

NEW BUILDING FEASIBILITY STUDY

White Mountain Fire Department
25474 US-6
Benton, CA 93512



April 1, 2025

Submitted by:



HMRARCHITECTS

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EXECUTIVE SUMMARY

The following is a feasibility and cost assessment report for a newly built fire department for the White Mountain Fire Protection District. This report is provided by HMR Architects and its MEP consultant, Sacramento Engineering Consultants. The proposed building is to replace the antiquated fire department located at 25474 Highway 6 in Benton, CA.

The current fire department apparatus bay was re-purposed from an older, relocated steel frame horse barn. Because the re-purposed barn was never designed for its current use, there are existing problems for utilizing as an apparatus bay, including weather sealing, storm water inclusion, and lack of proper interior space for apparatuses, offices, and other program functions. The White Mountain Fire Department has commissioned HMR to provide a feasibility assessment report to study the site, then provide schematics designs, and a cost estimate for a new fire department apparatus building, including an administrative office, training room, and temporary living space and site amenities. The site and design are to be compliant with the current state and international building energy code. The existing site is currently owned by the White Mountain Fire Department.

For the study, HMR visited the existing Benton site to survey the existing conditions, including the existing steel barn used as an apparatus bay and the auxiliary building in the back used for training, cooking, and bunking. After research with the White Mountain team and the site, the program is proposed to incorporate the following amenities:

Site:

- Demolition of existing buildings
- Demolition of existing utilities
- Grading and Paving
- Utilities (electricity, phone, water and sewer)
- High Capacity Storm Water Treatment & Storage System
- Flagpole
- Trash Enclosure
- On site sidewalks
- Landscape/Irrigation
- Site Lighting
- Storm Drainage Interceptor and Diversion
- Fencing and Gates
- Parking located in open lot in the front and by gate access in the rear
- 30,000 Gallon Water Storage Tank
- 30' x 50' Training Area
- 500 Gallon propane tank
- Communications Antenna
- Backup Generator
- Hose Drying Rack
- Access Road for Gate Access on rear of property
- Exterior Speaker System

EXECUTIVE SUMMARY

Interior:

Apparatus Bay with storage for 6 vehicles

Mezzanine Equipment Storage

Extractor Room with lockers

Multi-Purpose Room that can be used as the following:

Day Room with Kitchenette

Training Room for 16-20 occupants

Administrative Office

Restrooms

Bedrooms for overnight stay

Mechanical Room / Electrical Room

The following reports and drawings are the findings and proposed solutions provided by HMR Architects and Sacramento Engineering Consultants.



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MECHANICAL, FIRE PROTECTION, AND ELECTRICAL ENGINEERING SERVICES

December 17, 2024

Subject: White Mountain Fire District-Fire Station- Mech & Plumb Feasibility Study

SEC # 24528 (PRELIMINARY REPORT)

MPE design scope for the proposed utilities, electrical service size, HVAC, water, sewer, fire water, fire sprinkler tank, fire pump, fire alarm, low voltage systems, emergency generator, etc. HVAC system call out only. Gas, water, sewer, fire water pipe, pipe sizes will be provided. Fire water tank and fire pump will be sized.

Mechanical-HVAC

The proposal HVAC system includes radiant floor heating as primary heating and forced air ducted split system heat pump as secondary heating. The radiant floor heating will consist of four (4) zones: Sleeping quarters, Training room, Office/Laundry and Day Room with Kitchen and Restrooms.

The Radiant floor system consists of the following:

- A. One (1) High efficient, Condensing Boiler, 160,000 Btu/h.
 - i. Concentric vent kit for combustion air with roof termination and flashing.
 - ii. Condensate piping to floor drain.
 - iii. Gas piping from propane tank to Boiler.
- B. Manifold with four (4) zones with control valves.
- C. PEX tubing and fittings.
- D. Zone Controls.

The Forced Air Split System consists of the following:

- A. Four (4) Multipoise Vertical Ducted Fan Coil, Supply/Return Plenum, Filter mixing box.
- B. One (1) Outdoor Heat Pump/VRF unit located on concrete pad with snow hood.
- C. Attic ductwork, ceiling supply boxes/registers and ceiling return boxes/grilles.
- D. Branch Controller, refrigerant piping to branch controller/fan coils/outdoor unit (2-pipe system), Zone Controller for each zone.

Miscellaneous:

- A. Five (5) Ceiling exhaust fans for each restroom, shower and laundry room.
 - i. Including ductwork and termination thru roof with flashing.
 - ii. Interlock with lights.

- B. Apparatus Bay will have two (2) propane ceiling mounted unit heaters at the East and West Corners.
 - i. Propane pipe connections from below with shut off valve.
 - ii. B-type flue with roof termination cap with flashing.
 - iii. Thermostat control for each unit.

Plumbing -Water/Sewer/Gas Propane sizes

The domestic water will be pumped from an existing well, to the site water tank. The site domestic water will be stored in an above ground, insulated, 30,000-gallon tank, on the East side of the site. Domestic water will be pumped from the tank to the Fire Station building. It services plumbing fixtures in the kitchen, laundry, restrooms, and showers. Including exterior hose bibbs on the Fire Station building and interior Apparatus Bay.

The domestic cold and hot water system consists of the following:

- A. One (1) Flowtherm variable speed simplex pressure booster, 1-1/2" inlet/outlet
- B. Insulated copper pipe, hung above in the attic space.
- C. Four (4) Freeze protected hose bibbs at exterior walls and two (2) interior Apparatus Bay wall.
- D. One (1) 30-gallon propane water heater.
 - i. Propane gas piping and pressure relief piping.
 - ii. B-type flue piping, upper and lower combustion vent with flashings.

The sewer system consists of 1000-gallon septic tank located below the outdoor train area with the leach lines routing East of the property. There will be two (2) 4" soil waste line discharging to the East at the kitchen area and day room restroom area. These will connect to the septic tank.

The Apparatus Bay will have linear floor drains parallel to the perimeter of the exterior walls. These 4" drains will collect snow melt/dirt/grease/grime and discharge to a sand interceptor on the South side which discharges to storm drain outside toward Hwy 6.

The Fire Station and Apparatus Bay will be provided with one (1) 500-gallon propane tank to service the water heater, radiant heater boiler, and unit heater(s). The generator will need a separate propane tank. Underground propane yellow gas pipe will stub up at the mechanical room and Apparatus Bay.

The Apparatus Bay will have one (1) 5hp air compressor with sound jacket at jacket in the mezzanine above the locker room. Air piping overhead in the truck bay and drop down with hose reels adjacent to the fire trucks.

The Apparatus Bay will have one (1) Carmon carbon monoxide exhaust discharge fan and exhaust hose reel system above the fire trucks.



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MECHANICAL, FIRE PROTECTION, AND ELECTRICAL ENGINEERING SERVICES

December 17, 2024

Subject: White Mountain Fire District-Fire Station- Electrical Feasibility Study

SEC # 24528 (PRELIMINARY REPORT)

MPE design scope for the proposed utilities, electrical service size, HVAC, water, sewer, fire water, fire sprinkler tank, fire pump, fire alarm, low voltage systems, emergency generator, etc. HVAC system call out only. Gas, water, sewer, fire water pipe, pipe sizes will be provided. The Fire water tank and fire pump will be sized.

Electrical

The proposed electrical service would bring 3 phase power from utility pole across the street. The new service would be 600 amps, 120/208 volt, 3 phase, 4 wire with approximately 150 kva electrical load and fed from a pole mounted or ground mounted utility transformer on site. The service would be backed up with a propane generator.

Lighting

The interior lighting for the building will consist of all LED light fixtures, with downlights, 2' x 4' troffers, low/high bay for apparatus bay and linear fixtures. These would be recessed in a ceiling grid or gypsum board ceiling, surface and or pendant mounted. The lights and controls for lighting would meet California T24 lighting requirements. The interior controls would consist of occupancy sensors, photocells for daylighting and dimmer switches for interior lighting.

The exterior lighting would consist of surface wall pack fixtures around the building, pole lighting for the site and training area and in-grade fixture for lighting the flagpole. The exterior controls would consist of a lighting control panel with automatic timeclock function.

Power

The electrical power would consist of a main switchboard serving electrical panels to feed the HVAC systems, lighting system, receptacles, fire pump and any other equipment. The electrical panels would be disaggregated per T24 requirements. This would require a panel for HVAC equipment, a panel for lighting and panel(s) for all other loads. The main service would be backed up with an on-site propane fed generator. Freeze protection for site piping due to elevation of site will be required.

The on-site propane generator would run on propane gas from a propane gas tank on site. The generator would be a Tier 4 generator to comply with current standards. It would be a minimum size of 150 kw to provide power to the full 600 amp load of the facility. The generator would be housed in a weatherproof enclosure with acoustic insulation for sound attenuation.

There would also be a PV solar system connected to the main switchboard. The PV solar system would have solar panels on the roof and a battery storage system located on site.

Low Voltage Systems

The low voltage systems would consist of Audio Visual (AV), data communications, fire alarm, security, TV and fire district radio equipment. The AV system would consist of a projector, speakers and controls located in the training room. The Data communication system would have a data rack with incoming fiber optic cabling and category 6 cabling to outlets around the building. Fire alarm would be a fully automatic fire alarm system throughout the fire house and apparatus bay, with smoke detectors below ceiling and heat detectors above ceiling spaces. Carbon monoxide detection would be required within areas served with gas fired HVAC units. Horns and strobes would be placed throughout the fire house for occupant notification. The fire alarm system would be connected to a central station for monitoring the system. The Security system would consist of door contacts, motion sensors, cameras, gate access with key fobs and connected to a central station for monitoring the system. The TV system would be provided through the data communication system for streaming and programming. The Fire district radio equipment would be connected to the antenna located on site for communications with emergency personnel.

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US-6 HMT

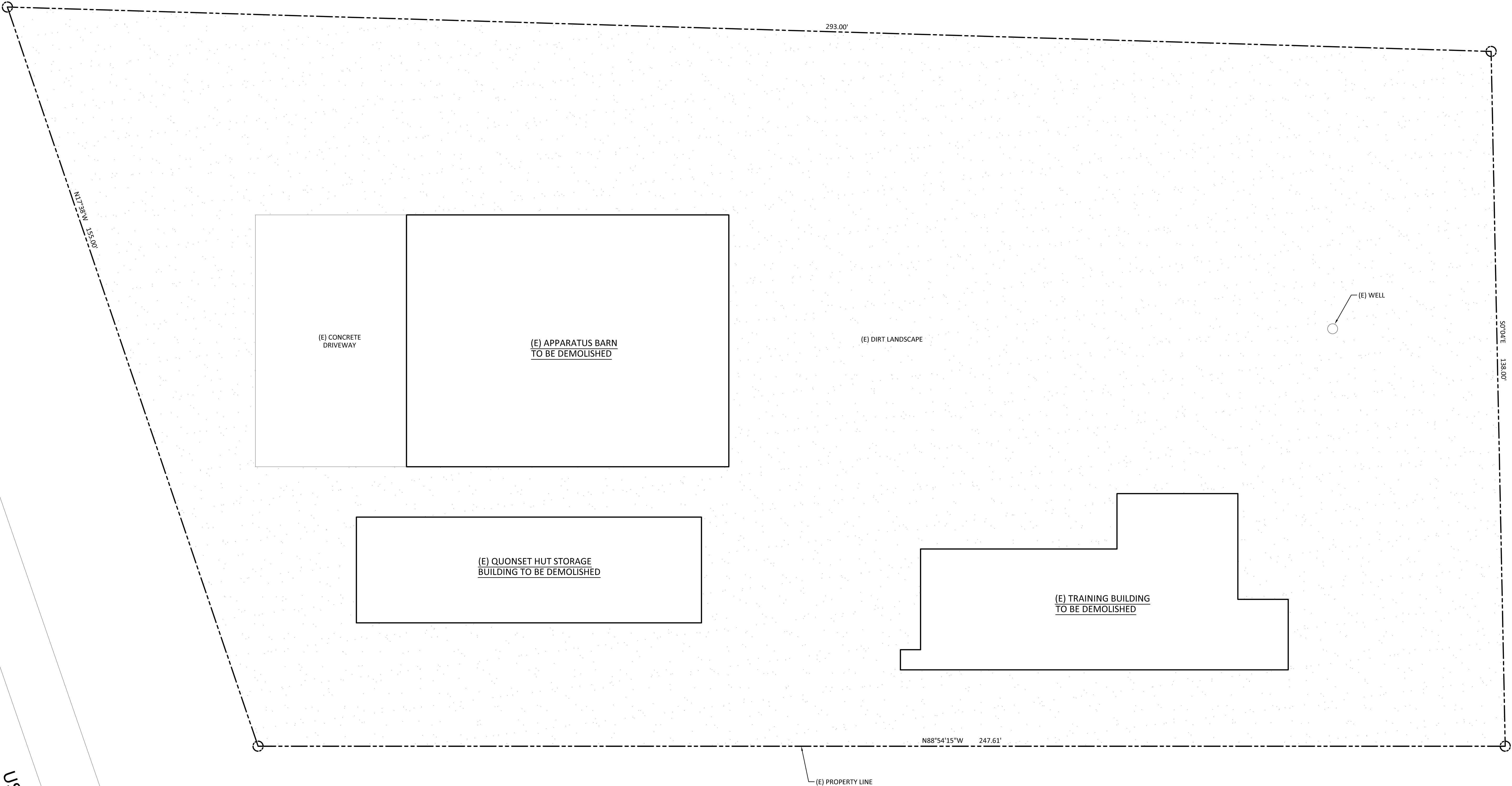
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REFERENCE SITE PLAN

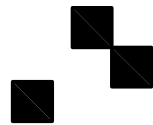
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FEASIBILITY STUDY

WHITE MOUNTAIN
FIRE PROTECTION
DISTRICT

25474 US-6
BENTON CA 93512



REVISIONS

NO.	DESCRIPTION	DATE
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REFERENCE SITE PLAN

MARCH 26, 2025

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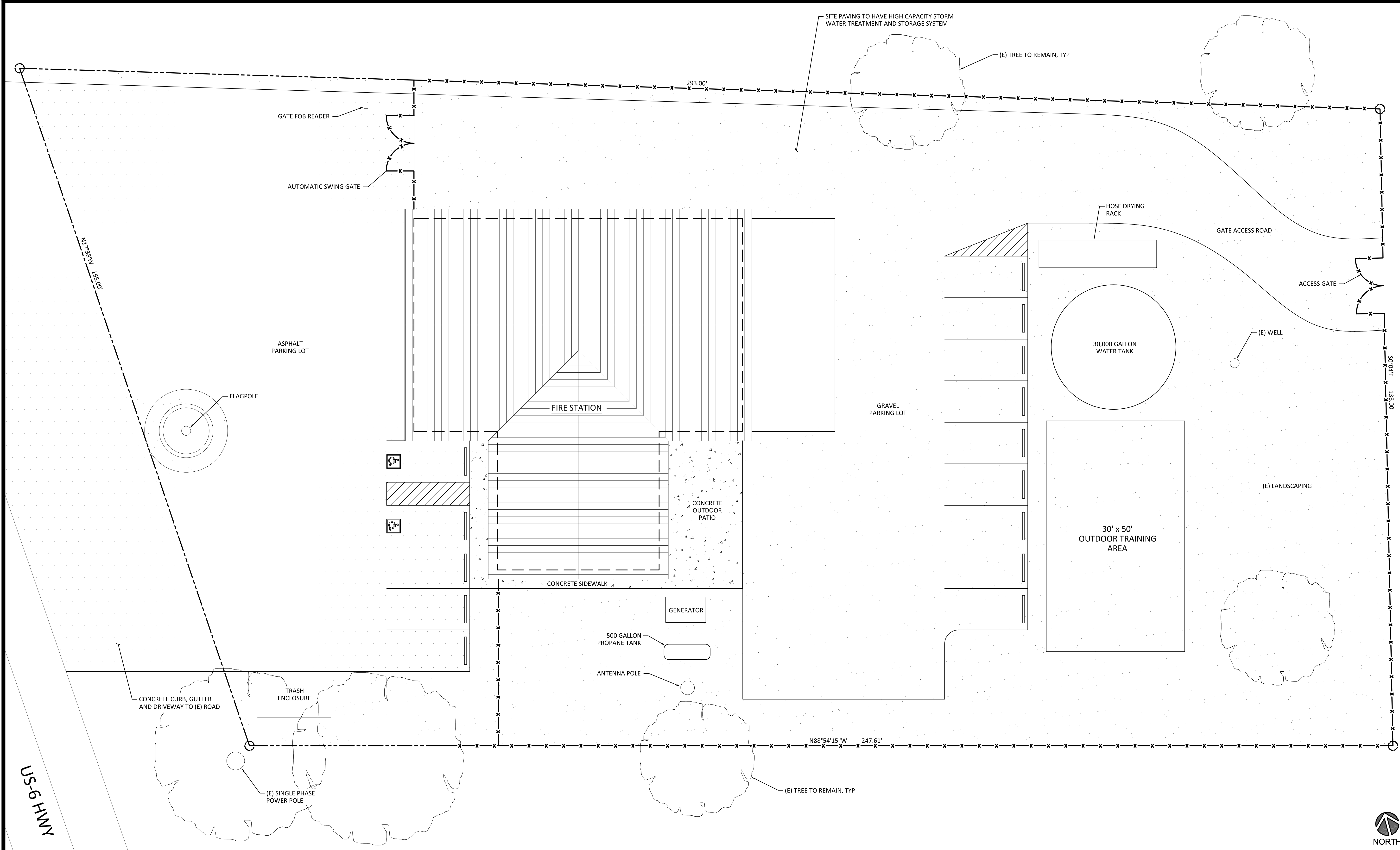
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CODE ANALYSIS - BUILDING DATA

BUILDING AREA = 4,335 S.F.
OCCUPANCY = R-2, B, AND S-2
CONSTRUCTION TYPE = V-B
NUMBER OF STORIES = ONE WITH STORAGE MEZZANINE
AUTOMATIC FIRE SPRINKLERS = YES
FIRE ALARM SYSTEM = YES
SMOKE CONTROL SYSTEM = YES
EMERGENCY RESPONSE RADIO COVERAGE = YES
FIRE SEVERITY ZONE = YES, HIGH

LANDSCAPE LEGEND

- EXISTING DIRT LANDSCAPE TO REMAIN
- PROPOSED ASPHALT PAVING AREA, APPROX 8,900 SQ FT
- PROPOSED CONCRETE PAVING AREA, APPROX 950 SQ FT
- PROPOSED GRAVEL PAVING AREA, APPROX 11,450 SQ FT
- PROPOSED BLACK CHAIN LINK FENCE, APPROX 582 LINEAR FT
- EXISTING PROPERTY LINE



PROPOSED SITE PLAN

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PROPOSED SITE PLAN
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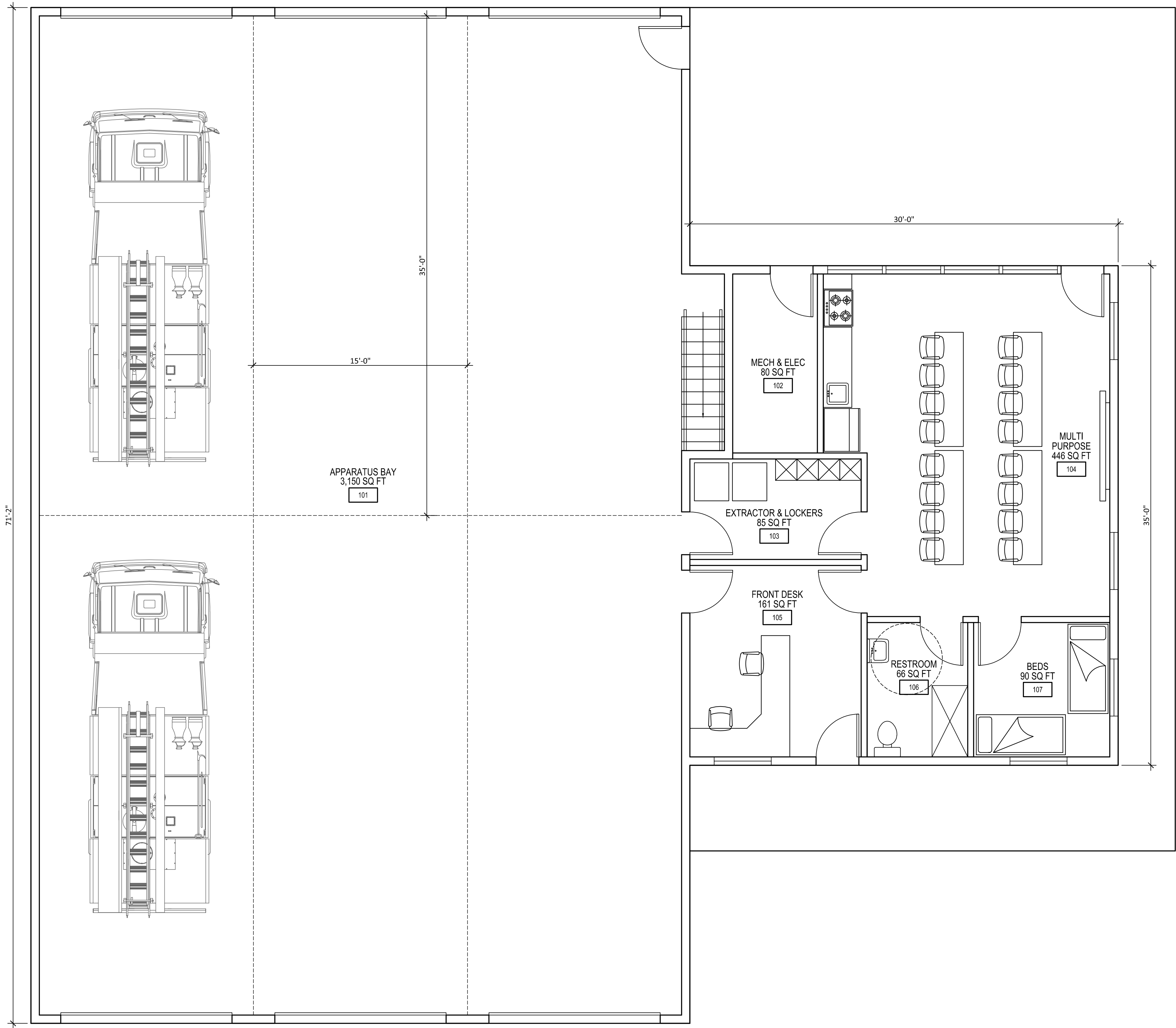
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FIRE STATION MAIN FLOOR PLAN

