dry-type transformers for 240 volt supplies.

4. Division 17 shall provide over-current protection per the NEC.

5. Each UPS shall be equipped with an external by-pass switch with AC disconnect.

6. Output voltage shall be 120V, single phase, 60 Hz.

7. Software package for IBM MS-DOS compatible computer and 6 foot cable with connectors for connection to laptop computer for maintenance diagnostics.

8. UPS alarm output shall be provided to interface with the alarm reporting system as described in Section 17170 titled Security Monitoring and Control System.

9. Units shall be equipped with sealed batteries.

10. Units smaller than 4KVA shall be rack mounted.
11. UPS unit shall have separate dry contact outputs for "UPS on battery" and "UPS Trouble". The contacts shall be wired so that they open in alarm. If required, additional on board interface cards shall be provided.
   
a. The "UPS on battery" contact shall open when the utility power fails and the UPS is powered by its batteries.
   
b. The UPS shall automatically run diagnostics at least once every 40 days to check the condition of the batteries and UPS electronics. The "UPS Trouble" contact shall open when the UPS detects:
      
i. A fault in the battery or UPS electronics.
      
ii. An over temperature condition.
      
iii. The UPS is overloaded.

B. Maintenance Bypass Switch:

1. Each UPS unit shall be provided with an external "break before make" bypass switch. The bypass switch shall be fast acting so that there is no interruption of the output power. The switch shall be universally designed so that it can be used with UPS's manufactured by a company other then the manufacturer of the bypass switch.

2. The connections to the bypass switch from the utility power, the connected UPS, and the load shall be as follows:
   
a. The connections to the bypass switch from the utility power shall be made with hardwired connections.
   
b. The connections between the bypass switch and the connected UPS shall be made with standard NEMA electrical receptacles and plugs.
   
c. The connections to the load from the bypass switch shall be made with hardwired connections.

3. The transfer time for the bypass switch shall be less then 6 milliseconds.

4. The by-pass switch shall be rack mounted.

5. The Maintenance Bypass Switch shall be compatible with the UPS.

6. The Maintenance Bypass Switch for the smaller UPS's shall be rated for at least 15 amps. The Maintenance Bypass Switch for the mid-size UPS's shall be rated for at least 20 amps. The Maintenance Bypass Switch for the larger UPS's shall be rated for at least 30 amps.

7. The by-pass switch shall be the Liebert POD series or approved equal.
PART 3 - EXECUTION

3.1 EXECUTION:

A. Contractor shall ensure that all equipment is installed and operated in accordance with the manufacturer's recommendations.

B. All connections to UPS equipment shall be hard wired.

C. Wire both alarm output contacts of each UPS to the Security Monitoring and Control System via PLC I/O modules as alarm inputs and display all UPS alarms at the Central Control touchscreens. The PLC system shall monitor the "On battery" alarm status for each UPS and time the event so the alarm to Central Control is activated only after the "On Battery" alarm status has been active for five (5) minutes.

3.2 COMPLETION:

A. Testing:

   1. Contractor shall inspect and test the installation and operation of the systems completely prior to acceptance tests.

   2. Acceptance tests shall be conducted by the Owner or Owner's representative to ensure compliance with plans and specifications.

3.3 TABLES

A. UPS units shall be sized no small than as indicated on the following tables.

TABLE 17900-1

UPS MINIMUM SIZE REQUIREMENTS

<table>
<thead>
<tr>
<th>SHEET</th>
<th>LOCATION</th>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>SE200</td>
<td>SEC-B</td>
<td>4 KVA</td>
</tr>
<tr>
<td>SE201</td>
<td>SEC-1</td>
<td>6 KVA</td>
</tr>
<tr>
<td>SE202</td>
<td>SEC-2</td>
<td>12 KVA</td>
</tr>
<tr>
<td>SE202</td>
<td>SEC-2A</td>
<td>13 KVA</td>
</tr>
<tr>
<td>SE203</td>
<td>SEC-3</td>
<td>10 KVA</td>
</tr>
<tr>
<td>SE203M</td>
<td>SEC-4</td>
<td>8 KVA</td>
</tr>
</tbody>
</table>

END OF SECTION