FILE:

SCALE: 1/4" = 1'-0"



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FLOOR PLAN

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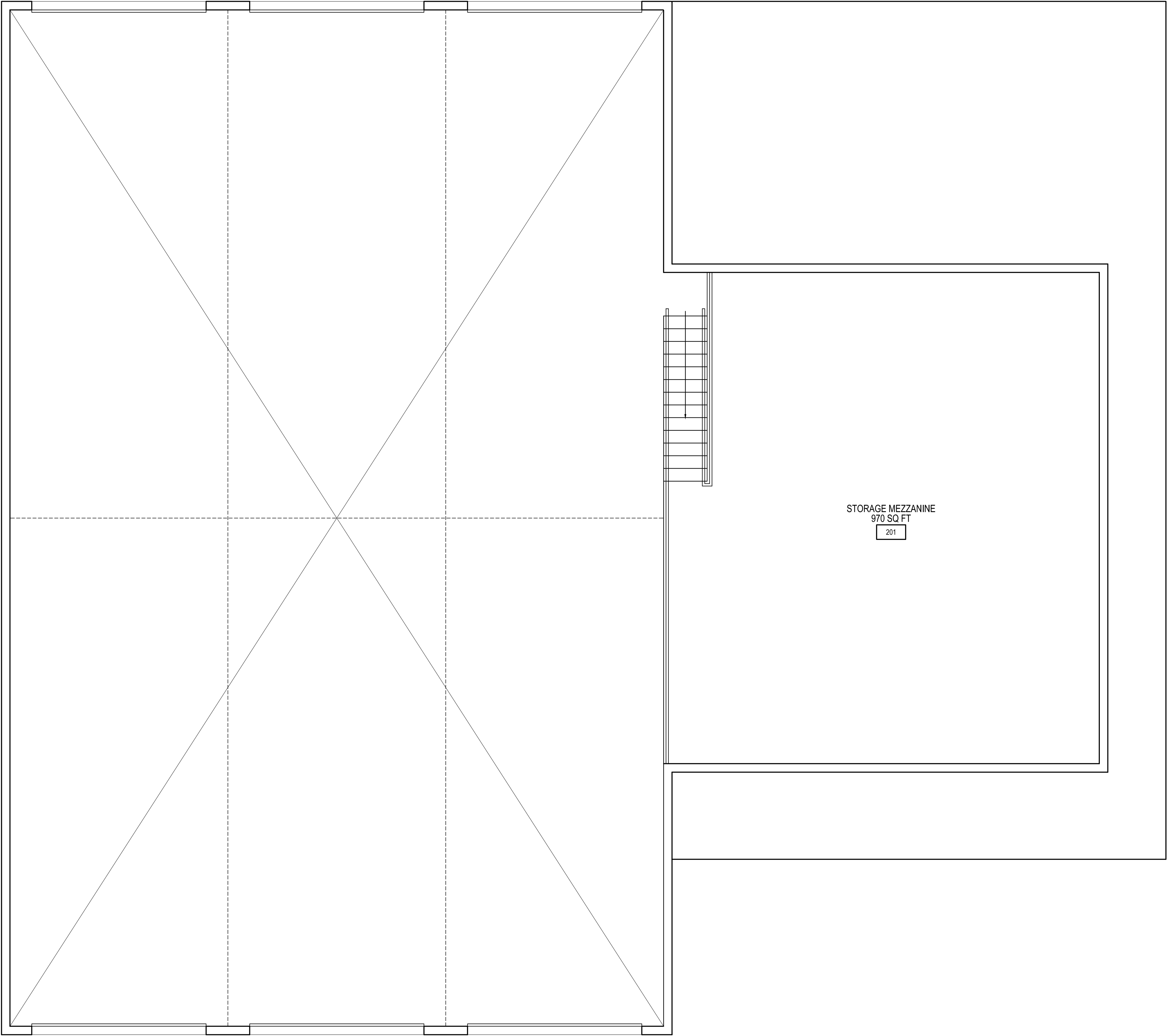
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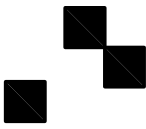
FIRE STATION MEZZANINE PLAN

FILE:

SCALE: 1/4" = 1'-0"



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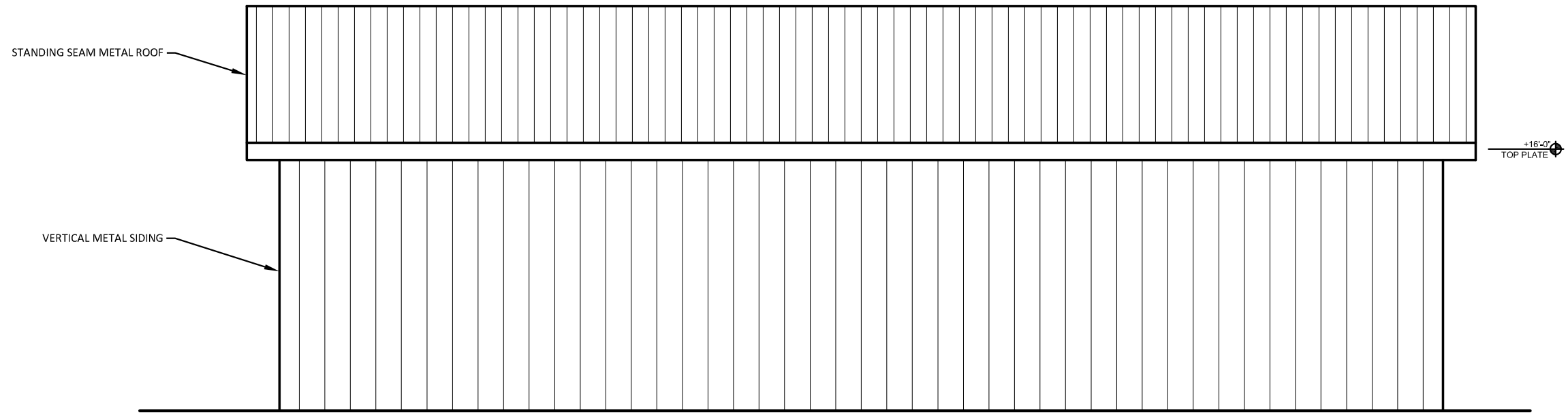
FLOOR PLAN

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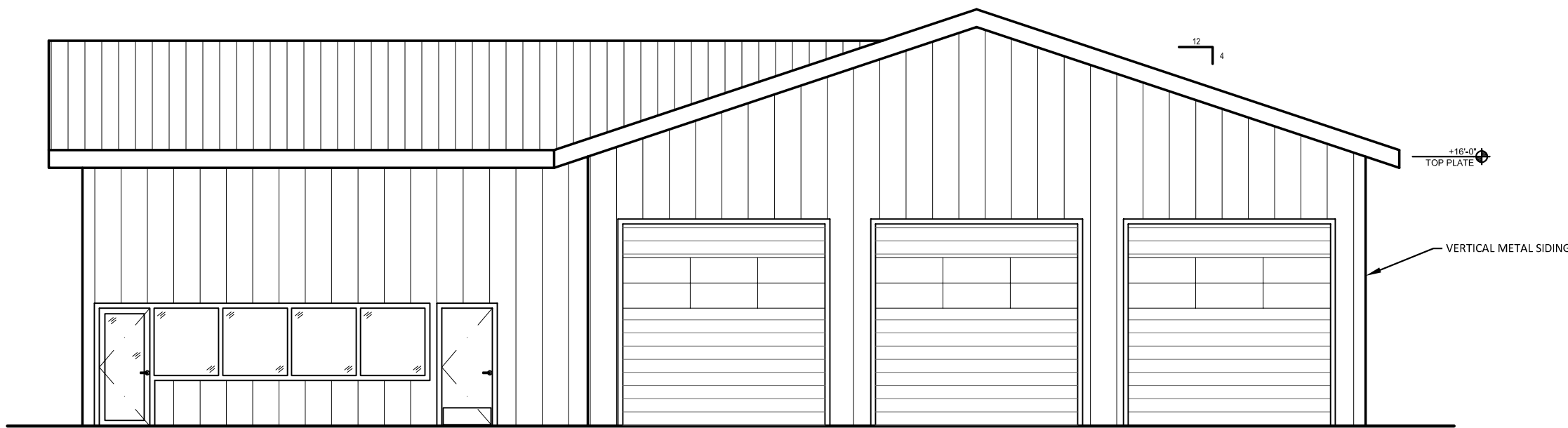
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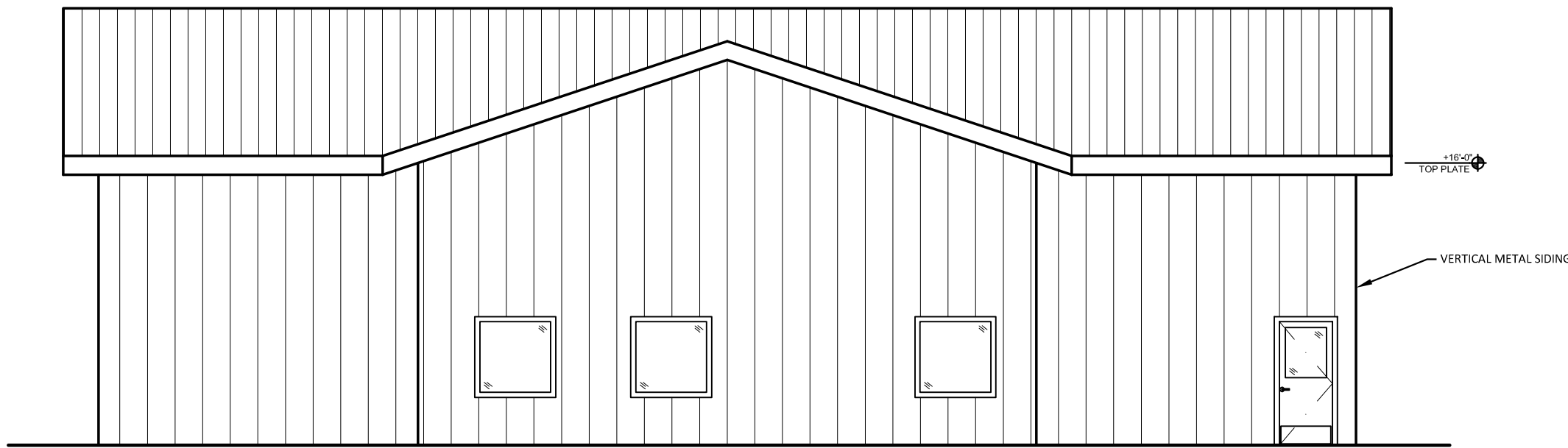
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EXTERIOR ELEVATION - NORTH
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SCALE: 1/8"=1'-0"



1B
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EXTERIOR ELEVATION - EAST
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SCALE: 1/8"=1'-0"



1C
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EXTERIOR ELEVATION - SOUTH
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SCALE: 1/8"=1'-0"



1D
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EXTERIOR ELEVATION - WEST
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ELEVATIONS

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BENTON VALLEY
FIRE STATION



30

3



WHITE MOUNTAIN
FIRE DEPARTMENT



30

WHITE MOUNTAIN
FIRE DEPARTMENT

BENTON VALLEY
FIRE STATION



















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NEW FIRE STATION
BENSON, CA**

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**WHITE MOUNTAIN FIRE DEPARTMENT
NEW FIRE STATION
BENSON, CA**

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WHITE MOUNTAIN FIRE DEPARTMENT
NEW FIRE STATION
BENSON, CA

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SELECTIVE SITE DEMOLITION

PART 1 – GENERAL

1.01 DEFINITION OF “NEW WORK”:

- A. It is the specific intent of these construction documents that all work indicated shall be considered new.
Any items specifically noted on the Contract Drawings as "existing" (E), "existing to remain", etc. shall be protected in place and modified as needed to accommodate new work. All demolition work or removal with reinstallation shall be included in the base bid to accommodate the installation of new work.

1.02 DESCRIPTION

- A. Furnish all materials, labor, equipment, and services necessary and incidental to the completion of demolition work as specified herein.
- B. Provide all demolition work necessary to complete the Work shown in these specifications, whether or not specific demolition requirements are indicated.

PART 2 – PRODUCTS, NOT USED

PART 3 – EXECUTION

3.01 GENERAL

- A. Preparation:
 - 1. Provide, erect, and maintain temporary barriers, chain link fences, and security devices as required. Protect all existing, structures, utilities and site elements which are not to be demolished.
 - 2. Notify all affected utility companies and local authorities and agencies prior to beginning the work.
- B. Environmental Requirements
 - 1. Comply with all anti-pollution ordinances including preventive measures against contamination of storm water.
 - 2. Noise producing activities shall be held to a minimum. Internal combustion engines and compressors, etc., shall be equipped with mufflers to reduce noise to a minimum. Comply with all noise abatement ordinances. Work shall be restricted from 7:00 AM to 5:00 PM daily unless special permission is obtained from the State Representative.
 - 3. Trucks leaving the site shall do so in such a manner that demolition debris will not be deposited on adjacent street pavements. This contractor shall promptly remove any demolition debris deposited on street pavements.

4. Dust: Operations generating dust shall be controlled by use of wetting truck to prevent the release of dust into the atmosphere. Wetting operations shall be continuous while all dust generating work is in progress. Keep all areas within the demolition area sufficiently dampened to prevent dust from rising due to demolition.
- C. Protection and Shoring:
1. Any damage done by this contractor to existing structures, utilities, data lines, pipe lines, etc. shall be repaired by him and at his expense in a manner acceptable to the State. This contractor shall report any existing damage prior to the beginning of work.
 2. All temporary shoring, bracing, etc., and maintenance thereto required for the completion of demolition work shall be provided by the General Contractor.
 3. Ensure provision of adequate bracing, shoring, lamps, warning signs and flags as required by agencies having jurisdiction and as directed by the State. Remove same when necessity for protection ceases.
- D. Performance
1. Coordinate demolition work with the State to maintain critical facility functions.
 2. Exercise extreme caution in removing materials to prevent damage to any existing utilities which are to remain in service. Existing utilities which are in any way damaged shall be repaired at no additional cost to the State.
 3. All materials from demolition area will be considered "waste" and shall be removed from the site. Waste material shall be removed from the site daily and not allowed to accumulate.
 - a. No burning or burying of waste material will be permitted.
 - b. Do not use facility dumpsters.
- E. Protect any existing and/or adjacent structures and appurtenances that are not to be demolished. Prevent movement or settlement. Provide bracing and shoring as required.
- F. Cease operations immediately if adjacent structures appear in danger. Notify State Representative. Do not resume operations until directed.

3.02 UTILITIES

- A. In accordance with Section 01 14 00 Work Restrictions, locate, identify, disconnect, and cap off utility services to be demolished.
- B. Maintain and protect existing utilities to remain in service before proceeding with demolition, providing bypass connections to other parts of the building.
- C. In accordance with Section 01 73 29 Cutting and Patching, where equipment or devices have been removed, and where the active side of the pipe remains, Contractor shall cap or plug all abandoned piping using either threaded or soldered fittings. Do not rely on the existing valves for a positive shutoff.

3.03 DEMOLITION

- A. Conduct demolition in accordance with Section 01 14 00 Work Restrictions and Section 01 35 16 Alteration Project Procedures [without disrupting Facilities' use of the building].
- B. In accordance with Section 01 56 00 Temporary Barriers and Enclosures, conduct demolition operations and remove debris to prevent injury to people and damage to adjacent buildings and site improvements.
- C. Perform Work in such a manner as to prevent damage to existing facilities to remain or to be salvaged. Hazardous Work shall not be left standing or hanging, but shall be knocked or pulled down to avoid damage or injury to employees or the public.

END OF SECTION

SECTION 03 10 00

CONCRETE FORMWORK

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

- A. Requirements of Division 01 apply to all work of this section.

1.02 SCOPE

- A. Design, furnish, and install forms for concrete as required to complete the concrete casting scope and as specified herein. Remove forms and shoring at specified time. Clean up.

1.03 RELATED WORK (See also Table of Contents)

- A. Section 02 41 13 Selective Site Demolition
- B. Section 03 21 00 Reinforcing Bars
- C. Section 03 30 00 Cast-In-Place Concrete
- D. Section 04 22 00 Concrete Unit Masonry
- E. Section 05 40 00 Cold Formed Metal Framing
- F. Section 05 50 00 Metal Fabrications
- G. Items relating solely to mechanical or electrical work are included under those Divisions, except as specifically indicated otherwise on Drawings.
- H. Section 32 31 13 Chain Link Fences and Gates

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Form Material:
 - 1. Smooth Concrete exposed to view: 5/8 inch minimum APA Plyform or steel.
 - 2. Concrete concealed from view: 5/8 inch minimum APA Plyform, steel or clean and sound 1 x 8 Standard Grade Douglas Fir.
- C. Form Clamps: Assembly to have cone washers, (1 inch break back) 3/8" inch center rod.
- D. Form Ties:

1. Concrete exposed to view: Snap ties allowing full 1 inch break back.
 2. Concrete concealed from view: Snap ties or wire.
 3. Verify special spacing requirements with architectural drawings at exposed concrete.
- E. Spreaders: Metal (no wood).
- F. Form Coating: Non-grain and non-staining types of form coating that will not leave a residual matter on the face of the concrete or adversely affect proper bonding of any subsequent paint or other surface applications.
1. Form coating containing mineral oils or other non-drying materials will not be permitted for any concrete work.
- G. Joint Tape: No. 471 plastic film tape 3 inches wide, as manufactured by the Industrial Tape Division of 3M Company.
- H. Expansion Joint Filler (Preformed): 1/2 inch thick; Flexcell by Celotex Corporation, Elastic Fiber Expansion Joint by Phillip Carey Mfg. Co., or Sealtight Fiber Expansion Joint by W.R. Meadows, Inc.
- I. Extruded Polystyrene Foam: ASTM C578 type IV. Dow Chemical Corp. "Styrofoam", UC Industries "Foamular", or approved equal.

PART 3 – EXECUTION

3.01 FORM CONSTRUCTION

- A. Construct substantial forms to the shapes, lines, grades and elevations shown, sufficiently tight to prevent leakage of mortar, and tied, clamped and braced to prevent spreading, shifting or settling. Plywood joints shall be square and tight; plywood shall be arranged in such manner as to minimize number of joints and to provide a smooth, attractive finished concrete surface.
- B. Apply form coating to forms before reinforcing steel is in place.
- C. Sleeves, anchors and bolts, including those for angle frames, supports, ties and other materials in connection with concrete construction, shall be secured in position before the concrete is placed.
- D. Proper provisions shall be made for openings, blockouts, sleeves, offsets, sinkages, recesses and depressions required by other trades and suppliers prior to placing concrete.
1. The Contractor shall also see that sleeves have been installed and other provisions have been made for the installation of mechanical, electrical and other equipment.
 2. Coordinate with all trades to insure proper placement of all items in forms and to provide proper blockouts wherever required.

END OF SECTION

SECTION 03 21 00

REINFORCING BARS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 specification Sections apply to Work of this Section as if printed herein.

1.02 SCOPE

- A. Unless noted otherwise, furnish and install reinforcing for all concrete, including dowels, chairs, spacers, bolsters, etc., necessary for supporting and fastening of reinforcement in place as shown on the Drawings and specified herein.

1.03 RELATED WORK (See also Table of Contents)

- A. Section 02 41 19 Selective Building Demolition
- B. Section 03 10 00 Concrete Formwork
- C. Section 03 30 00 Cast-In-Place Concrete
- D. Section 04 05 00 Mortar and Grout
- E. Section 04 22 00 Concrete Unit Masonry

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Reinforcement Bars: ASTM A615, Grade 60 for all bars.
 - 1. Bar reinforcement to be welded shall meet chemical requirements of ASTM A706 grade 60.
 - 2. Longitudinal reinforcement in columns and beams of special moment-resisting frames shall meet the chemical requirements of ASTM A706.
- B. Stirrups and Ties: ASTM A615, Grade 60 for all bars.
- C. Steel Dowels: Same grade as bars to which dowels are connected.
- D. Welded wire Fabric: ASTM A185.
- E. Tie Wires: FS-QQ-W-461, annealed steel, black, 16 gauge minimum.
- F. Welding Electrodes: AWS D1.4, low hydrogen, E70XX series.

PART 3 – EXECUTION

3.01 FABRICATION

- A. Shop fabricate reinforcement to meet requirements of Contract Drawings.
- B. Fabricate reinforcement in accordance with the requirements of ACI 315 where specific details are not shown or where Drawings and Specifications are not more demanding.
- C. Steel reinforcement shall not be bent or straightened in a manner that will injure the material. Bars with kinks or bends not shown on the Drawings shall not be used. Heating of bars for bending will not be permitted.
- D. Reinforcing shall not be field bent or straightened without Architect's review.
- E. Provide offsets in rebar (1:6 maximum) where required to maintain clearances.

3.02 CONDITION OF SURFACES

- A. Examine surfaces and conditions receiving or affecting the work. Do not proceed until unsuitable conditions have been corrected.
- B. All bars shall be clean of rust, grease, or other materials likely to impair bond.

3.03 GENERAL

- A. Concrete shown without reinforcing shall be reinforced as similar parts shown with reinforcing except where concrete is specifically noted to be unreinforced.
- B. All bends shall be made cold.
- C. All reinforcing bars shall be accurately and securely placed before pouring concrete or applying grout.
- D. Spacing of bars noted on drawings or details shall be considered as maximum spacing.
- E. Anchor bolts shall conform to either A.S.T.M. A307 or A36 unless noted otherwise, and shall be headed bolts or threaded rods with double nuts.
- F. All anchor bolts shall be galvanized steel.
- G. Diameter of bolt holes in steel shall be 1/16 inch larger than the bolt size unless noted otherwise.

END OF SECTION

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 specification Sections apply to Work of this Section as if printed herein.

1.02 SCOPE

- A. Furnish, place, and finish cast in place concrete and related work as indicated on the Drawings and specified herein.
 - 1. Install miscellaneous metal and other items furnished by other trades to be installed in concrete work.
 - 2. Provide facilities for job curing of test cylinders and transporting to Testing Laboratory.
- B. Provide grouting of steel base plates as indicated on the Drawings and specified herein.

1.03 RELATED WORK (See also Table of Contents)

- A. Section 02 41 19 Selective Building Demolition
- B. Section 03 10 00 Concrete Formwork
- C. Section 03 21 00 Reinforcing Steel
- D. Section 04 05 00 Mortar and Grout
- E. Section 04 22 00 Concrete Unit Masonry
- F. Section 05 05 19 Post-Installed Concrete Anchors
- G. Section 31 00 00 Earthwork
- H. Section 32 16 00 Site Concrete

PART 2 – PRODUCTS

2.01 MATERIAL

- A. Portland Cement: ASTM C 150, Type I or Type II. One brand of cement shall be used throughout to maintain uniform color for all exposed concrete. Per ACI 318-14 Section 26.4.

- B. Concrete Aggregate: Fine and coarse hardrock aggregates shall be regarded as separate ingredients. Each size of coarse aggregate, as well as combination of sizes when two or more are used, shall conform to grading requirements of appropriate ASTM Standards and CBC Section 1903A.6.
- C. Water: Clean and free from injurious amounts of oil, acids, alkali, organic matter and other deleterious substances; suitable for domestic consumption.
- D. Admixtures shall be subject to prior approval by the Engineer, in accordance with ACI 318 Section 3.6. Calcium Chloride is not permitted.
- E. Slab on Grade Vapor Retarder (at interior slabs)
 - 1. Vapor Retarder must have the following qualities:
 - a. 15 mil thickness minimum
 - b. WVTR less than 0.008 as tested by ASTM E 96
 - c. ASTM E 1745 Class A (Plastics)
 - 2. Vapor Retarder Products
 - a. Stego Wrap Vapor Retarder by STEGO Industries LLC.
 - b. W.R. Meadows Premoulded Membrane with Plasmatic Core.
 - c. Zero-Perm by Alumiseal.
 - 3. Vapor Retarder Tape
- G. Gravel Below Slabs: Free-draining ground or crushed rock graded so that 100 percent will pass a one inch sieve with no appreciable material passing a no. 4 sieve. No bedding sand shall be used below slabs outside of utility trenches crossing footings.
- H. Abrasive aggregate for non-slip finish: Fused aluminum oxide grits, graded 12/30. Use factory-graded rustproof and non-glazing material that is unaffected by freezing, moisture and cleaning materials.
- I. Expansion Joint Filler: "Fibrated Expansion Joint Filler", or approved equal.
- J. Bonding Agent: Sonneborn "Sonobond"; the Euclid Chemical Company "Euco-Weld"; Larsen Products Corp., "Weld-Crete" or approved equivalent.
- K. Concrete Sealer: Cure and Seal, as manufactured by the Euclid Chemical Company "Aqua- Cure VOX", Sonneborn "Kure-N-Seal WB", Burke "Spartan-Cote", W.R. Meadows "Intex" or approved equal conforming to ASTM C-309, Type I, Class B requirements, and conforming to State of California Air Resources Board VOC Regulations.
- L. Concrete Hardener/Sealer: Clear, water soluble, sprayable in-organic silicate based hardener/sealer or acrylic co-polymer resin. Products shall be equal to Euclid Chemical Company "Eucosil", Burke "Spartan-Cote", Sonneborn "Sonosil", W.R. Meadows "Pena-Lith", or approved equal and must conform to State of California Air Resources Board VOC Regulations.

2.02 CONCRETE

- A. Concrete Mixes:
 - 1. Type A Concrete: (curbs and slabs)
Strength: 3000 lbs. per square inch at 28 days.
Maximum Aggregate Size: 1 inch.
Minimum Cement Content: As required by mix design (ACI Section 5.3)
5.5 sacks per yard minimum.
- B. Consistency of Concrete: Concrete slump, measured in accordance with ASTM C 143, shall fall within the following limits.
 - 1. For General concrete placement: 3 inch plus or minus 1 inch.
 - 2. Mixes employing the specified mid-range water reducer shall provide a measured slump not to exceed 7 inch +1 inch after dosing, 2 inch +1 inch before dosing.
 - 3. Concrete slump shall be taken at point of placement. Use water reducing admixtures as required to provide a workable consistency for pump mixers. Water shall not be added at the jobsite without written review by the structural engineer.
- C. Mix Design:
 - 1. Mix Design: All concrete used in this work will be designed for strength in accordance with provisions of ASI 318-14 Section 26.4. Should the Contractor desire to pump concrete, a modified mix design will need to be submitted for review. Fly ash may be used in concrete to improve workability in amounts up to 15% of the total cementitious weight.
- D. Mixing:
 - 1. Equipment: All concrete shall be ready-mixed per ACI 301 Standards and A.S.T.M. C-94. Provide adequate equipment and facilities for accurate measurement and control of materials.

PART 3 – EXECUTION

3.01 PLACEMENT

- A. Before any concrete is placed, the following items of work shall have been completed in the area of placing.
 - 1. Forms shall have been erected, adequately braced, cleaned, sealed, lubricated if required, and bulkheaded where placing is to stop.
 - 2. Any wood forms other than plywood shall be thoroughly water soaked before placing any concrete. The wetting of forms shall be started at least 12 hours before concreting.
 - 3. Reinforcing steel shall have been placed, tied and supported.

4. Embedded work of all trades shall be in place in the forms and adequately tied and braced.
 5. The entire place of deposit shall have been cleaned of wood chips, sawdust, dirt, debris, hardened concrete and other foreign matter. No wooden ties or blocking shall be left in the concrete except where indicated for attachment of other work.
 6. Reinforcing steel, at the time the concrete is placed around it, shall be cleaned of scale, mill scale, or other contaminants that will destroy or reduce bond.
 7. Concrete surfaces to which fresh concrete is to be bonded shall be brush cleaned to remove all dust and foreign matter and to expose the aggregate, and then coated with the bonding adhesive herein specified.
 8. Prior to placing concrete for any slabs on grade, the moisture content of the subgrade below the slabs shall be adjusted to at least optimum moisture.
 9. No concrete shall be placed until formwork and reinforcement has been approved by Architect. Clean forms of all debris and remove standing water. Thoroughly clean reinforcement and all handling equipment for mixing and transporting concrete. Concrete shall not be placed against reinforcing steel that is hot to the touch. Notify Structural Engineer 48 hours in advance of concrete pour.
 10. Minimum concrete cover around reinforcing steel shall be per CBC Table 1808.8.2.
- B. Conveying: Handle concrete from mixer to place of final deposit by methods which will prevent separation or loss of ingredients. Deposit concrete in forms as nearly as practicable at its final position in a manner which will insure that required quality is obtained. Chutes shall slope not less than 4 inches and not more than 6 inches per foot of horizontal run.
- C. Depositing: Deposit concrete into forms in horizontal layers not exceeding 24 inches in thickness around building, proceeding along forms at a uniform rate and consolidating into previous pour. In no case shall concrete be poured into an accumulation of water ahead of pour, nor shall concrete be flowed along forms to its final place of deposit. Fresh concrete shall not be permitted to fall from a height greater than 6 feet without use of adjustable length pipes or, in narrow walls, of adjustable flexible hose sleeves. Concrete shall be scheduled so that placing is a continuous operation for the completion of each section between predetermined construction joints. If any concreting operation, once planned, cannot be carried on in a continuous operation, concreting shall stop at temporary bulkheads, located where resulting construction joints will least impair the strength of the structure. Location of construction joints shall be as shown on the drawings or as approved by Architect. The rate of rise in walls shall not be less than 2 feet per hour.
1. Consolidation: Concrete shall be thoroughly compacted and worked to all points with solid continuous contact to forms and reinforcement to eliminate air pockets and honeycombing. Power vibrators of approved type shall be used immediately following pour. Spading by hand, hammering of forms or other combination of methods will be allowed only where permitted by Architect. In no case shall vibrators be placed against

- reinforcing steel or used for extensive shifting of deposited fresh concrete. Provide and maintain standby vibrators, ready for immediate use.
2. Hot Weather Concreting: Unless otherwise directed by the Architect, perform all work in accordance with ACI 305 when air temperature rises above 75 degrees F and the following:
- a. Mixing Water: Keep water temperature as low as necessary to provide for the required concrete temperature at time of placing. Ice may be required to provide for the design temperature.
 - b. Aggregate: Keep aggregate piles continuously moist by sprinkling with water.
 - c. Temperature of Concrete: The temperature of the concrete mix at the time it is being placed in the forms shall not exceed 90 degrees F per ACI 301. The method employed to provide this temperature shall in no way alter or endanger the design mix or the design strength required.
 - d. Dampen subgrade and formwork before placing concrete. Remove all excess water before placing concrete. Keep concrete continuously wet when air temperature exceeds 85 degrees F for a minimum of 48 hours after placing concrete. For slab on grade construction, see Section 3.1.E.
 - e. Protection: Minimize evaporation from concrete in place by providing shade and windbreaks. Maintain such protection in place for 14 days minimum.
3. Cold Weather Concreting: Follow recommended ACI 306 procedures when average of the highest and lowest air temperature falls below 40 degrees F for more than three consecutive days, as approved by Architect. Concrete placed in these temperatures shall have a minimum temperature based on dimensions of concrete sections placed as shown in ACI 301. No chemicals or salts shall be used to prevent freezing and no accelerating agents shall be used without prior approval from Architect.
- D. Construction Joints: Install only as indicated and noted on Drawings. Joints not indicated on Drawings shall be so located, when approved, as to least impair strength of structure, and shall conform to typical details. Construction joints shall have level tops, vertical sides. Horizontal construction joints shall be thoroughly cleaned and roughened by removing entire surface film and exposing clean aggregate solidly embedded in mortar matrix. Joints between concrete and masonry shall be considered construction joints. Vertical construction joints need not be roughened. See Drawings for doweling and required keys.
1. Roughen construction joints by any of following methods:
- a. By sandblasting joint.
 - b. By thoroughly washing joint, using a high pressure hose, after concrete has taken initial set. Washing shall be done not less than 2 hours nor more than 4 hours after concrete has been poured, depending upon setting time.
 - c. By chipping and wire brushing.

2. All decisions pertaining to adequacy of construction joint surfaces and to compliance with requirements pertaining to construction joints shall be reviewed with the Architect.
3. Just before starting new pour, horizontal and vertical joint surfaces shall be dampened (but not saturated).
4. Before placing regular concrete mix, horizontal construction joint surfaces shall be covered with a layer of mortar composed of cement and fine aggregate of same proportions as that used in prescribed mix, but omitting coarse aggregate.
5. For slabs, construction joints shall be in locations shown on plan. If not shown, locate at intervals not exceeding 150 feet in each direction. Refer to drawings for proper details for reinforcing at construction joints.

E. Concrete Slabs on Grade:

1. Exterior and interior concrete slabs on grade shall be poured as required under this Section. Base shall be accurately leveled and compacted prior to placing of concrete.
2. Typically, interior slabs on grade shall be poured over a minimum of four (4 inch) inches of compacted crushed rock, unless otherwise indicated, over a vapor retarder.
3. Protect slab on grade subbase from moisture prior to placing concrete. Avoid wetting rock layer to allow adequate concrete curing and avoid future vapor transmission. If the subbase has been wet excessively, verify that water has been eliminated prior to placement of concrete.
4. Vapor Retarder installation shall be in accordance with manufacturer's instructions and ASTM E 1643-98.
 - a. Unroll Vapor Retarder with the longest dimension parallel with the direction of the pour.
 - b. Lap Vapor Retarder over footings and seal to foundation walls.
 - c. Overlap joints 6 inches and seal with specified tape.
 - d. Seal all penetrations (including pipes) per manufacturer's instructions.
 - e. No penetration of the Vapor Retarder is allowed except for reinforcing steel and permanent utilities.
 - f. Repair damaged areas by cutting patches of Vapor Retarder, overlapping damaged area 6 inches and taping all four sides with tape.

F. Control Jointing – Slabs on Grade:

1. Joints shall be in locations indicated on Drawings, or as directed by Architect.
2. Joints in interior slabs shall be made by one of following methods:
 - a. By use of construction joints laid out in checkerboard pattern; pour and allow alternate slabs to set; fill out balance of checkerboard pattern with second pour.
 - b. By use of dummy groove joints at least 1/4 depth of slab, and at least 1/8 inch wide. These joints may be sawcut as soon as wet concrete can support the weight of the equipment and operator. Delaying sawcutting past this point will make jointing ineffective.

3. Control jointing in exterior paving slabs shall be laid out in a checkerboard pattern; pour as described above, but with joint edges tooled to provide a uniform joint at least 3/8 inch in depth.
 4. Slab reinforcing need not be terminated at control joints.
 5. Construction and expansion joints shall be counted as control joints.
- G. Expansion Joints:
1. Unless otherwise indicated, use 3/8 inch thick expansion joint filler. See Section 2.01.H.
 2. Joints in interior slabs on grade shall be only in locations indicated.
 3. Joints in exterior slabs on grade shall be installed at each side of structures, at curb transitions opposite apron joints, at ends of curb returns, at back of curb when adjacent to sidewalk, and at uniformly spaced intervals not exceeding 20 feet.
 4. Edges of concrete at joints shall be edger finished to approximately 3/8 inch radius.
 5. Interrupt reinforcing at all expansion joints.
- H. Score markings on exterior slabs on grade shall be located as indicated. Where not indicated, mark slabs into rectangles of not less than 12 square feet nor more than 20 square feet using a scoring tool which will leave edges of score markings rounded.

3.02 CURING AND PROTECTION

- A. Curing: Exposed surfaces of all concrete used in structure shall be maintained in a moist condition for at least 7 days after placing. The following final curing processes shall normally be considered to accomplish this. Concrete shall be maintained at not less than 50 degrees F nor more than 100 degrees F for a period of 72 hours after being deposited.

3.03 FINISHES

- A. Formed Surfaces:
1. Rough Form Finish: Surfaces shall be reasonably true to line and plane with no specified requirements for selected facing materials. Tie holes and defects shall be patched and fins exceeding 1/4 inch in height shall be rubbed down with wooden blocks. Fins and other rough spots at surfaces to receive membrane waterproofing shall be completely removed and the surfaces rubbed smooth. Otherwise, surfaces shall be left with the texture imparted by forms.
 2. Smooth Plywood Form Finish: Finish shall be true to line and plane. Tie holes and defects shall have been patched and ground with surface fins removed. Arrangement of plywood sheets shall be orderly, symmetrical, as large as practical and free of torn grain or worn edges. Surface concrete shall be treated with 1 part muriatic acid, in three parts water solution, followed immediately by a thorough rinsing with clear water. Surfaces which are glazed, have efflorescence, or traces of form oil,

curing compounds or parting compounds shall be cleaned or treated to match other formed surfaces, except as otherwise indicated or specified.

- B. Flatwork (Slabs and Floors):
1. Unless otherwise indicated or specified, flatwork shall have an integral monolithic finish.
 2. Integral Monolithic Finish: Apply as soon as freshly poured concrete slabs will bear weight of workers. Pour slabs full thickness to finish floor elevations indicated. At proper time, tamp surface repeatedly with a wire mesh or grid tamper in a manner to force aggregate down below surface and to bring sufficient mortar to surface to provide for a smooth coating of cement mortar over entire surface. Allow surface mortar to partially set, then float with wooden floats and finish with one of following, as required.
 - a. Broom Finish: Steel trowel surface to a smooth dense surface free of lines, tool marks, cat faces and other imperfections. After troweling, and before final set, give surface a broom finish, brushing perpendicular to the primary direction of travel, parallel to the direction of drainage, or as directed by Architect. Broom finish shall be used typically on all exterior flatwork except as otherwise indicated or specified and shall be "medium" texture for areas with slope of 5% (1:20) or less and as approved by Architect. For areas with a slope 5% and 8.33% (1:12) provide "heavy" texture broom finish perpendicular to the direction of the slope.
 - b. Smooth Steel Trowel Finish: Apply 2 steel trowelings to obtain hard, smooth surface. All lips, irregularities, uneven levels, etc. shall be worked out before last troweling. All interior flatwork shall have a smooth steel trowel finish unless specified otherwise.
 1. Where slab is not exposed or where appearance is not important, cracks larger than 1/32 inch wide shall be filled with cement grout and struck off level with surface.
 2. Where slab is exposed and appearance is important, unsightly cracks shall be repaired in a manner satisfactory in appearance to Architect. If this cannot be accomplished, concrete shall be considered defective.

END OF SECTION

SECTION 03 35 00
CONCRETE FINISHING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes finishing for cast-in-place concrete.
 - 1. Slabs-on-grade.
 - 2. Concrete wall finishes.
 - 3. Slab flatness).
 - 4. Slab Levelness
 - 5. Repair materials.

1.3 REFERENCES

- A. California Code of Regulations, Title 24, Part 11 California Green Building Standards Code, "CAL-Green."
- B. California Code of Regulations, Title 24, Part 2, California Building Code (CBC), International Building Code with California Amendments.
- C. 36 CFR 1191 - Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Rule; Federal Register, July 26, 1991; updated 2010.
- D. Shop Drawings:
 - 1. Layout of where all finishes, flatness and levelness will be executed.
 - a. Coordinate Shop Drawings with requirements indicated on Structural Drawings.
- E. Qualification Data: For Installer.

1.4 PERFORMANCE REQUIREMENTS

- A. VOC limits for adhesives, sealants, fillers, primers, and coatings. Comply with limits specified in Section 01 6116.

- B. Slip Resistance: Exposed concrete surfaces for pedestrian traffic to have a minimum static coefficient of friction per test method ASTM D 2047 of 0.6 at horizontal surfaces and a minimum static coefficient of 0.8 at ramp surfaces exceeding a 5 percent slope.

1.5 STEEL REINFORCEMENT

- A. Refer to Section 03 2000 "Concrete Reinforcing."

1.6 CONCRETE MATERIALS

- A. Refer to Section 03 3000 "Cast-In-Place Concrete" for cementitious materials and other requirements for admixtures and aggregates.

1.7 CONCRETE MIXING

- A. Refer to Section 03 3000 "Cast-In-Place Concrete."

1.8 CURING MATERIALS

- A. Refer to Section 03 3000.
- B. Comply with Structural Drawings for curing materials and other requirements for curing.

1.9 REPAIR MATERIALS

- A. Bonding Agent: ASTM C 1059, Type II, nonredispersible, acrylic emulsion or styrene butadiene.
- 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 suit requirements.
- C. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from **1/8 inch (3.2 mm)** and that can be feathered at edges to match adjacent floor elevations.
- D. Repair Overlayment: Interior-use, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from **1/4 inch (6.4 mm)** to **1-1/2 inches (38.1 mm)**, and that can be filled in over a scarified surface to match adjacent floor elevations.

PART 2 - EXECUTION

2.1 PROTECTION OF MATERIALS

- A. Protect materials from damage, weather, and contaminants such as grease, oil, and dirt.

2.2 INSTALLATION OF CAST-IN-PLACE CONCRETE

- A. Refer to Section 03 3000.

2.3 AS-CAST FORMED FINISHES

- A. Perform subsequent finishing operations as soon as practical after stripping formwork, except as specifically noted.
- B. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections exceeding specified limits on formed-surface irregularities.
- C. 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.
- D. Form-Liner Finish: Produce a textured surface free of pockets, streaks, and honeycombs, and of uniform appearance, color, and texture.
- E. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Remove fins and other projections exceeding specified limits on formed-surface irregularities. Repair and patch tie holes and defects.
 - 1. Architectural Concrete: Smooth-Formed finish and as follows.
 - a. No facing materials with raised grain.
 - b. Facing materials set in orderly and symmetrical arrangement, demonstrated in shop drawings.
 - c. Minimize seams.

2.4 CAST-IN-PLACE CONCRETE SLAB FINISHES

- A. General: Comply with ACI 302.1R recommendations for screeding, floating, restraightening, and finishing operations for slabs.
 - 1. Do not wet concrete surfaces.
- B. Evaporation Control: Protect concrete from rapid moisture loss before and during finishing operations. Apply evaporation control material prior to the commencement of finishing operations and periodically during finishing as needed. Do not apply water to the slab surface prior to the completion of finishing operations.
- C. Measurement of Slab Tolerances: Measure slab finish tolerances within 72 hours after slab finishing and before removal of supporting formwork or shoring. Use the specified method and tolerance listed for each type of finish.

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- D. Scratch Finish: While still plastic, screed and bullfloat concrete surface. Roughen the surface with stiff brushes or rakes to produce a profile of 1/4 inch in one direction before final set of concrete.
 - 1. Finish Tolerance: 1/2 inch in 10 feet measured by "10-feet straightedge method" in ACI 117.
- E. Float Finish: Screed and bullfloat concrete surface. Consolidate surface with power-driven floats or by hand floating if area is too small or inaccessible by power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
 - 1. Finish Tolerance: 5/16 inch in 10 feet measured by "10 -feet straightedge method" in ACI 117.
- F. Light Trowel Finish: Apply float finish. Consolidate concrete surface by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks, uniform in texture, and planed to the specified tolerance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
- G. Hard Trowel Finish: Apply light trowel finish. Continue hand troweling until a ringing sound is produced as the trowel is moved over the surface. Final hand-troweling shall leave finished surface free of trowel marks, uniform in texture and appearance, and planed to the specified tolerance.
- H. Broom Finish: Apply float finish. Lightly steel trowel to remove irregularities. Roughen surface by drawing a fiber bristle broom, not less than 24 inches wide, across surface perpendicular to main traffic route. Produce even texture from edge to edge, lapping adjacent strokes slightly to produce a uniform pattern.
 - 1. Finish Tolerance: 5/16 inch in 10 feet measured by "10-feet straightedge method" in ACI 117.
 - 2. Obtain Architect's approval for texture of final finish before application.
- I. Swirl Finish: Apply float finish. Hand float using a wood float to produce a continuous swirl patterned surface, free from porous and rough spots that may be produced by disturbing particles of coarse aggregate embedded near the surface.
 - 1. Finish Tolerance: 5/16 inch in 10 feet measured by "10-feet straightedge method" in ACI 117.
 - 2. Obtain Architect's approval for texture and pattern of final finish before application.
- J. Slip-Resistive Finish: Apply initial float finish. Before final floating, apply slip-resistive aggregate according to manufacturer's written instructions. Minimum rate of application shall be 25 pounds per 100 square feet. Follow spreading and tamping of slip-resistive aggregate with a final float, but do not force below surface and apply a light trowel finish. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive material.
 - 1. Finish Tolerance: 5/16 inch in 10 feet measured by "10-feet straightedge method" in ACI 117.

2.5 REPAIRS

- A. Repair and cure defective finished surfaces of cast-in-place architectural concrete only when approved by Architect. Match repairs to color, texture, and uniformity of surrounding surfaces and to repairs on approved mockups.
 - 1. Remove and replace cast-in-place architectural concrete that cannot be repaired and cured to Architect's approval.
- B. Contractor shall propose repair methods for Architect's approval, and perform proposed repair testing on approved mockups before repairing permanent work.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
- E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Architect's approval.

2.6 FIELD QUALITY CONTROL

- A. Testing and Inspecting: Owner will engage a qualified testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Inspections:
 - 1. Floor and Slab Flatness and Levelness: Measured according to ASTM E 1155 within 48 hours of finishing.

- END OF SECTION -

SECTION 04 22 00

MASONRY

PART 1 - GENERAL

1.01 SUMMARY

- A. Exterior Wall Construction:
 - 1. Solid grouted reinforced hollow unit masonry.
- B. Interior Construction:
 - 1. Load-bearing partitions.

1.02 QUALITY ASSURANCE

- A. Independent Testing Lab: masonry units, mortar and grout.

1.03 MATERIALS

- A. Concrete Units: Hollow concrete masonry units, split-face.
- B. Reinforcing: Steel bars ASTM A615 Grade 60.
- C. Embedded Flashing: Sheet metal.
- D. Mortar and Grout.

1.04 INSTALLATION

- A. Bond Pattern: One-half running bond.
- B. Parge below-grade masonry.
- C. Recycle clean masonry waste as fill material.

END OF SECTION

SECTION 05 12 00

STRUCTURAL STEEL

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

- A. Work included: All miscellaneous iron and steel, aluminum or other items not specifically described in other sections of these specifications but required for a complete and operable facility. This work includes pipe and tube railing where shown on the Plans.

1.03 SUBMITTALS

1.04 TESTING AND INSPECTIONS

1.05 PRODUCT HANDLING

- A. Protection: Use all means necessary to protect miscellaneous metal before, during, and after installation and to protect the installed work and materials of all other trades.

PART 2 – PRODUCTS

2.01 STEEL TUBING

- A. All steel tubing shall be new, free from rust, and conforming with the requirements of ASTM A-500 Grade B.

2.02 STEEL PLATES AND SHAPES

- A. All steel plates and shapes shall be new, free from rust, and conforming with the requirements of ASTM A-36 or A572 Grade 50 as noted on structural drawings.

2.03 MACHINE BOLTS

2.04 ANCHOR BOLTS

2.05 EXPANSION ANCHOR BOLTS

2.06 GALVANIZING

2.07 DISSIMILAR MATERIALS

2.08 ELECTRODES

PART 3 – EXECUTION

3.01 SURFACE CONDITIONS

- A. Inspection:
 - 1. Prior to all work of this section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where fabrication and installation of the work of this section may properly commence.

3.02 FABRICATION

3.03 SHOP PAINTING

3.04 ERECTION

END OF SECTION

SECTION 05 40 00

COLD-FORMED METAL FRAMING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.03 SUBMITTALS

1.04 QUALITY ASSURANCE

1.05 DELIVERY, STORAGE, AND HANDLING

PART 2 – PRODUCTS

2.01 ACCEPTED MANUFACTURERS

- A. Members of the Steel Stud Manufacturer's Association (SSMA), or approved equal.

2.02 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

2.03 COLD-FORMED STEEL FRAMING MATERIALS

2.04 FASTENERS

- A. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, in accordance with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

2.05 FABRICATION

PART 3 – EXECUTION

3.01 EXAMINATION

3.02 INSTALLATION, GENERAL

3.04 INSTALLATION OF EXTERIOR NON-LOAD-BEARING WALL FRAMING

3.05 INSTALLATION TOLERANCES

3.06 REPAIRS

END OF SECTION

SECTION 05 50 00

METAL FABRICATIONS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 specification Sections apply to Work of this Section as if printed herein.

1.02 SCOPE

- A. Shop fabricated metal items and miscellaneous metal work.
- B. Refer to Schedule at end of this Section.

1.04 RELATED SECTIONS

- A. Section 02 41 19 Selective Building Demolition
- B. Section 03 21 00 Reinforcing Steel
- C. Section 03 30 00 Cast-in-Place Concrete
- D. Section 05 12 00 Structural Steel Framing
- E. Section 08 71 00 Door Hardware
- F. Section 09 97 13 Steel Coatings

1.05 REFERENCES

1.06 SHOP DRAWINGS

1.07 QUALIFICATIONS

1.08 DELIVERY, STORAGE AND HANDLING

PART 2 – PRODUCTS

2.01 MATERIALS

2.02 FABRICATION

2.03 FINISH

PART 3 – EXECUTION

3.01 PREPARATION

- A. Obtain Architect's approval prior to site cutting or making adjustments not scheduled.
- B. Clean and strip primed steel items to bare metal where site welding is scheduled.
- C. Make provision for erection loads with temporary bracing. Keep work in alignment.
- D. Supply items required to be cast into concrete with setting templates, for installation under appropriate Sections.

3.02 FABRICATION

- A. Unless indicated otherwise on the construction drawings, all steel is to be finish fabricated and provided with a hot-dip galvanized finish before delivery to the jobsite. See item 2.3-D above. Any alterations of final connections performed on site are to receive cold applied galvanizing touch-up paint.

3.03 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 primer, except repair exposed galvanized work (not to be painted) with hot process field galvanizing, in accord with manufacturer's published directions.

3.04 SCHEDULE

END OF SECTION

- SECTION 05 51 00

METAL STAIRS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fabricated steel stairs with concrete-filled treads.
 - 2. Fabricated guardrails and handrails.

1.3 RELATED REQUIREMENTS

1.4 REFERENCES

1.5 SUBMITTALS

1.6 QUALITY ASSURANCE

1.7 COORDINATION

1.8 WARRANTY

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. VOC limits for adhesives, sealants, fillers, primers, and coatings. Comply with limits specified in Section 01 6116.
- B. Metal Stair Fabricators:
 - 1. Sharon Companies, LTD; Drop-In Stairs and Accessories; www.duvinage.com .
 - 2. Alfab, Inc.; www.alfabinc.com
 - 3. American Stair, Inc.; www.americanstair.com .

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NEW FIRE STATION
BENSON, CA**

4. Substitutions: Section 01 2500.

2.2 MATERIALS

2.3 METAL STAIRS, GENERAL

- A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
- B. Metal Jointing and Finish Quality Levels:

2.4 METAL STAIRS WITH CONCRETE TREADS AND LANDINGS

- A. Jointing and Finish Quality Level: Commercial, as defined above.
- B. Risers: Closed.
- C. Treads: Metal pan with field-installed concrete fill.
- D. Stringers: Rolled steel channels.
- E. Landings: Similar construction, using corrugated steel decking, supported and reinforced as required to achieve design load capacity.
- F. Railings: Steel pipe railings.
- G. Finish: Shop- or factory-prime painted.
- H. Under Side of Stair: Exposed to view, to be finished same as specified for other exposed to view surfaces.

- 2.5 FASTENERS
- 2.6 STAIR NOSINGS
- 2.7 CONCRETE AT STAIR TREADS AND LANDINGS
- 2.8 MISCELLANEOUS MATERIALS
- 2.9 FABRICATION, GENERAL
- 2.10 FABRICATION OF STEEL-FRAMED STAIRS
- 2.11 FABRICATION OF STAIR RAILINGS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions with Installer present for compliance with requirements, installation tolerances, and other conditions affecting performance of the work.

3.2 INSTALLATION

- END OF SECTION -

SECTION 06 10 00

ROUGH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

- A. Framing with dimension lumber and engineered wood products.
- B. Wood furring, grounds, nailers and blocking.
- C. Sheathing.

1.02 MATERIALS

- A. Wood Treatment: Preservative.
- B. Framing:
 - 1. Non-Load-Bearing Interior partitions: Dimension lumber.
 - 2. Load-Bearing Walls: Dimension lumber.
- C. Engineered Wood Products: Prefabricated wood I-joists.
- D. Concealed, Performance-Rated Structural-Use Panels: Combination subfloor-underlayment, wall sheathing, roof sheathing.
- E. Plywood backing panels for electrical, telephone equipment.
- F. Air-Infiltration Barrier; Polyolefin air retarder.
- G. Metal Framing anchors: joist hangers, post bases, joist ties, hold downs.
- H. Sill-sealer gaskets.

1.03 INSTALLATION

- A. Exterior Wall Framing: 2x6 studs at 16 inches o.c.
- B. Interior Wall Framing: 2x4 studs at 16 inches o.c.
- C. Roof Framing: Engineered trusses at 24 inches o.c.
- D. Floor Framing: 16 inches o.c.

END OF SECTION

SECTION 06 18 00

GLUE LAMINATED BEAMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Beams, girders and purlins.

1.02 QUALITY ASSURANCE

- A. Members designed by engineer of record.

1.03 MATERIALS

- A. Structural Glued-Laminated Units:
 - 1. Lumber Species: Douglas fir.
 - 2. Appearance Grade: Architectural.
 - 3. Treatment: Seal coat.
- B. Factory finishing.

END OF SECTION

SECTION 06 20 00

FINISH CARPENTRY

PART 1 - GENERAL

1.01 SUMMARY

- A. Framing with dimension lumber.
- B. Wood blocking and backing.
- C. Sheathing.
- D. Subflooring.
- E. Interior wood trim.

1.02 MATERIALS

- A. Wood Treatment: Preservative.
- B. Framing: Interior partitions.
- C. Boards: Concealed.
- D. Interior Wood Trim: softwood Hardwood.
- E. Plywood backing panels for electrical and telephone equipment.

1.03 INSTALLATION

- A. All equipment, handrails, grab bars and etc. shall have backing installed.

END OF SECTION

SECTION 06 41 00

CUSTOM CASEWORK

PART 1 - GENERAL

1.01 SUMMARY

- A. Related Documents.
- B. Description of requirements for materials, fabrications and installation of casework, and accessory items as shown on Drawings and necessary to complete the Work.
 - 1. Plastic Laminated and wood cabinets.
 - 2. Plastic laminated countertops and back splashes.
 - 3. Custom casework.
 - 4. Preparation for installation of utilities.
 - 5. Casework grade to be Custom WIC unless specified otherwise.
 - 6. Provide all required cabinet hardware.
- C. Related Sections:
 - 1. Section 06100: Rough Carpentry (Blocking)
 - 2. Section 06200: Finish Carpentry
 - 3. Section 09260: Gypsum Wallboard Systems.
 - 4. Section 09650: Resilient Floor Tile.
 - 5. Section 09900: Painting (Painter applied primer and finish work).
 - 6. Division 15: Plumbing/ Mechanical
 - 7. Division 16: Electrical

1.02 QUALITY ASSURANCE

- A. References and Standards:
- B. Fabricator and Installer Qualifications.
- C. Installation Acceptance.

1.03 SUBMITTALS (Submit under provision of Section 01300)

- A. Shop Drawings: Drawings shall show each of the items to be provided under this Section including: materials, profiles and elevations, assembly methods, fastening methods, accessory listings, hardware types and locations, schedule of finishes, completely detailing joinery, including D.S.A. approved anchorage.
- B. Certification:
- C. Samples:

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery.
- B. Storage and Handling:

1.05 JOB CONDITIONS

- A. Environmental Requirements:

PART 2 - MATERIALS

2.01 MATERIALS AND CONSTRUCTION GRADE

- A. Materials and Construction Grades:
- B. Base Material for Plastic Laminate:
- C. Fasteners:
- D. Miscellaneous/Casework Items:

2.02 FABRICATION - GENERAL

- A. General:
- B. Plastic Laminate Covered Casework:
- C. Shelving.
- D. Drawers and Flat Files:
- E. Casework Bases.

2.03 FABRICATION - GENERAL CASES AND COUNTER TOPS

2.04 HARDWARE

A. General Requirements.

B. Hardware Installation:

2.05 MISCELLANEOUS

2.06 SOURCE QUALITY CONTROL

2.07 SAFE LOCATION

PART 3 - EXECUTION

3.01 CONDITION OF SURFACES

3.02 INSTALLATION

3.03 FINAL INSPECTION:

3.04 CLEANING AND ADJUSTING

END OF SECTION

SECTION 07 21 00

BLANKET INSULATION

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Section Includes: Description of requirements for materials, fabrications, and installation of building thermal insulation, acoustical insulation, and associated accessories except as specified in other Sections of these Specifications. Insulation shall be installed in all new construction and in all locations where wall/ceiling cavities are exposed by modernization work.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. The requirements of Division 01 apply to the Work of this Section.
- B. Related Sections:
1. Section 05 40 00 Cold-Formed metal Framing
 2. Section 08 12 13 Metal Frames
 3. Section 09 29 00 Gypsum Board
 4. Section 07 40 00 Roof and Siding Panels

1.03 QUALITY ASSURANCE

- A. Acceptable Manufacturers:
1. Thermal and Sound Insulation: Certainteed; Manville; Owens/Corning Fiberglas; United States Gypsum.
 2. Manufacturers designated herein for certain products indicate the quality to be provided for that specific product. Products of all other manufacturers must be preapproved equal as determined by the architect.

1.04 SUBMITTALS (Submit under the provisions of Section 01 33 00)

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

1.06 JOB CONDITIONS

PART 2 – PRODUCTS

2.01 MANUFACTURERS

2.02 PRODUCT STANDARDS

2.03 MATERIALS

PART 3 – EXECUTION

3.01 EXAMINATION

3.02 INSTALLATION

A. General Requirements:

1. Install insulation in accordance with manufacturer's recommendations to fit snugly between framing members and around pipes, conduits, and outlet boxes as necessary to maintain integrity of insulation.
2. Provide means to prevent displacement where required
3. Insulation shall have joints properly sealed.
4. No wire required if supported by Gypsum Board or suspended ceiling.
5. Securely fasten and anchor insulation in place to prevent displacing or sagging of material in all areas. At wood stud walls staple facing flanges at maximum 6 inches on center.

B. Acoustical Insulation: Install the specified insulation in all areas indicated herein and additionally as indicated on the plans.

1. Studs Walls: The insulation shall be friction fit securely between studs and furring to provide a continuous seal.
3. Comply with requirements of section 3.02 A above.

C. Sealing Insulation:

1. Install around all ducts, pipes, conduits, etc. passing through walls, at all "poke-through" openings, as required to seal any opening or holes between above-ceiling spaces, attics, plenums, and exterior walls of buildings, and at any other locations indicated on the drawings.
 - a. Install a 1-1/2" minimum thick top seal or smoke seal installed as recommended by manufacturer.

3.03 DEFECTIVE WORK

3.04 CLEAN UP

- A. Upon completion of the work of this section, remove all surplus materials, rubbish and debris from the premises.

END OF SECTION

SECTION 07 21 13

BOARD INSULATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Wall insulation and air barrier foam board.

1.02 RELATED SECTIONS

- A. Section 04 22 00 Concrete Unit Masonry
- B. Section 07 40 00 Roofing and Siding Panels
- C. Section 09 22 16 Non-Structural Metal Framing
- D. Items relating solely to mechanical or electrical work are included under those Divisions, except as specifically indicated otherwise on Drawings.

1.03 REFERENCES

- A. Air Barrier Association of America (ABAA)
- B. American National Standards Institute (ANSI):
- C. ASTM International (ASTM):
- D. International Code Council (ICC):

1.04 SUBMITTALS

- A. Submit under provisions of Section 01 33 00 Submittals
- B. Product Data: Manufacturer's data sheets on each product to be used

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store and handle products per manufacturer's instructions until ready for installation.

1.06 SEQUENCING

1.07 PROJECT CONDITIONS

1.08 WARRANTY

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer List: Products of the following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules, and these Specifications:
1. Atlas Roofing; (800) 677-1476; www.atlasroofing.com
 2. Rmax - A Business Unit of the Sika Corporation; Phone (800) 527-0890; www.rmax.com
 3. Johns Manville; (800) 654-3103; www.jm.com/en

2.02 MATERIALS

- A. Basis of design shall be board insulation: EnergyShield Ply Pro by Atlas Roofing
Description: ASTM C1289, Type 5, grade 3 (25psi), closed cell polyisocyanurate foam core faced with coated glass facers on both sides, bonded to nominally 5/8 inch thick 4' x 8' fire-retardant treated plywood.
- B. System Fastening Components
- C. System Joint Sealants, Joint Tapes, and Flashing Materials:

PART 3 – EXECUTION

3.01 EXAMINATION

3.02 PREPARATION

3.03 INSTALLATION

3.04 PROTECTION

END OF SECTION

SECTION 07 22 00

ROOF AND DECK INSULATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Flat and tapered Polyiso Roof Insulation
 - 1. Faced with non-asphaltic, fiber-reinforced cellulosic in-organic felt facers on both major surfaces of the core foam (GRF).

1.02 RELATED SECTIONS

- A. Section 07 22 20 Roof Boards
- B. Section 07 40 00 Roofing and Siding Panels

1.03 REFERENCES

1.04 DEFINITIONS

1.05 SUBMITTALS

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum twenty-five years documented experience.
- B. Installer Qualifications: Company specializing in the installation of products specified in this section with minimum 5 years documented experience in installing products of the same type and scope as specified.

1.07 DELIVERY, STORAGE, AND HANDLING

1.08 SEQUENCING

1.09 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer List: Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules, and Specifications:
 - 1. Atlas Roofing Corporation; 2000 Riveredge Parkway Suite 800, Atlanta, GA 30328; phone: 800-388-6134; web: www.atlasrwi.com
 - 2. GAF, 11800 Industry Avenue, Fontana, CA 92337; phone: 1-951-360-4200; www.gaf.com
 - 3. Carlisle SynTec Systems; P.O. Box 7000, Carlisle, PA 17013; phone 800.479.6832; www.carlislesyntec.com
- B. Substitutions:

2.02 MATERIALS

- A. Roof Insulation panel (base panel): Flat closed-cell polyisocyanurate (polyiso) foam core integrally bonded to non-asphaltic, fiber-reinforced inorganic coated glass facers.
- B. Tapered Insulation panels: Factory tapered panels of type equal to the base panels above.
- C. Accessory components (pre-cut crickets, drain set sump, pre-cut miter, tapered edge strip, etc.) shall be of manufacturer's standard line equal to the base sheet material identified above.

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Examine roof deck and adjacent conditions for suitability to receive insulation.
- B. Verify that substrate is dry, clean and free of foreign material that will damage insulation or impede installation.
- C. If substrate preparation is the responsibility of another installer, notify Owner of unsatisfactory preparation before proceeding.
- D. Verify that roof drains, scuppers, roof curbs, nailers, equipment supports, vents, and other roof accessories are secured properly and installed in conformance with Contract Documents.
- E. Verify that deck is structurally sound to support installers, materials and equipment without damaging or deforming work.
 - 1. Start of installation indicates installer accepts conditions of existing deck surfaces.

3.02 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.
- C. Verify the manufacturer's roof edge details for accuracy to fit the assembly.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's installation instructions.
- B. Install specified insulation using approved mechanical fasteners, hot asphalt or adhesives in accordance with manufacturer's latest written instructions and as required by governing codes and University's insurance carrier.
- C. Install with end joints staggered to avoid having insulation joints coinciding with joints in deck. In multi-layer installations, stagger joints in top and bottom layers.

3.04 PROTECTION

- A. Remove trash and construction debris from insulation surface prior to application of roofing membrane.
- B. Do not leave installed insulation exposed to weather. Cover and waterproof completed roof system immediately after installation.
 - 1. Temporarily seal exposed insulation edges at the end of each day.
 - 2. Remove and replace installed insulation that has become wet or damaged with new insulation.
- C. Protect installed insulation and roof cover from traffic by use of protective covering materials during and after installation.

END OF SECTION

SECTION 07 22 20

ROOF BOARDS

PART 1 – GENERAL

1.01 SUMMARY

- A. Section Includes: Fiberglass-mat faced gypsum roof boards for application directly under roofing finish systems.

1.02 REFERENCES

- A. ASTM International (ASTM):
- B. Underwriters Laboratories (UL): UL 790 Standard Test Methods for Fire Tests of Roof Coverings

1.03 RELATED WORK (See also Table of Contents)

- A. Section 07 22 00 Roof and Deck Insulation
- B. Section 07 40 00 Roof and Siding Panels
- C. Section 07 60 00 Flashing and Sheet Metal
- D. Section 07 95 00 Expansion Control
- E.
- F. Items relating solely to mechanical or electrical work are included under those Divisions, except as specifically indicated otherwise on Drawings.

1.04 SUBMITTALS

1.05 DELIVERY, STORAGE, AND HANDLING

1.06 FIELD CONDITIONS

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer List: Products of the following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules, and these Specifications:
 - 1. Georgia-Pacific Gypsum, LLC; (800) 225-6119; www.buildgp.com

2. US Gypsum; (800) 950-3839; www.usg.com
3. National Gypsum; (704) 365-7300; www.nationalgypsum.com

2.02 FIBERGLASS-MAT FACED GYPSUM ROOF BOARDS

- A. Composition: Impact-resistant, nonstructural, siliconized moisture and mold resistant gypsum core, with high- performance fiberglass facer; manufactured to conform to ASTM C1177.
- B. Fiberglass Mat Faced Gypsum Roof Board:

2.03 MISCELLANEOUS MATERIALS

PART 3 – EXECUTION

3.01 INSTALLATION

- A. Apply only as many roof boards as can be covered by a roof membrane system in the same day.
- B. Board edges and ends shall be butted tightly together; do not gap edges or ends.
- C. Refer to roof system manufacturer's written instructions, local code requirements, and Factory Mutual Global and/or Underwriters Laboratories requirements for proper installation techniques.
- B. Use fasteners specified in accordance with above requirements. Install approved fasteners with plates into the roof board panels, flush with the surface. Fasteners shall penetrate the insulation board and fully engage the structural metal decking. Fasteners should be installed in strict compliance with the roof system manufacturer's installation recommendations and FMG Loss Prevention Data Sheet 1-29. Proper fastener spacing is essential to achieve wind-uplift performance.

END OF SECTION

DOCUMENT 07 40 00

ROOFING AND SIDING PANELS

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 specification Sections apply to Work of this Section as if printed herein.

1.02 SCOPE

- A. Furnish and install formed pre-finished metal wall and roof panel systems.

1.03 RELATED WORK

- A. Section 05 05 19 Post-Installed Concrete Anchors
- C. Section 05 40 00 Cold-Formed Metal Framing
- D. Section 07 21 13 Board Insulation
- E. Section 07 22 00 Roof and Deck Insulation
- F. Section 07 22 20 Roof Board
- G. Section 07 60 00 Flashing and Sheet Metal
- H. Section 07 92 00 Joint Sealants
- I. Section 07 95 00 Expansion Control
- J. Section 08 11 13 Hollow Metal Doors and Frames
- K. Items relating solely to mechanical or electrical work are included under those Divisions, except as specifically indicated otherwise on Drawings.

1.04 SUBMITTALS

- A. Product Data:
- B. Shop Drawings:
- C. Samples
- D. Qualification Data: For Installer, provide letter from manufacturer that installer has a successful record of product installation for a minimum of 5 years.

- E. Sample Warranties: Provide draft of manufacturer's standard warranty indicating maximum length of warranty for weather tightness, color retention, and material defects.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Store metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weather tight and ventilated covering. Store metal panels to ensure dryness with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation

1.06 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer List: Products of the following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules, and these Specifications:
 - 1. AEP Span; (800) 733-4955; www.aepspan.com
 - 2. McElroy Metal; (800) 950-8448; mcelroymetal.com
 - 3. Western States Metal Roofing; (877) 787-5467; www.metalforroofing.com

2.02 MATERIALS

- A. Metal Wall Panels:
 - 1. Basis of design shall be AEP Span Reverse HR-36, exposed fastener metal wall panels: metal panels consisting of formed metal sheet with vertical panel edges, with flush joints or reveal between panels, and attached to supports using exposed color coordinated fasteners.
- B. Metal Roof Panels:
 - 1. Basis of design shall be AEP Span Design Span hp panels; concealed fastener metal panels: metal panel consisting of formed metal sheet with

integral overlapping locking seams to conceal fastener clips and subtle striations between ribs.

2.03 ACCESSORIES

2.04 FABRICATION

2.05 FINISHES

PART 3 – EXECUTION

3.01 EXAMINATION

3.02 PREPARATION

3.04 METAL PANEL INSTALLATION

- A. Install metal wall panels in strict accordance with manufacturer's technical instructions.
- B. Install metal roof panels in strict accordance with manufacturer's technical instructions.

3.05 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal panel units within installed tolerance of 1/4 inch in 20 feet on slope and location lines and within 1/8 inch offset of adjoining faces and of alignment of matching profiles.

3.6 CLEANING AND PROTECTION

END OF SECTION

SECTION 07 60 00

FLASHING AND SHEET METAL

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Related Documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Sections apply to Work of this Section as if printed herein.
- B. Section Includes:
 - 1. Roof flashings with a galvanized bonderized finish
 - 2. Counter flashing over Roofing base flashings with galvanized finish
 - 3. Counter flashing to lap under roof mounted mechanical equipment, exhaust fans, vent stacks, etc.
 - 4. "Z" furring with a galvanized bonderized finish to span insulation board
 - 5. Gutters and downspouts
- C. RELATED SECTIONS
 - 1. Section 05 05 19 Post-Installed Concrete Anchors
 - 2. Section 07 22 00 Roof and Deck Insulation
 - 3. Section 07 40 00 Roofing and Siding Panels
 - 4. Section 07 92 00 Joint Sealants
 - 5. Section 07 95 00 Expansion Control
 - 6. Section 09 91 00 Painting
 - 7. Items relating solely to mechanical or electrical work are included under those Divisions, except as specifically indicated otherwise on Drawings.

1.02 REFERENCES

1.03 QUALITY CONTROL

1.04 SUBMITTALS (Submit under the provisions of Section 01 33 00)

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

1.06 JOB CONDITIONS

1.07 QUALITY ASSURANCE

1.08 WARRANTY

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Sheet Metals:
 - 1. Galvanized Sheet Metal: ASTM A653, G 90, commercial quality, heavy duty 20 gauge, unless otherwise noted. Use hot-dip galvanized steel or cadmium plated fasteners.
 - 2. Steel plates and flat bar stock shall have galvanized finish and conform to ASTM A36.
 - 3. Sheet metal flashing with bonderized coating for field painting.
- B. Solder and Flux:
- C. Asphaltic Primer: ASTM D41
- D. Plastic Cement: Asphaltic, FS SS-C-153, Type I, asphaltic base cement.
- E. Sealants:
 - 1. Refer to Section 07 92 00 Joint Sealants
- F. Packing and Wedges: Lead or other nonferrous alloys as approved by Architect.
- G. Items for Permanent Protection of Dissimilar Metals and Materials
- H. Protective backing paint: FS-TT-C-494A, Bituminous paint

2.02 FABRICATION

2.03 FINISHES

PART 3 – EXECUTION

3.01 INSPECTION

- A. Examine areas to receive items and verify the following:
 - 1. All shapes and dimensions of surface to be covered.
 - 2. That substrates, adjacent or adjoining surfaces are clean, dry and reasonably smooth, and free from defects to extend needed for sheet metal work.
 - 3. That wood surfaces to be in contact with sheet metal are free from projecting nails.
 - 4. Absence of other conditions that will adversely affect installation.
- B. Do not start work until unsatisfactory conditions have been corrected. Beginning of work means acceptance of existing conditions.

3.02 PREPARATION

3.03 INSTALLATION

3.04 SEALANTS

3.05 TOUCH-UP

END OF SECTION

SECTION 07 92 00

JOINT SEALANTS

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Related Documents: Drawings and General Provisions of Contract, including General Conditions and Division 01 Specification Sections apply to Work of this Section as if printed herein.
- B. Section Includes: Description of requirements for materials, fabrications, and installation of sealants, caulking, and associated accessories, except for those specified in other Sections, where indicated on Drawings, and where required to provide for a weather tight and watertight condition shall be furnished and installed under this section of the specifications.
- C. Related Sections:
 - 1. Section 03 30 00 Cast-in-Place Concrete
 - 2. Section 04 22 00 Concrete Unit Masonry
 - 3. Section 05 40 00 Cold-Formed Metal Framing
 - 4. Section 06 83 16 Fiberglass Reinforced Paneling
 - 5. Section 07 40 00 Roofing and Siding Panels
 - 6. Section 07 60 00 Flashing and Sheet Metal
 - 7. Section 07 95 00 Expansion Control
 - 8. Section 08 11 13 Metal Doors and Frames
 - 9. Section 09 29 00 Gypsum Board
 - 10. Section 09 30 00 Tiling
 - 11. Section 09 91 00 Painting
 - 12. Items relating solely to mechanical, plumbing, or electrical work are included under those Divisions, except as specifically indicated otherwise on the Contract Drawings.

1.02 QUALITY ASSURANCE

1.03 SUBMITTALS

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

1.05 JOB AND ENVIRONMENTAL CONDITIONS

1.06 WARRANTY

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Sealants: Sealants shall be polysulfide, polyurethane, or silicone elastomeric type sealants.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Surface Acceptance: Examine all surfaces to be sealed or caulked for acceptance.

3.02 PREPARATION

- A. General: Thoroughly clean all joints, removing all foreign matter such as dust, oil, grease, water, surface dirt, etc. Sealant must be applied to the base surface.
- B. Porous Material such as concrete or masonry shall be cleaned where necessary by grinding, sand, or water blast cleaning, mechanical abrading, acid washing, or a combination of these methods as required to provide a clean, sound base surface for sealant adhesion.
- C. Nonporous Surfaces such as metal and glass shall be cleaned either mechanically or chemically.
- D. Sealant Preparation: Do not modify the sealant by addition of liquids, solvents or powders.

3.03 APPLICATION:

3.04 CLEAN-UP

END OF SECTION

SECTION 07 95 00

EXPANSION CONTROL

PART 1 – GENERAL

1.01 GENERAL REQUIREMENTS

- A. Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 specification Sections apply to Work of this Section as if printed herein.

1.02 SCOPE

- A. Interior and exterior building expansion joint closure assemblies. Assemblies shall be fire rated at exterior perimeter of walls and roof.
- B. Joint closure products shall be coordinated for sizes and locations of building expansion joints with constructed joint widths and anticipated movement.

1.03 RELATED WORK

- A. Section 04 22 00 Concrete Unit Masonry
- B. Section 05 05 19 Post Installed Concrete Anchors
- C. Section 07 40 00 Roofing and Siding Panels
- D. Section 07 60 00 Flashing and Sheet Metal
- E. Section 07 92 00 Joint Sealants

1.04 SUBMITTALS

1.05 PERFORMANCE REQUIREMENTS

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer List: Products of the following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules, and these Specifications:
 - 1. Balco, Inc.; 2626 S. Sheridan, Wichita, KS 67217; phone (800) 767-0082; www.balcousa.com
 - 2. Inpro Architectural Products; World Headquarters, S80 W18766 Apollo Drive, Muskego, WI 53150; (800) 222-5556; www.inprocorp.com
 - 3. Construction Specialties (CS) - Allway; Hughesville, PA; (800) 233-8493; www.c-sgroup.com

2.02 Expansion and Seismic Joint Systems

- A. Interior expansion and seismic joint systems with fire rating
- B. Exterior expansion and seismic joint systems with fire rating:
- C. Roof expansion and seismic joint systems with fire rating:

2.03 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.04 ACCESSORIES

- A. Fire Block: 1 to 2-hour fire-rated intumescent fire barrier including expansion joint system with shear movement capability.
- B. Compressible Foam Fire Barrier: 1 to 3-hour fire-rated insulative fire barrier including expansion joint system.

PART 3 – EXECUTION

3.01 EXAMINATION

3.02 PREPARATION

3.03 INSTALLATION

3.04 CONNECTIONS

3.05 PROTECTION

END OF SECTION

SECTION 08 14 00

FLUSH WOOD DOORS

PART 1 - GENERAL

1.01 SUMMARY

- A. Solid-core doors with Birch wood-veneer faces.
- B. Job-fit doors to frames.
- C. Factory machining for hardware.
- D. Light frames.

1.02 QUALITY ASSURANCE

- A. Quality Standard: NWWDA.

1.03 WARRANTY

- A. Materials and Workmanship:
 - 1. Solid-Core Interior Doors: Life of installation.

1.04 MATERIALS

- A. Doors for Opaque Finish:
 - 1. Grade: Premium.
 - 2. Faces: Hardboard for interior doors.
- B. Interior Hardboard-Faced, Solid-Core Doors:
 - 1. Core: Particleboard.
 - 2. Construction: Bonded core.
- C. Louvers: Galvanized steel.
- D. Light Opening Frames: Wood.
- E. Finish: Shop prime.

END OF SECTION

SECTION 08 31 00

ACCESS DOORS AND PANELS

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes access doors and frames for walls and ceilings.

1.03 SUBMITTALS

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer List: Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules, and Specifications:
 - 1. Nystrom; www.nystrom.com
 - 2. Karp; www.karpinc.com
 - 3. Babcock Davis; www.babcockdavis.com

2.02 ACCESS DOORS AND FRAMES – (Non-Rated)

- A. Flush Access Doors: Concealed Flanges for drywall (Non-Rated General Purpose Access Door).

PART 3 – EXECUTION

3.01 EXAMINATION

3.02 INSTALLATION

3.03 ADJUSTING

END OF SECTION

SECTION 08 33 23

OVERHEAD COILING DOORS

PART 1 - GENERAL

1.01 SUMMARY

- A. Overhead Coiling Doors:
 - 1. Insulated service doors.

1.02 QUALITY ASSURANCE

- A. Performance Requirements:
 - 1. Wind Load: 20 lbf/sq. ft.
 - 2. Cycles: Designed for not less than 20,000 cycles.

1.03 MATERIALS

- A. Door Curtain: Hot-dipped galvanized steel with view lights.
- B. Polystyrene or polyurethane-foam insulation with hot-dipped galvanized inside curtain face.
- C. Seals: Weather.
- D. Counterbalancing mechanism enclosed in hood.
- E. Finishes:
 - 1. Steel and Galvanized Steel: Factory fluoropolymer powder-coat-applied finish.
- F. Manual Door Operators: Chain hoist.
- G. Electric motor operation: Remote-control station with obstruction detection device and radio control.

END OF SECTION

SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONT

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Related Documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 specification Sections apply to Work of this Section as if printed herein.
- B. Section Includes: Work shall include but not be limited to installation of aluminum architectural storefront window systems and doors including perimeter trims, stools, accessories, shims and anchors, and perimeter sealing. Requirements for materials fabrications and installation of aluminum doors, aluminum frames for doors, and associated accessories indicated on Drawings and necessary to complete the work.
- C. Related Sections:
 - 1. Section 03 30 00 Cast-in-Place Concrete
 - 2. Section 04 22 00 Concrete Unit Masonry
 - 3. Section 05 05 19 Post-Installed Concrete Anchors
 - 4. Section 05 40 00 Cold-Formed Metal Framing
 - 5. Section 07 21 13 Board Insulation
 - 6. Section 07 21 16 Blanket Insulation
 - 7. Section 07 40 00 Roofing and Siding Panels
 - 8. Section 07 92 00 Joint Sealants
 - 9. Section 07 95 00 Expansion Control
 - 10. Section 08 71 00 Door Hardware
 - 11. Section 08 80 00 Glazing
 - 12. Section 09 29 00 Gypsum Board

1.02 PERFORMANCE REQUIREMENTS

- A. Storefront System Performance Requirements:
 - 1. Wind loads:
 - 2. Air Leakage:
 - 3. Water Resistance:
 - 4. Uniform Load:
 - 5. Seismic:
 - 6. Thermal Movements:
 - 7. Energy Efficiency:

1.03 SUBMITTALS

1.04 QUALITY ASSURANCE

- A.

1.05 PROJECT CONDITIONS

1.06 DELIVERY, STORAGE, AND HANDLING

1.07 WARRANTY

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer List: Products of the following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules, and Specifications:
1. Kawneer Company, Inc.; 555 Guthridge Court, Norcross, GA 30092; (770) 449-5555; www.kawneer.com
 2. EFCO Corp; 1000 County Rd., Monett, MO 65708; (800) 221-4169; www.efcocorp.com
 3. Arcadia, Inc., 3225 East Washington Blvd., Vernon, CA. Telephone 323/269-7300; www.arcadiainc.com

2.02 ALUMINUM STOREFRONT SYSTEMS

- A. Aluminum Extrusions:
B. Fasteners:
C. Anchors, Clips, and Accessories:
D. Reinforcing Members:
E. Sealant:
F. Tolerances

2.03 STOREFRONT FRAMING SYSTEM

- A. Thermal Barrier:
B. Brackets and Reinforcements:
C. Fasteners and Accessories:
D. Perimeter Anchors: When steel anchors are used, provide insulation between steel material and aluminum material to prevent galvanic action.

2.04 GLAZING SYSTEMS

- A. Glazing: As specified in Section 08 80 00 Glazing.
B. Glazing Gaskets: Manufacturer's standard compression types; replaceable, extruded EPDM rubber.

- C. Spacers and Setting Blocks: Manufacturer's standard elastomeric type.
- D. Bond-Breaker Tape: Manufacturer's standard TFE-fluorocarbon or polyethylene material to which sealants will not develop adhesion.
- E. Glazing Sealants: As recommended by manufacturer for joint type.

2.02 FABRICATION

2.05 ENTRANCE DOOR SYSTEMS

- A. Entrance Doors: The door stile and rail face dimensions shall be not less than:
 - 1. Vertical Stile: 3 1/2" minimum
 - 2. Top and hardware rails: 3 1/2" minimum
 - 3. Bottom Rail: 10" minimum
- C. Entrance Door Hardware: As specified in Section 08 71 00 Door Hardware.
- D. Fabrication:

PART 3 – EXECUTION

3.01 EXAMINATION

3.02 INSTALLATION

3.03 FIELD QUALITY CONTROL

3.04 ADJUSTING, CLEANING, AND PROTECTION

END OF SECTION

SECTION 08 71 00

DOOR HARDWARE

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. Factory fabricated and finished door hardware systems. These shall include all required hardware for door functions including but not limited to the following:
 - 1. Hinges
 - 2. Locksets, Passage and Accessible hardware
 - 3. Closers, holders, stops, bumpers, and silencers
 - 4. Kick plates and thresholds
 - 5. Additional hardware required for a complete and operational door hardware system.
- B. Retain and reuse existing hardware where indicated in door schedule and hardware groups.

1.02 RELATED SECTIONS

- A. Section 03 30 00 Cast-in-Place Concrete
- B. Section 04 22 00 Concrete Unit Masonry
- C. Section 05 05 19 post-Installed Concrete Anchors
- D. Section 05 40 00 Cold-Formed Metal Framing
- E. Section 05 50 00 Metal Fabrication
- F. Section 06 83 16 Fiberglass Reinforced Paneling
- G. Section 08 11 00 Metal Doors and Frames
- H. Section 08 14 00 Wood Doors
- I. Section 10 14 00 Signage

1.03 SUBMITTALS

1.04 GUARANTEE

1.05 QUALITY ASSURANCE

PART 2 – PRODUCTS

2.01 NUMBER DESIGNATIONS

2.02 FINISH AND BASE MATERIAL DESIGNATIONS

2.03 CONTINUOUS GEAR HINGE

2.04 HINGES

2.05 LOCKSETS

- A. Manufacturer shall be Best 9K-Series or Best 40H-Series to match site standard and shall have 626 (Satin Chromium) finish or equal. Functions shall be as listed under “Schedule of Finish Hardware” paragraph.

2.06 PANIC HARDWARE

- A. Manufacturer Von Duprin 98, Falcon, Detex, or equal.

2.07 OVERHEAD CLOSERS

- A. Manufacturer LCN 4040XP Series, Norton 9500, or equal.

2.08 HOLD OPENS, STOPS, AND BUMPERS

- A. Stop with holder equal to Ives FS446 - Floor stop - 3 3/4" at exterior doors.
- B. Wall Bumper Equal to Ives WS401CVX - (Convex) wall bumpers.

2.09 SILENCERS & SEALS

- A. Provide silencers in metal door frames, unless weather stripping is provided; 3 per jamb at single-door frame and at pair doors provide 2 at each half at head frame, plus 3 each on astragal.
- B. Provide continuous weatherstrip / gasketing on exterior doors and provide smoke, light, or sound gasketing where indicated on hardware schedule. Provide non-corrosive fasteners for exterior applications.

2.10 ARMOR, KICK, AND MOP PLATES

- A. Manufacturers
 - 1. Ives

2. Hager
3. Rockwood
4. or equal

B.

2.11 PUSH AND PULL PLATES

- A. Manufacturers
1. Ives
 2. Trimco
 3. Rockwood
 4. or equal

2.12 THRESHOLDS

- A. Provide thresholds that meet ADA / current CBC accessibility requirements and as indicated in the schedule below. Thresholds shall be of extruded metal produced from 6063 aluminum alloy.

B.

2.13 FASTENERS AND ANCHORS

- A. Provide finish hardware with necessary screws, bolts, or other fasteners of suitable type and size to securely anchor hardware for long life under heavy use. The following guidelines should be adhered to for fasteners and anchors. See also Section 05 05 19 Post-Installed Concrete Anchors.

PART 3 – EXECUTION

3.01 HARDWARE INSTALLATION

- A. Provide hardware in strict accordance with Manufacturer's recommendations. Fasteners shall be threaded into drilled and tapped holes, no self-drilling or sheet metal screws affixing hardware to doors. Unless otherwise indicated, set finish hardware at the following heights or to match existing.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Related Documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Section apply to Work of this Section as if printed herein.
- B. Section Includes: Description of requirements for materials, fabrications, and installation of glass and glazing and associated accessories and as shown on Drawings and necessary to install a complete glazing system.
- C. Related Sections:
 - 1. Section 07 92 00 Joint Sealants, except as included herein
 - 2. Section 08 41 13 Aluminum-Framed Entrances and Storefront
 - 3. Section 10 14 00 Signage

1.02 QUALITY ASSURANCE

1.03 SUBMITTALS

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

1.05 ENVIRONMENTAL REQUIREMENTS

1.06 FIELD MEASUREMENTS

- A. Verify all field measurements at existing frames prior to fabrication and cutting of glass.

1.07 WARRANTY

PART 2 – PRODUCTS

2.01 GENERAL

- A. All glass shall be graded and meet requirements of federal specification DD-G-451d. Each lite of glass delivered and installed shall have affixed thereto the manufacturer's grade label.
- B. Manufacturers shall be Cardinal Glass, Vitro Architectural Glass (formerly PPG Glass), Pilkington, or pre-approved equal.

2.02 GLASS TYPES

- A. Single Pane Float Glazing: Not Used
- B. Exterior Dual Pane Glazing:
- C. Laminated Safety Glazing:

2.03 GLAZING MATERIALS

- A. Primer-Sealers and Cleaners: As recommended by the glass manufacturer.
- B. Non-rate Glazing Sealants: ASTM C920, Type S, Grade NS, uses "G" and "A", as manufactured by Dow Corning 795, Tremco "Proglaze", or approved equal.
- C. Rated Glazing Sealants: UL 9 and CBC 703.6 compliant, GVD grade and erosion resistant high performance glazing compound. Pemko "Fireglaze FG 3000" or acceptable equal.
- D. Tape for Glazing:
- E. Setting Blocks: .
- F. Shims and Spacers.
- G. Filler Rod: Compressible synthetic rubber or foam, chemically compatible with sealant used.
- H. Glazing Points and Wire Spring Clips.
- I. Miscellaneous: Furnish all primers and sealers, setting blocks, shims, compression seals, felts, etc., as required for a first class workmanlike job.

PART 3 – EXECUTION

3.01 INSPECTION AND JOB CONDITIONS

3.02 PREPARATION

3.03 INSTALLATION

3.03 ADJUST AND CLEAN

END OF SECTION

SECTION 09 29 00

GYPSUM BOARD

PART 1 – GENERAL

1.01 SCOPE OF WORK

- A. This Section includes gypsum board assemblies for the walls and ceilings.
- B. Fire-test-response characteristics: Where fire-resistance-rated gypsum board assemblies are indicated, provide gypsum board assemblies that are identical to assemblies tested for fire resistance according to ASTM E 119.

1.02 RELATED SECTIONS

- A. Section 05 40 00 Cold-Formed Metal Framing
- B. Section 06 83 16 Fiberglass Reinforced Paneling
- C. Section 07 92 00 Joint Sealant
- D. Section 07 95 00 Expansion Control
- E. Section 08 11 13 Metal Doors and Frames
- F. Section 08 31 00 Access Doors and Frames
- G. Section 08 41 13 Aluminum-Framed Entrances and Storefront
- H. Section 08 62 23 Tubular Skylights
- I. Section 09 30 00 Tiling
- J. Section 09 91 00 Painting

1.03 SUBMITTALS

- A. Submit under provisions of Section 01 33 00. Submit product data.
- B.

1.04 QUALITY ASSURANCE

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, all products shall be from a single manufacturer from the following list:
 - 1. Gypsum Board and Related Products:
 - a. United States Gypsum Co.
 - b. National Gypsum Co.; Gold Bond Building Products Division.
 - c. Georgia-Pacific Corp.
 - d. Domtar Gypsum.
 - e. Or equal.
- B. Gypsum board products: Types indicated in maximum lengths available that will minimize end-to-end butt joints in each area indicated to receive gypsum board application.
 - 1. Gypsum wall board
 - 2. Gypsum ceiling board:
 - 3. Gypsum tile backer board:
- C. Accessories for interior installation: Cornerbead, edge trim, and control joints complying with ASTM C 1047, formed metal or plastic, with metal complying with the following requirement:
- D. Joint treatment materials: Provide joint treatment materials complying with ASTM C 475 and the recommendations of both the Manufacturers of sheet products and of joint treatment materials for each application indicated.
- E. Miscellaneous materials: Provide auxiliary materials for gypsum board construction that comply with referenced standards and recommendations of gypsum board Manufacturer.

PART 3 – EXECUTION

3.01 GYPSUM BOARD APPLICATION AND FINISHING STANDARDS

- A. Install and finish gypsum panels to comply with ASTM C 840 and GA-216.

3.02 DIRECT-BONDING TO SUBSTRATE

3.03 INSTALLING TRIM ACCESSORIES

3.04 FINISHING GYPSUM BOARD ASSEMBLIES

- A. Treat gypsum board joints, interior angles, flanges of cornerbead, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.

END OF SECTION

SECTION 09 30 00

TILING

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Tile and Accessories:
 - 1. Glazed porcelain tile – large format wall tile
 - 2. Glazed porcelain tile – accent wall tile
 - 3. Tile Setting Materials
 - 4. Grout
 - 5. Aluminum trim shapes

1.02 RELATED SECTIONS

- A. Section 04 22 00 Concrete Unit Masonry
- B. Section 06 83 16 Fiberglass Reinforced Paneling
- C. Section 07 92 00 Joint Sealants
- D. Section 08 11 13 Hollow Metal Doors and Frames
- E. Section 08 31 13 Access Doors and Frames
- F. Section 09 29 00 Gypsum Board
- G. Section 09 91 00 Painting
- H. Section 10 21 13 Toilet Compartments
- I. Section 10 28 13 Toilet Accessories
- J. Items relating solely to mechanical, plumbing, or electrical work are included under those Divisions, except as specifically indicated otherwise on Drawings.

1.03 REFERENCES

- A. American National Standards Institute (ANSI):
- B. American International (ASTM):
- C. Tile Council of North America (TCNA): TCNA Handbook for Ceramic Tile Installation, 2018.

1.04 PERFORMANCE REQUIREMENTS

1.06 QUALITY ASSURANCE

1.07 DELIVERY, STORAGE, AND HANDLING

1.08 PROJECT CONDITIONS

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer List: Products of the following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules, and Specifications:
 - 1. Daltile; www.daltile.com
 - 2. American Olean; www.americanolean.com
 - 3. Crossville; www.crossvilleinc.com
- B. Substitution Limitations: Subject to requirements of section 01 25 00 Substitution Procedures.

2.02 TILE

- A. Tiles identified in the Finish Schedule within the Contract Drawings are listed as the basis of design as approved by the Site. Contractor's selection of alternate manufacturers shall be based on providing a direct match for same.

2.03 TILE SETTING MATERIALS

- A. Tile Setting Materials: Comply with ANSI A108/A118/A136.1 as applicable to the installation methods referenced in Part 3 of this Section. .
- B. Patching and Leveling Compound: As recommended by tile manufacturer and compatible with both substrate and setting materials.

2.04 GROUT

- A. For floor and wall locations and elsewhere as required for grouting tile as specified by ANSI A108.10.

2.05 ACCESSORIES

- A. Waterproofing underlayment:
- B. Trim pieces:

PART 3 – EXECUTION

3.01 EXAMINATION

3.02 PREPARATION

- A. Layout: Determine locations of control and expansion joints before starting tile work. Layout tile work to minimize cuts less than one-half tile in size.

3.03 INSTALLATION

- A. General: Comply with ANSI A108/A118/A136.1 and manufacturer's recommendations. Comply with applicable TCNA Handbook for Tile Installation requirements as listed below.

3.04 CLEANING AND PROTECTION

END OF SECTION

- SECTION 09 65 00

RESILIENT FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Vinyl composition floor tile (VCT).
 - 2. Laminate plank.

1.3 RELATED REQUIREMENTS

- A. Pertinent Sections specifying Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 01 8113 "Sustainable Design Requirements."
- C. Section 07 2633 "Moisture Mitigation Control Coating" for epoxy coating on concrete substrate to control water vapor emission and alkalinity.
- D. Section 09 0511 "Concrete Floor Preparation."
- E. Section 09 0512 "Concrete Floor Moisture Content and pH Testing."
- F. Section 09 6513 "Resilient Floor Accessories" for resilient base, reducer strips, and other accessories installed with resilient floor covering.

1.4 REFERENCES

1.5 SUBMITTALS

1.6 QUALITY ASSURANCE

1.7 DELIVERY, STORAGE AND HANDLING

1.8 ENVIRONMENTAL REQUIREMENTS

1.9 EXTRA MATERIALS

1.10 WARRANTY

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. VOC limits for adhesives, sealants, fillers, primers, and coatings. Comply with limits specified in Section 01 6116.
- B. VOC Emission Limits: Comply with CAL-GREEN 5.504.4.6; products must be listed on one of the following databases.
- C. Fire Resistance:
- D. Slip Resistance: Resilient flooring with a polish-coated surface shall have a minimum static coefficient of friction per test method ASTM D 2047 of 0.6 at horizontal surfaces and a minimum static coefficient of 0.8 at ramp surfaces exceeding a 5 percent slope.

2.2 MANUFACTURERS

- A. Basis of Design Manufacturer: Armstrong World Industries, Inc.; www.armstrong.com .
- B. Subject to compliance with requirements, provide named product or an equivalent product by one of the following:
 - 1. Mannington Commercial, www.mannington.com .
 - 2. Tarkett, www.tarket.com .
 - 3. Congoleum Commerical, www.congoleum.com .
 - 4. Substitutions: Section 01 2500.

2.3 VINYL COMPOSITION FLOOR TILE

- A. Basis of Design Product: Premium Excelon® Arteffects® Vinyl Composition Tile manufactured by Armstrong.

2.4 LAMINATE PLANK

- A. Basis of Design Product: Architectural Remnants™ Laminate Plank manufactured by Armstrong.

2.5 INSTALLATION MATERIALS

2.6 ACCESSORIES

PART 3 - EXECUTION

3.1 EXAMINATION

- A. .

3.2 PREPARATION

3.3 INSTALLATION, GENERAL

3.4 INSTALLATION OF RESILIENT FLOORING

3.5 CLEANING AND PROTECTION

- END OF SECTION -

WHITE MOUNTAIN FIRE DEPARTMENT
NEW FIRE STATION
BENSON, CA

WMFD _____
RECORD OF MATERIAL TRANSFER

Date: _____

Job No.: _____

Job Name: _____

Specification Reference: _____

Quantities and Materials: ☐ _____

☐ _____

☐ _____

☐ _____

☐ _____

☐ _____

Delivered by (Name & Co.): _____

Received by: Name: _____

Owner/Architect: _____

Date: _____

SECTION 09 67 23

RESINOUS FLOORING

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This section includes the following:
 - 1. Resinous flooring system as shown on the drawings and described herein.
- B. Related sections include the following:
 - 1. Section 03 30 00 Cast-in-Place Concrete
 - 2. Section 04 22 00 Concrete Unit Masonry
 - 3. Section 05 05 19 Post-Installed Concrete Anchors
 - 4. Section 07 92 00 Joint Sealants
 - 5. Section 09 29 00 Gypsum Board
 - 6. Section 09 30 00 Tiling

1.03 SYSTEM DESCRIPTION

- A. The work shall consist of preparation of the substrate, the furnishing and application of an epoxy based multi roller applied flooring system with Macro colored decorative chips and urethane topcoat. The system shall have the color and texture as specified by the Owner with a nominal thickness of 60 mils. It shall be applied to the prepared area(s) as defined in the plans strictly in accordance with the Manufacturer's recommendations.
- B. Cove base to be applied where noted on plans and per details in the contract drawings unless otherwise noted.

1.04 SUBMITTALS

1.05 QUALITY ASSURANCE

1.06 PRODUCT DELIVERY, STORAGE, AND HANDLING

1.07 PROJECT CONDITIONS

1.08 WARRANTY

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer List: Products of the following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules, and Specifications:
1. Dur-A-Flex; www.dur-a-flex.com. Poly-Crete = Product is the basis of design below.
 2. BASF Master Builders; www.master-builders-solutions.basf.us
 3. Key Resin Company; (888) 943-4532; www.keyresin.com
- B.

2.02 MATERIALS

- A. Dur-A-Flex, Inc, Dur-A-Chip, Epoxy-Based seamless flooring system
- 1.

2.03 PRODUCT REQUIREMENTS

- | | | |
|----|-------------------------------|----------------------------|
| A. | Primer | Dur-A-Glaze #4 WB |
| B. | Broadcast Coat | Dur-A-Gard OPF |
| C. | Broadcast Coat and Grout Coat | Dur-A-Glaze #4 Water Clear |
| D. | Topcoat | Armor Top |

PART 3 – EXECUTION

3.01 EXAMINATION

3.02 PREPARATION

- A. General
1. New and existing concrete surfaces shall be free of oil, grease, curing compounds, loose particles, moss, algae growth, laitance, friable matter, dirt, and bituminous products.
 2. Moisture Testing: Perform tests recommended by manufacturer and as follows.
 3. There shall be no visible moisture present on the surface at the time of application of the system. Compressed oil-free air and/or a light passing of a propane torch may be used to dry the substrate.
 4. Mechanical surface preparation

5. At spalled or worn areas, mechanically remove loose or delaminated concrete to a sound concrete and patch per manufactures recommendations.

3.03 APPLICATION

- A. General
 1. The system shall be applied in six distinct steps as listed below:
 - a. Substrate preparation
 - b. Priming
 - c. First broadcast coat application with first chip broadcast
 - d. Second broadcast coat with second chip broadcast
 - e. Grout coat application,
 - f. Topcoat application
- B. Primer
- C. Broadcast Coats
- D. Grout Coat
- D. Topcoat

3.04 FIELD QUALITY CONTROL

3.05 CLEANING AND PROTECTION

END OF SECTION

- SECTION 09 68 00 -

CARPETING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Carpet tiles.

1.3 RELATED REQUIREMENTS

- A. Pertinent Sections specifying Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 01 8113 "Sustainable Design Requirements."
- C. Section 07 2633 "Moisture Mitigation Control Coating" for epoxy coating on concrete substrate to control water vapor emission and alkalinity.
- D. Section 09 0511 "Concrete Floor Preparation."
- E. Section 09 0512 "Concrete Floor Moisture Content and pH Testing."
- F. Section 09 6513 "Resilient Floor Accessories" for resilient wall base and accessories installed with carpet.

1.4 REFERENCES

- A. Green Building Standards Code, "CAL-Green."
- B. California Code of Regulations, Title 24, Part 2, California Building Code (CBC), International Building Code with California Amendments.
- C. 36 CFR 1191 - Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Rule; Federal Register, July 26, 1991; updated 2010.
- D. American Association of Textile Chemists and Colorists (AATCC):
- E. ASTM International

- F. Carpet and Rug Institute (CRI)
- G. National Fire Protection Association (NFPA)

1.5 SUBMITTALS

1.6 QUALITY ASSURANCE

1.7 DELIVERY, STORAGE AND HANDLING

1.8 ENVIRONMENTAL REQUIREMENTS

1.9 EXTRA MATERIALS

1.10 WARRANTY

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. VOC limits for adhesives, sealants, fillers, primers, and coatings. Comply with limits specified in Section 01 6116.
- B. Carpet: Comply with Title 24, Part 11, 5.504.4.4;

2.2 CARPET TILES

- A. Carpet tile product to be provided and installed by General Contractor.

2.3 ACCESSORIES

- A. Carpet Edge and Transition Strips: As specified in Section 09 6513.

2.4 INSTALLATION MATERIALS

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting floor covering performance.

3.2 PREPARATION

3.3 INSTALLATION

3.4 CLEANING AND PROTECTION

- END OF SECTION -

WHITE MOUNTAIN FIRE DEPARTMENT
NEW FIRE STATION
BENSON, CA

WMFD _____
RECORD OF MATERIAL TRANSFER

Date: _____

Job No.: _____

Job Name: _____

Specification Reference: _____

Quantities and Materials: ☐ _____

☐ _____

☐ _____

☐ _____

☐ _____

☐ _____

Delivered by (Name & Co.): _____

Received by: Name: _____
Owner/Architect: _____
Date: _____

SECTION 09-91-00

PAINTING

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Related Documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to Work of this Section as if printed herein.
- B. Section Includes: Description of requirements for materials and application of paints and finishes applied to surfaces at job site, except those specifically excluded under Sub-paragraph 2 below.

1.02 QUALITY ASSURANCE

1.03 SUBMITTALS

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

1.05 JOB CONDITIONS

1.06 WARRANTY

1.07 RELATED SECTIONS

- A. The requirements of Division 01 apply to the Work of this Section.
- B. Section 04 22 00 Concrete Unit Masonry
- C. Section 05 12 00 Structural Steel
- D. Section 07 60 00 Flashing and Sheet Metal
- E. Section 07 92 00 Joint Sealants
- F. Section 08 11 13 Hollow Metal Doors and Frames
- G. Section 08 31 00 Access Doors and Frames
- H. Section 09 29 00 Gypsum Board
- I. Section 09 97 13 Steel Coatings

- J. Items relating solely to mechanical or electrical work are included under those Divisions, except as specifically indicated otherwise on Drawings.

PART 2 – PRODUCTS

2.01 MATERIALS

PART 3 – EXECUTION

3.01 INSPECTION

3.02 SURFACE PREPARATION

3.03 MATERIALS PREPARATION

3.04 PAINT APPLICATION AND WORKMANSHIP

3.05 PAINTING SCHEDULING

- A. Surfaces not required to be painted: Refer to Paragraph 1.01-B-2 & 3, above.
- B. Interior Surfaces:
- C. Exterior Surfaces:

END OF SECTION

SECTION 10 11 00

VISUAL DISPLAY BOARDS

PART 1 - GENERAL

1.01 SUMMARY

- A. Marker boards: Claridge Series 4, Type A, liquid chalk surface of porcelain enamel coated steel backed by hardboard, with chalk trough and map rail.
- B. Tackboard: Claridge #1381-FREW, vinyl covered Fir-tex tackboard.
- C. Provide divider bars, trim, chalk troughs, marker and eraser kits, cleaner, etc. for complete functional systems.

END OF SECTION

SECTION 10 14 00

SIGNAGE

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Related Documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to Work of this Section as if printed herein.
- B. Section Includes: Description of requirements for materials, fabrications, and installation of all signs, plaques, and associated accessory items as shown on the contract drawings and herein specified necessary to complete the Work but not limited to the following:
 - 1. Signage for Restrooms package
 - 2. Directional signage
 - 3. Building Entry signage
- C. Related Section:
 - 1. Section 04 22 00 Concrete Unit Masonry
 - 2. Section 07 40 00 Roof and Wall Panels
 - 3. Section 07 92 00 Joint Sealants
 - 4. Section 08 80 00 Glazing
 - 5. Section 09 29 00 Gypsum Board
 - 6. Section 09 30 00 Tiling
 - 7. Section 09 91 00 Painting

1.02 QUALITY ASSURANCE

- A. Disabled Signs and Plaques as specified herein shall conform with the requirements of the California Code of Regulations, Title 24, "Disabled Regulations".

1.03 PRODUCT DELIVERY, STORAGE, AND HANDLING

PART 2 – PRODUCTS

2.01 MATERIALS

2.02 SIGNAGE

- A. Building Entry Sign
- B. Tactile Exit Sign

- C. Restroom Signage Package

PART 3 – EXECUTION

3.01 INSTALLATION

- A. General: Install or apply all signs and plaques at all locations either required by code or as indicated on the contract drawings. All materials shall be installed level and plumb and at the heights required by ADA / California T-24 requirements.
- B. Wall mounted signs shall be vandal proof and mounted to exterior wall surfaces by vandal resistant mechanical fasteners and set in a perimeter bed of sealant with fastener quantities as recommended by the manufacturer.

3.02 ADJUST AND CLEAN

END OF SECTION

SECTION 10 28 13

TOILET ACCESSORIES

PART 1 – GENERAL

1.01 DESCRIPTION

- A. Related Documents: Drawings and General Provisions of Contract, including General and Supplementary Conditions and Division 01 Specification Sections apply to work of this section as if printed herein.
- B. Section Includes: Description of requirements for materials, fabrications, and installation of toilet room accessories as specified herein or as indicated on the Contract Drawings. Work also includes all related blocking.
 - 1. Refer the Contract Drawings for items that will be supplied by the University and installed by the Contractor. These items shall have blocking / backing provided and installed by the contractor prior to covering of wall framing.

1.02 RELATED SECTIONS

- A. Section 04 22 00 Concrete Unit Masonry
- B. Section 05 05 19 Post-Installed Concrete Anchors
- C. Section 05 40 00 Cold-Formed Metal Framing
- D. Section 07 92 00 Joint Sealants
- E. Section 09 29 00 Gypsum Board
- F. Section 09 30 00 Tiling
- G. Section 09 91 00 Painting
- H. Section 10 21 13 Toilet Compartments
- I. Items relating solely to mechanical or electrical work are included under those Divisions, except as specifically indicated otherwise on Drawings.

1.03 REFERENCES

- A. ASTM A167: Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheets and Strip
- B. ASTM A269: Seamless and Welded Austenitic Stainless Steel Tubing for General Service
- C. California Building Code Chapter 11B – Accessibility Standards, 2022 Edition

- D. US – ADA Accessibility Guidelines for Buildings and Facilities, Federal Register Volume 56, Number 44, Latest Edition

1.04 SUBMITTALS

- A. Submit manufacturer's Product data and installation instructions for items furnished herein under provisions of Section 01 33 00.

1.05 DELIVERY, STORAGE, AND HANDLING

1.06 PROTECTION

1.07 WARRANTY

PART 2 – PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Models indicated are items provided by Bobrick Washroom Equipment and are listed as the standard of quality for design, function, materials, workmanship, and appearance.

2.02 MATERIALS

2.03 FINISHES

- A. Stainless Steel: No. 304 Satin Luster finish.

2.04 FABRICATION

PART 3 – EXECUTION

3.01 PREPARATION

3.02 INSTALLATION

3.03 ADJUSTMENT AND CLEANING

PART 4 – SCHEDULES

- 4.01 REFER TO INTERIOR ELEVATIONS IN THE CONTRACT DRAWINGS FOR
ACCESSORY SCHEDULE AND QUANTITIES.

END OF SECTION

SECTION 10 44 00

FIRE PROTECTION SPECIALTIES

PART 1 – GENERAL

1.01 SECTION INCLUDES:

- A. Fire Extinguishers
- B. Mounting Brackets
- C. Wall mounted cabinets

1.02 RELATED SECTIONS:

- A. Section 04 22 00 Concrete Unit Masonry
- B. Section 05 05 19 Post-Installed Concrete Anchors
- C. Section 05 40 00 Cold-Formed Metal Framing
- D. Section 06 83 16 Fiberglass Reinforced Paneling
- E. Section 07 92 00 Joint Sealants

1.03 REFERENCES:

- A. 2022 CFC Section 906
- B. National Fire Protection Association (NFPA):
- C. ADA Accessibility Guidelines
- D. ASTM International (ASTM):

1.04 QUALITY ASSURANCE

- A. Conform to NFPA 10 requirements for portable fire extinguishers.

1.05 SUBMITTALS

1.06 DELIVERY, STORAGE, AND HANDLING

1.07 WARRANTY

PART 2 – PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer:
 - 1. Larsen's Manufacturing Co., 7421 Commerce Lane N.E., Minneapolis, MN 55432, (763) 571-1181 or (800)527-7367, www.larsensmfg.com
 - 2. J. L. Industries, Inc., a division of Activar Construction Products Group, 9702 Newton Av S, Bloomington, MN 55431, (800) 554-6077, www.activarcpg.com
 - 3. Babcock-Davis, 9300 73rd Avenue N, Brooklyn Park, MN 55428, (888) 412-3726, www.BabcockDavis.com

2.02 FIRE EXTINGUISHERS

- A. Multi-Purpose Chemical Type: Extinguisher unit containing a fluidized and siliconized mono ammonium phosphate powder; nonconductive and nontoxic.

2.03 EXTINGUISHER MOUNTING BRACKET

2.04 FIRE EXTINGUISHER CABINETS

- A. Cabinet Construction at framed wall locations:
- B. Cabinet Construction at concrete wall locations:

2.05 SOURCE QUALITY CONTROL

PART 3 – EXECUTION

3.01 EXAMINATION

3.02 INSTALLATION

- A. Install cabinets in locations and at mounting heights indicated, or if not indicated, at heights to comply with applicable regulations of governing authorities.

3.03 FIELD QUALITY CONTROL

3.04 ADJUSTING AND CLEANING

3.03 FIELD QUALITY CONTROL

END OF SECTION

SECTION 10 51 13

LOCKERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Description: Provide open front metal equipment lockers,
- B. Related Work Specified Elsewhere:
 - 1. Section 03300 - Concrete
 - 2. Section 06100 - Rough Carpentry
 - 3. Section 06200 - Finish Carpentry

1.02 QUALITY ASSURANCE

- A. Manufacturing Standard.
- B. Fabricator Qualifications.
- C. Installer Qualifications.

1.03 SUBMITTALS

- A. Shop Drawings: Submit manufacturing and installation details, including fastenings, for review prior to fabrication of work.
- B. Samples: Submit the following listed samples for review prior to fabrication of work.
- C. Product Data.

1.04 PRODUCT HANDLING

- A. General.
- B. Delivery.
- C. Storage.

1.05 GUARANTEE

- A. GUARANTEE-WARRANTY: Submit upon completion of the work, in the form prescribed under Section 01600 - Warranties, covering all defects in materials and workmanship excluding finish, damage resulting from deliberate destruction and vandalism under this Section for a period of 10 years from the date of final acceptance by the Owner.

PART 2 - PRODUCTS

2.01 MATERIAL

- A. Available Manufacturers.
- B Steel.
- C. Fasteners.
- D. Hardware.

2.02 FABRICATION

- D. Frame Vertical Panels.
- E. Integral Frame Locker Base.
- L. Shelves and Horizontal Dividers/Bottoms.
- M. Backs.
- M. Locker Accessories:
 - 1. Locks:
 - 3. Number Plates.
 - 4. Finished End Panels.
 - 6. Filler panels, false fronts and trim.

PART 3 - EXECUTION

3.01 EXAMINANATION OF CONDITIONS

- A. Conditions of the Workplace.
- B. Job Measurements.

3.02 INSTALLATION:

- A. Placement.
- B. Anchorage.
- C. Trim.

3.03 ADJUSTMENTS AND MAINTENANCE:

- A. GENERAL: Prior to occupancy of the building, all moveable parts shall be properly adjusted to assure smooth operation.

3.04 CLEANING:

- A. GENERAL.

END OF SECTION

SECTION 10 56 13

STORAGE SHELVING

PART 1 - GENERAL

1.01 SUMMARY

- A. Metal storage shelving: 20" deep x 72" high open shelving system, self-supporting, with seismic anchorage to floor and walls.

END OF SECTION

SECTION 10 75 00

FLAGPOLES

PART 1 - GENERAL

1.01 SUMMARY

- A. Steel flagpole.

1.02 SUBMITTALS

- A. Structural calculations showing compliance with design loadings.

1.03 QUALITY ASSURANCE

- A. Structural Performance: Basic wind speed 100 mph.

1.04 MATERIALS

- A. Anodized aluminum: Cone tapered, with shop applied double coat fluoropolymer resin coating finish.
 - 1. Mounting: Baseplate.
- B. Fittings: Finial ball, internal halyard, winch system with halyard flag snaps.

END OF SECTION

SECTION 11 21 73

LAUNDRY EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide residential grade washer and dryer in living quarters.
- B. Provide commercial grade laundry extractor in apparatus bay.
- C. Coordinate work with Utilities required at equipment locations, as shown on plans.
- D. Provide all materials, labor and equipment necessary to install Laundry equipment specified herein. Equipment shall be provided with seismic anchors upon installation.

PART 2 - PRODUCT

- A. Residential washer and dryer
 - 1. Washer: GE Model WBVH64240F or equal
 - 2. Electric Dryer: GE Model DBVH512EF or equal
- B. Commercial Extractor (apparatus bay)

PART 3 – INSTALLATION

- A Laundry Equipment:
 - 1. Install all equipment per the manufacturer's requirements.
 - 2. Coordinate installation of all laundry systems with utility requirements including electrical, gas, water, steam, exhaust vents and sanitary sewer.
 - 3. Provide seismic anchor bolts or tip over anchors at each unit.

END OF SECTION

SECTION 11 39 00

RESIDENTIAL EQUIPMENT

PART 1 – GENERAL

1.01 SUMMARY

- A. All kitchen equipment shall be new, unless otherwise noted.
- B. Contractor provided, Contractor installed items:
 - 1. Dishwasher: GE Tall Tub Dishwasher Model GLDA690MWW or equal
 - 2. Range/Oven: GE Electric range Model JBS15HWW or equal
 - 3. Hood: Broan NuTone Series NTM Model NTM30WH under cabinet mounted or equal
 - 4. Refrigerator/Freezer: GE Top Freezer Refrigerator with ice maker model GTS18KCP

END OF SECTION

SECTION 12 21 13

HORIZONTAL BLINDS

PART 1 - GENERAL

1.01 SUMMARY

- A. Venetian blinds for wall, (window head), mounting.

1.02 SUBMITTALS

- A. Schedule of blinds using room designations on Drawings.

1.03 QUALITY ASSURANCE

- A. Mockups for each form of construction and finish.

1.04 MATERIALS

- A. Louvers:
 - 1. Material: Aluminum.
 - 2. Width: 1 inch.
 - 3. Tilt Operation: Manual with wand.
 - 4. Lift Operation: Manual with chords.

1.05 INSTALLATION

- A. Install blinds between jambs.

END OF SECTION

SECTION 21 00 00

FIRE SUPPRESSION

PART 1 - GENERAL

1.1 DESIGN, PROVIDE AND INSTALL:

- A. Fire Sprinkler System: Furnish and install all materials and perform all labor necessary for the complete installation of the Fire Protection System, and related items to provide a complete functional system in accordance with the requirements of NFPA Standard #13, NFPA Standard #24, and California State Fire Marshal (CSFM) regulations in all areas of the building including fire sprinkler mains and connection to on-site underground main, appurtenances, and underground piping.
- B. System design shall be hydraulically calculated and identified on the Drawings.
 - 1. Hydraulically designed sprinkler systems shall be provided with a minimum of a 10 percent safety margin on either the supply or pressure side of the design graph.
 - 2. All sprinkler systems shall be designed to provide the appropriate density based upon a hazard occupancy classification specified by NFPA 13
 - 3. The water supply requirement for sprinklers only shall be calculated from the density curves in NFPA 13. System piping shall be calculated to satisfy a single-point on the appropriate design curve. It is not necessary to meet all points on the selected curve.
 - 4. Approval and acceptance of system is subject to compliance with the listed requirements, plan check approval, approval by field inspection, and necessary tests. Approval of plans and specifications shall not constitute a waiver of approval to violate any code or requirement. Submittals having inaccurate hydraulic calculations, content which is illegible, incomplete, or unclear will be returned without review or approval.

PART 2 - REQUIREMENTS

2.1 Underground Piping:

- A. All underground pipe shall be installed per the latest version of NFPA 24.requirements of NFPA Standard #13, NFPA Standard #24, and California State Fire Marshal (CSFM) regulations in all areas of the building including fire sprinkler mains and connection to on-site underground main, appurtenances, and underground piping.

- B. Tracer wire shall be taped to nonmetallic piping. Tape shall be applied at a maximum of 20 foot intervals.
- C. When the system riser is close to a foundation or footing, underground fittings of proper length shall be used to avoid pipe joints located in or under the wall or footing. When the connection passes through a foundation or footing below grade, a 1- to 2-inch clearance shall be provided around the pipe, and the clear space filled with asphalt mastic or similar flexible waterproofing material.

2.2 **Materials:**

- A. When the system riser is close to a foundation or footing, underground fittings of proper length shall be used to avoid pipe joints located in or under the wall or footing. When the connection passes through a foundation or footing below grade, a 1- to 2-inch clearance shall be provided around the pipe, and the clear space filled with asphalt mastic or similar flexible waterproofing material.
- B. Sprinkler Heads: Sprinkler heads shall be UL listed or FM approved, regular, automatic, closed type of ordinary temperature rating (165 degrees F at clg, 200 degrees F at roof) or equal. Heads shall be recessed at all finished ceiling locations. Sprinkler heads in equipment rooms, storage rooms, and in other areas subject to damage shall be standard pendant type provided with wire guards. Higher temperature ratings shall be approved in intermediate and high classification areas.
- C. Escutcheons: Escutcheons at all heads shall match finish in which installed, white in white ceilings, brass in wood finishes.
- D. Spare Heads: Furnish minimum 6 spare heads. The heads shall be placed in an emergency cabinet. Provide one sprinkler wrench. The cabinet will be of No. 20 gauge pressured steel with red lacquer finish complete with manufacturers standard labeling. The spare heads shall be representative of, and in proportion to, the number of each type and temperature of heads installed.
- E. Pipe, Fittings:
 - 1. Pipe for installation above ground shall be UL and SFM approved ASTM A- 53, A-135.
 - a. All welded pipe: Schedule 10.
 - b. All threaded pipe: Schedule 40 black steel.

2. Pipe fittings for installation above ground shall conform to the requirements of Federal Specifications WW-P-501, Type I, Class A.
 - a. Fittings to be UL approved cast iron screwed or grooved with associated couplings. Mechanical tees, saddle fittings, beveled edge fittings and bushings shall not be used. Grooved pipe and associated fittings shall only be allowed in exposed locations.
 3. Pipe for installation below slab and to 5 feet outside building shall be cast iron pipe conforming to the requirements of Federal Specifications WW-P-421, Types I, II, III, or V, Class 150, U.L. approved for fire lines. Design Builder shall have option to use PVC Pressure Class 150, AWWA C900 piping and fittings UL approved for fire service.
 - a. Pipe fittings for installation below ground from 5 feet outside building to water main shall be of cast iron conforming to the requirements of American Water Works Association Standard Specification for cast iron Special Castings, Class D, 150 pound, U.L. approved for fire lines.
- F. Valves:
1. OS&Y valve shall be Grinnell, Viking, or equal, gate type, 175 psi working pressure, UL or FM listed for fire protection services.
 2. Gate valves 2 inches and smaller shall be Crane No. 459, Grinnell, or equal, 2-1/2 inches and larger shall be Crane No. 467, Grinnell, or equal, all to the Underwriters approved rising stem type (OS&Y).
 3. Check valves shall be Crane No. 375, Grinnell, or equal; drain valves shall be Crane No. 7, Kennedy, or equal.
 4. Angle valves, globe valves with screw-in bonnet, internal seat and renewable disc.
 5. Riser check valve: TYCO CV-1FR or equivalent.
 6. Dry pipe valve: TYCO DPV-1 or equivalent.
- G. Sprinkler riser assemblies shall be complete with standard trim including Victaulic couplings at top and bottom of riser; pressure gauge; and flow switch with contacts for remote electric alarm and remote monitoring.
- H. Flow Switches: Provide CSFM listed paddle type flow switches with automatic recycle retard and double pole, double throw contacts.
- I. Tamper Switches: Provide CSFM listed weather-resistant tamper switches on all control valves. PIV switches shall monitor target position. OS&Y switches shall monitor stem movement and shall be complete with J-bolts. Plug and loop type tamper switches shall not be used to supervise control valves.

J. Alarm Switch and Bell:

1. Potter VSR, or equal, vane type series bell, electric alarm switch for connection to bell. Alarm bells shall be 10-inch diameter, UL or FM approved.
2. The bell shall be located on the face of the protected building adjacent to the fire department connection (if provided) with a mounting height of eight to ten feet above finished grade.

K. Gauges:

1. Pressure gauges shall UL listed and labeled 3-1/2 inch dial, liquid filled type, 0-300 psi scale, markings not to exceed 5 psi increments.
2. Gauges shall be installed on each side of the main check valve and at each test pipe.
3. Each pressure gauge shall be fitted with a three-way valve and 1/4 inch test gauge connection.

L. Inspector's test connections shall be AGF #3011 Test and Drain, or equal.

M. Flashings and Counter flashings: Submit proposed methods of sealing penetrations through exterior of buildings for approval.

PART 3 - CRITERIA

3.1 General:

- A. Installation of the fire protection system shall not be started until complete plans and specifications, including water supply information, have been approved by the Auburn Fire Department. Apply the flow information at the connection of the new underground piping to an existing water main. Maximum velocity through sprinkler lines including cross-mains, bulk mains and risers shall be 30 feet per second. Maximum velocity through the underground shall be 16 feet per second.
- B. All piping shall be installed as required by NFPA 13 and 24.
- C. All piping shall be pressure tested and flushed according to the procedures set forth in NFPA 13 and 24.

- D. Shop drawings shall show locations of earthquake bracing, both lateral and longitudinal. Earthquake bracing shall utilize cast fitting ends to improve workmanship and projections of plain end pipes protruding from braces. Metal flush clamps shall be used in place of wire style u-bolt brace anchors.
- E. All equipment installed shall be properly thrust blocked and earthquake braced. Earthquake bracing and pipe hangers must be drilled through and bolted to structural frame members.
- F. Furnish and install all sleeves required for work where it passes through concrete. If sleeves are not installed, all penetrations shall be core drilled. All gaps and seams shall be filled with fire rated caulking material.
- G. All valves shall be clearly labeled as to their functions (i.e., MAIN DRAIN, ALARM TEST, etc.).
- H. Design Builder shall be responsible for any damage to other work caused by installation or by leaks in the fire protection lines.
- I. All work shall be done in a neat and workmanlike manner.

3.2 Quality Assurance:

- A. Provide all material and perform all work in accordance with all applicable codes, agency standards and manufacturers written instructions.

3.3 INSTALLATION OF PIPING SYSTEMS:

- A. Support all piping firmly held in place by approved iron hangers, supports, anchors as required in accordance with NFPA Pamphlet No. 13. Grade as required to drain at low points. Seismic bracing shall be complete pre-engineered system. Hanger rods less than 3/8 inch diameter riot permitted.
- B. All piping in finished areas must be run concealed above ceilings.
 - 1. Overhead sprinkler piping within a "grid" portion of a hydraulically designed system shall not be sized smaller than 1-1/4 inch I.D.
 - 2. All piping, including cross-mains, shall be installed as close as practical to the roof structure. Cross-mains shall follow the roofline so as to remain an approximate constant distance from the roof structure.
 - 3. Drainage capabilities shall be provided per NFPA 13 to allow for complete drainage of system piping, preferably to the main riser drain or to additional auxiliary drains as needed.
 - 4. Connections and fittings shall be threaded, flanged, grooved, or welded. Grooveless clamp or saddle fittings are not acceptable.
 - 5. Grooved clamp tees and bolted branch outlets shall not exceed I-inch branch size and are subject to inspection prior to attachment of branch piping or sprinklers.

6. Reducing fittings shall be tapered cast metal products. Where grooved couplings are used, there shall be a separate coupling for each connection to the reducing fitting.
7. Each sprinkler head shall be connected to supply piping via a threaded branch outlet and by a minimum 1-inch to 1/2-inch threaded reducing fitting.

3.4 SPRINKLER HEAD LOCATION:

- A. Sprinkler heads shall be located at exposed beams and in finished ceilings, (centered in structural bay sections of tiles) soffits, overhangs, etc., and in all enclosed spaces, above ceilings, canopies, overhangs, etc., in accordance with NFPA requirements but conforming to ceiling lighting and building modules which may require additional heads for symmetry.

3.5 DRAINS:

- A. Inspector's test drain shall be installed with auxiliary drains on all low points of the system. Drain valves shall be in accordance with the requirements of NFPA Pamphlet No. 13 and piped to a safe place of visible discharge either by open-end pipe or sight drain fitting. Do not discharge onto sidewalks or other pedestrian areas. Flushing connections shall be provided at ends of all cross mains.

3.6 ELECTRICAL REQUIREMENTS:

- A. All wiring, conduit, fuses, thermal overloads, disconnect switches, and connection of all motors, alarms, flow switches is under Electrical Work.

3.7 COORDINATION:

- A. Design Builder shall be responsible to coordinate the location of sprinkler piping with all existing construction such as suspended ductwork, electrical work and plumbing work, and it shall be the Design Builder who shall off-set and modify the sprinkler system as may be required to coordinate the sprinkler system with all other systems as shown and/or found to be existing.

PART 4 - EVALUATION AND TESTING

4.1 SUBMITTALS:

- A. Submit shop Drawings in accordance with Section 013323 Shop Drawings, Product Data and Samples. Prepare and furnish complete detailed plans for the installation of an automatic fire sprinkler system to PG&E and Auburn Fire Department.

B. At a minimum the submittal shall include:

1. The address/name of the project, and a site map showing the project location, name and address of the Design Builder. Drawings shall be signed and stamped by the individual assuming design responsibility. Provide a Fire Department signature block for approval.
2. Submit hydraulic calculations calculating frictional losses in valves, piping and fittings to demonstrate that the hydraulically most remote area of the fire service water main is adequate to provide the required flow.
 - a. Indicate water supply information, static and residual pressures.
 - b. Show on-site backflow prevention devices, hydrants, Fire Department connections, etc., and proposed connection to the on-site main.
3. Product data and manufacturer literature to include but not be limited to:
 - a. Sprinkler heads and accessories, make, type, number, and nominal orifice size.
 - b. OS&Y, inspector test, drain, check, gate, globe valves, gauges.
 - c. Pipes and fittings.
 - d. Hangers and supports.
 - e. Identification signs.
 - f. CSFM listing numbers.
4. Complete piping plans showing ceiling construction, lights, air distribution outlets, with all areas clearly designated.
 - a. Show sufficient detail and dimensions to clearly indicate that sprinkler lines will be concealed or arranged neatly in exposed areas and will not conflict with structural, mechanical or electrical systems. Show feed main hanger locations.
5. Show location of all control valves and trim, check, drain, test valves and their termination and alarm bell.
6. Submit hangers and supports and seismic structural bracing.
7. Submit all painting products.

- C. A required general note on plans submitted for approval by the University Fire Department and the California State Fire Marshal shall include the following standard wording:
 - 1. The automatic sprinkler system shall conform to the requirements of the latest edition of NFPA 13.
 - 2. Penetrations of rated assemblies shall be fire-stopped. Fire stopping shall be an approved material as described in State Fire Marshal Standard 12-43.1.
 - 3. Installation of the sprinkler system shall not be started until completed plans and specifications (including water supply information and capacity of existing sprinkler system, if any) have been approved by the Auburn Fire Department.
 - 4. Approved plans and specifications shall be kept on the job site and made available upon request.
 - 5. At various stages and upon completion, the system must be tested in the presence of the University Fire Department and/or State Fire Marshal.
- D. At completion of work submit all Operation and Maintenance Manuals, all Test, Inspection, and Certification Reports to the University's Representative.
- E. Submit as-built record drawings of above and underground work to University's Representative.

4.2 TESTS AND APPROVALS:

- A. Tests and Maintenance: All tests described and referenced in these standards shall be performed by the Design Builder in the presence of the Auburn Fire Department representative. A minimum of 72 hour notice is required by the Fire Department prior to need. Tests and inspections shall apply to all water-source fire protection systems, including fire hydrants, sprinklers, standpipes, and all underground piping which supplies these systems and devices.
- B. Hydrostatic Test Preparation: The following preparations shall be made for hydrostatic testing.
 - 1. Underground and other piping directly exposed to the exterior environment and/or piping containing water absorbent material (e.g., asbestos cement) shall be filled with water 24 hours preceding hydrostatic testing.
 - 2. Interior piping shall be filled with water two hours preceding hydrostatic testing.
 - 3. Piping shall be purged of all air and other gases prior to hydrostatic testing.
 - 4. Underground piping shall be center-loaded and all fittings, joints, strapping, and thrust blocking shall be exposed for inspection and hydrostatic testing.

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5. All above grade and interior piping, fittings, and supports shall be exposed for inspection and hydrostatic testing.
6. Fire department connections and piping shall be included in hydrostatic testing and shall be flushed.
7. Underground mains and supply connections to sprinkler risers shall be flushed thoroughly before connection to sprinkler systems.
8. Test of drainage facilities shall be conducted by opening each drain valve while the system control valves are open to the supply. Systems will be tested in the presence of the Fire Department representative.
9. Water remaining in normally dry piping shall be evacuated at completion of testing.
10. Upon satisfactory completion of all testing and inspections, the contractor shall certify to the University Fire Department by submittal of a completed Form 6, "Contractor's Material & Test Certificate for Aboveground Piping" and/or a Form 7, "Contractor's Material & Test Certificate for Underground Piping" immediately upon completion of said test and inspections. Any variation in procedure must be approved in writing by the Fire Department.
11. Hydraulic Nameplate, required sprinkler spares and wrench with box and other control valve signage and miscellaneous required materials shall be provided prior to acceptance of system.
12. Design Builder shall be responsible for coordination of all testing. System shall not be acceptable with uncorrected or unresolved deficiencies. Water damage or associated effects as a result of failure of piping or materials are the responsibility of the Design Builder.

END OF SECTION 210000

SECTION 22 11 16

PLUMBING PIPING SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Cast Iron Soil Pipe and Fittings: Used for pipe buried in or in contact with earth and for extension of pipe to a distance of approximately 1500 mm (5 feet) outside of building walls and interior waste and vent piping above grade.
- B. Steel Pipe and Fittings: May be used for vent piping and storm water piping above grade.
- C. Interior Domestic Water Pipe: Copper tube, ASTM B88, Type K or L, drawn.
- D. Trap Primer Pipe: Copper tube, ASTM B88, Type K, hard drawn.
- E. Cleanouts: Same size as the pipe. Cleanouts shall be easily accessible. Provide a minimum clearance of 24 inches for rod out. Provide cleanouts at or near the base of the vertical stacks.
- F. Provide on all sanitary branch waste connections from fixtures or equipment not provided with traps.
- G. Provide a backflow prevention device at any point in the plumbing system where the potable water supply comes in contact with a potential source of contamination.

END OF SECTION

SECTION 22 11 26

LIQUID PROPANE GAS DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

- A. Propane gas distribution outside the building.

1.02 SYSTEM PERFORMANCE

- A. Comply with requirements of NFPA 58[, and] [, NFPA 54] [, and] [, the International Fuel Gas Code] for LPG distribution system, including materials, installation, and testing.
- B. Comply with requirements of authorities having jurisdiction.
- C. Comply with requirements of utility company supplying LPG.
- D. Minimum Operating-Pressure Ratings:
- E. Minimum Working-Pressure Ratings:
- F. LPG System Pressure within Buildings:
- G. Delegated Design: Design restraints and anchors for LPG piping and equipment, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.
- H. 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.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. PE Pipe, Tubing, and Fittings :
 - 1. PE Pipe and Tubing: ASTM D2513, SDR 11.
 - 2. PE Fittings: ASTM D2683, socket-fusion type or ASTM D3261, butt-fusion type.
 - 3. PE Transition Fittings: Factory-fabricated fittings with PE pipe complying with ASTM D2513, SDR 11, and steel pipe complying with ASTM A53/A53M, black steel, Schedule 40, Type E or S, Grade B.
- B. Shutoff Valves: Lubricated tapered plug, Ball, Lubricated plug.
- C. Valve boxes.
- D. Service Regulators: Single-stage, steel jacketed.
- E. Service Meters: Positive-displacement type.

- F. Earthquake, automatic shutoff.
- G. Underground warning tape.
- H. Concrete base.

PART 3 – EXECUTION

3.01 EARTHWORK

3.02 PREPARATION

3.03 INSTALLATION OF OUTDOOR PIPING

- A. Service Piping: Underground.

3.04 INSTALLATION OF INDOOR PIPING.

3.05 INSTALLATION OF VALVES

3.06 PIPING JOINT CONSTRUCTION.

- A. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join in accordance with ASTM D2657.
 - 1. Plain-End Pipe and Fittings: Use butt fusion.
 - 2. Plain-End Pipe and Socket Fittings: Use socket fusion.

3.07 PIPING CONNECTIONS

3.08 CONCRETE BASES

END OF SECTION

SECTION 221519

GENERAL-SERVICE PACKAGED AIR COMPRESSORS AND RECEIVERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Reciprocating air compressors - lubricated.
 - 2. Rotary-screw air compressors - oil flooded.
 - 3. Rotary, sliding-vane air compressors - oil sealed.
 - 4. Air filters - inlet type.
 - 5. Compressed-air aftercoolers - air cooled.
 - 6. Compressed-air dryers - refrigerant type.

1.2 DEFINITIONS

- A. Actual Air: Air delivered from air compressors. Flow rate is delivered compressed air measured in **acfm** (actual L/s).
- B. Standard Air: Free air at **68 deg F** (20 deg C) and **1 atmosphere** (29.92 in. Hg) before compression or expansion and measured in **scfm** (standard L/s).

1.3 ACTION SUBMITTALS

- A. Product data.
- B. Product data submittals.
- C. Shop Drawings:
 - 1. Plans, elevations, sections, and **[mounting]** **[attachment]** details.
 - 2. Details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and locations and size of each field connection.
 - 3. Diagrams for power, signal, and control wiring.
- D. Delegated Design Submittals: For compressed-air equipment mounting.
 - 1. Detail fabrication and assembly of supports.

2. Include design calculations for selecting vibration isolators[**and seismic restraints**] and for designing vibration isolation bases, indicated to comply with performance requirements and design criteria, including analysis data[**signed and sealed by the qualified professional engineer responsible for their preparation**].

1.4 INFORMATIONAL SUBMITTALS

- A. Seismic Qualification Certificates: For compressed-air equipment, accessories, and components, from manufacturer.
 1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
 2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
 3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's written instructions for delivery, storage, and handling.

1.8 WARRANTY

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASME Compliance: Fabricate and label receivers to comply with ASME Boiler and Pressure Vessel Code.
- C. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design compressed-air equipment mounting..
- D. Seismic Performance: Compressed-air equipment to withstand the effects of earthquake motions determined in accordance with [ASCE/SEI 7] <Insert requirement>.[See Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment.]

2.2 GENERAL REQUIREMENTS FOR PACKAGED AIR COMPRESSORS AND RECEIVERS

- A. General Description: Factory-assembled, -wired, -piped, and -tested; electric-motor-driven; air-cooled; continuous-duty air compressors and receivers that deliver air of quality equal to intake air.
- B. Control Panels: Automatic control station with load control and protection functions. Comply with NEMA ICS 2 and UL 508.
- C. Receivers: Steel tank constructed in accordance with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - 1. Pressure Rating: At least as high as highest discharge pressure of connected compressors, and bearing appropriate code symbols.
 - 2. Interior Finish: Corrosion-resistant coating.
 - 3. Accessories: Include safety valve, pressure gauge, drain, and pressure-reducing valve.

2.3 RECIPROCATING AIR COMPRESSORS - LUBRICATED

- A. Reciprocating Air Compressors - Lubricated <Insert drawing designation>:
- B. Compressor(s): Lubricated, reciprocating-piston type with lubricated compression chamber and crankcase.
 - 1. Submerged gear-type oil pump.
 - 2. Oil filter.
 - 3. Combined high discharge-air temperature and low lubrication-oil pressure switch.
 - 4. Belt guard totally enclosing pulleys and belts.
- C. Receiver: ASME construction steel tank.
- D. Capacities and Characteristics:

2.4 AIR FILTERS - INLET TYPE

2.5 COMPRESSED-AIR DRYERS - REFRIGERANT TYPE

2.6 MOTORS

PART 3 - EXECUTION

3.1 INSTALLATION OF EQUIPMENT

- A. Examine roughing-in of compressed air piping to verify actual location before air compressor installation.
- B. Equipment Mounting:
- C. Install compressed-air equipment anchored to substrate.
- D. Arrange equipment so controls and devices are accessible for servicing.
- E. Maintain manufacturer's recommended clearances for service and maintenance.
- F. Install the following devices on compressed-air equipment:
 - 1. Thermometer, Pressure Gauge, and Safety Valve: Install on each compressed-air receiver.
 - 2. Pressure Regulators: Install downstream from air compressors[and dryers].
 - 3. Automatic Drain Valves: Install on aftercoolers, receivers, and dryers. Discharge condensate over nearest floor drain.

AIR COMPRESSORS AND RECEIVERS

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3.2 PIPING CONNECTIONS

- A. Comply with requirements for piping specified in Section 221513 "General-Service Compressed-Air Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to equipment, allow space for service and maintenance.

3.3 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.

3.4 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

3.5 IDENTIFICATION

- A. Identify general-service air compressors and components. Comply with requirements for identification specified in Section 220553 "Identification for Plumbing Piping and Equipment."

3.6 STARTUP SERVICE

3.7 ADJUSTING

- A. Adjust equipment to function smoothly, and lubricate as recommended by manufacturer.

- B. Adjust control set points.

3.8 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection.
 - 2. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 3. Operational Test: After electrical circuitry has been energized, start unit to confirm proper motor rotation and unit operation.
 - 4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 5. Air compressors, aftercoolers, air dryers, and controllers will be considered defective if they do not pass tests and inspections.
- B. Prepare test and inspection reports.

3.9 DEMONSTRATION

END OF SECTION

SECTION 22 34 00

FUEL FIRED, DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Residential, gas water heaters.

1.02 QUALITY ASSURANCE

- A. Gas Water Heaters: AGA certification labeled.
- B. Quality Standard for Water heater, Hot-Water Storage Tanks: ASME Boiler and Pressure Vessel Code.
- C. Performance Efficiency Standards:
 - 1. Household Water Heaters: ASHRAE 90.2.

1.03 WARRANTY

- A. Materials and Workmanship for Storage Tanks: 6 years.
- B. Materials and Workmanship for Circulators: 6 years.
- C. Materials and Workmanship for Burner Assemblies: 2 years.

PART 2 - PRODUCTS

2.01 PRODUCTS

- A. Residential, Power Vent, Storage, Gas Water Heaters: ANSI Z21.10.1/CSA 4.1.
 - 1. Burner: For use with power-vent water heaters.
 - a. Temperature Control: Adjustable thermostat.
 - b. Automatic ignition.
 - 2. Powered-Vent System: Interlocked with burner.
- B. Accessories:
 - 1. Combination temperature and pressure relief valves.
 - 2. Gas Shutoff Valves: Manually operated.
 - 3. Gas pressure regulators.

FUEL FIRED, DOMESTIC WATER HEATERS

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PAGE 1 OF 2

4. Water heater stand and drain pan units.
5. Pressure & Temperature drain piping.
6. Water heater mounting brackets.
7. Drain pan
8. Drain pan piping.

PART 3 EXECUTION

3.01 INSTALLATION OF DOMESTIC WATER HEATER

3.02 PIPING CONNECTIONS

3.03 FIELD QUALITY CONTROL

3.04 DEMONSTRATION

END OF SECTION

SECTION 22 42 00

PLUMBING FIXTURES AND TRIM

PART 1 - GENERAL

1.01 SUMMARY

- A. Plumbing fixtures and related components.

1.02 QUALITY ASSURANCE

- A. Quality Standard: NSF 61 for fixture materials in contact with potable water.

1.03 MISCELLANEOUS FITTINGS AND ACCESSORIES

1.04 WATER CLOSETS

- A. Water Closets:
 - 1. Style. Flush Tank
 - 2. Bowl Type. Vitreous China
 - 3. Height. ADA
 - 4. Design Consumption. 1.28 gpf

1.06 LAVATORIES

- A. Lavatories/Sinks.
 - 1. e. Wall Hung
 - 2. Size. 20x18
 - 3. Height: ADA
 - 4. Protective shielding guards.

1.07 INDIVIDUAL SHOWERS

- A. Individual Showers: Accessible shower.
 - 1. Shower Faucet.

1.08 KITCHEN SINK

- A. Double Compartment Sink.
 - 1. Size. 33"x19-1/2"x5-1/2"
 - 2. Two bowls,
 - 3. ADA

4. Stainless Steel.
5. Min Cabinet size 36"
6. Sink Faucet.

END OF SECTION

SECTION 23 05 00 –
GENERAL MECHANICAL

PART 1-GENERAL

1.01 GENERAL CONDITIONS

- A. Section 230000 and 220000, General Mechanical & Plumbing Requirements applies to this section.

1.02 SUMMARY

- A. This section includes all plumbing (pipe and fittings, specialties) outside the portable buildings including connection to site plumbing systems and connections to stubs at the portable buildings.

1.03 RELATED SECTIONS

- A. Section 22116 – Domestic Water Piping

1.04 REFERENCES

- A. PIPES AND TUBES
- B. FITTINGS
- C. JOINING MATERIALS

1.05 SUBMITTALS

PART 2 - PRODUCTS

2.01 GENERAL

2.02 PIPE, FITTING, AND JOINING MATERIALS

2.03 PIPE AND FITTING APPLICATIONS

- A. Outside Building (from 5'-0" outside building line).
- B. Connection to Building (within 5'-0" of building line).

2.04 VALVES

2.05 PIPING ACCESSORIES

PART 3 - EXECUTION

3.01 PIPING

3.02 VALVES, UNIONS AND FLANGES

3.03 INSTALLATION OF PIPING SYSTEMS

- A. Thrust Blocks.
- B. Sleeves.
- C. Cathodic Protection.
- D. Expansion.

- 3.04 INSTALLATION OF UNDERGROUND PIPE PROTECTION
- 3.05 EXCAVATING AND TRENCHING
- 3.06 BACKFILLING
- 3.07 CROSSING EXISTING UTILITIES
- 3.08 PROTECTION FROM DAMAGE
- 3.09 FINAL CONNECTIONS
- 3.10 STUBS
- 3.11 PIPING TESTING

A. Testing Criteria

END OF SECTION

SECTION 23 07 19

INSULATION HVAC PIPING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. The requirements of the GENERAL CONDITIONS, SUPPLEMENTARY CONDITIONS, SPECIAL CONDITIONS and DIVISION 1 GENERAL REQUIREMENTS, apply to the work of this section.

1.02 SUMMARY

- A. Related Sections:
- B. Section 230713, "Duct Insulation" for duct insulation Requirements applies to this section.

1.03 QUALITY ASSURANCE

1.04 SUBMITTALS

PART 2-PRODUCTS

2.01 GENERAL

2.02 PIPE INSULATION MATERIALS

- A. Flexible Elastomeric: Closed-cell, or expanded-rubber materials; suitable for maximum use temperature between minus 70 deg F and 220 deg F. Comply with ASTM C534/C534M, Type I for tubular materials, Type II, for sheet materials.

PART 3 - EXECUTION

3.01 GENERAL

3.02 DUCT INSULATION

3.03 PIPE INSULATION

3.04 FINISHING

END OF SECTION

SECTION 23 31 13

METAL DUCT

PART 1 - GENERAL

- A. SECTION INCLUDES:
1. Single-wall rectangular ducts and fittings
 2. Single-wall round ducts and fittings.
 3. Sheet metal materials
 4. Duct liner.
 5. Sealants and gaskets.
 6. Hangers and supports

1.01 QUALITY ASSURANCE

PART 2 PRODUCTS

2.01 SINGLE-WALL ROUND DUCTS AND FITTINGS

- A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Ch. 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated
1. Construct ducts of galvanized sheet steel unless otherwise indicated.
 2. Manufacturers: Subject to compliance with requirements, provide products by one of the following: McGill Airflow, Ductmate Industries, SEMCO LLC or equivalent
- B. Transverse Joints: Select joint types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- C. Longitudinal Seams: Select seam types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
- D. Tees and Laterals: Select types and fabricate in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.02 DUCT LINER

- A. Fibrous-Glass Duct Liner: Comply with ASTM C1071, NFPA 90A, or NFPA 90B; and with NAIMA AH124, "Fibrous Glass Duct Liner Standard."
1. Basis-of-Design Product: Subject to compliance with requirements, provide CertainTeed: Saint Gobain; ToughGard® R Duct Liner or comparable product by one of the following:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Knauf Insulation.
 - c. Owens Corning.
 2. Maximum Thermal Conductivity:
 - a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
 - b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature
 3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound is to be tested for efficacy by an NRTL and registered by the EPA for use in HVAC systems.
 4. Water-Based Liner Adhesive: Comply with NFPA 90A or NFPA 90B and with ASTM C916.
- B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C534/C534M, Type II, Grade 1; and with NFPA 90A or NFPA 90B.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Aeroflex USA, Inc.
 - b. Armacell LLC.
 - c. Ductmate Industries, I
 2. Surface-Burning Characteristics: Maximum flame-spread index of 25 and maximum smoke-developed index of 50 when tested in accordance with UL 723; certified by an NRTL.

3. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A or NFPA 90B.

PART 3 - EXECUTION

3.01 DUCT INSTALLATION

- A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and coordination drawings.
- B. Install ducts in accordance with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.
- C. Install ducts in maximum practical lengths with fewest possible joints.
- D. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.
- E. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.
- F. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.
- G. Install ducts with a clearance of 1 inch (25 mm), plus allowance for insulation thickness.
- H. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.
- I. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches (38 mm).
- J. Install fire[, combination fire/smoke,] and smoke dampers where indicated on Drawings and as required by code, and by local authorities having jurisdiction. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers and specific installation requirements of the damper UL listing.
- K. Install heating coils, cooling coils, air filters, dampers, and all other duct-mounted accessories in air ducts where indicated on Drawings.
- L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials both before and after installation.[Comply with SMACNA's "IAQ Guidelines

for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."]

- M. Elbows: Use long-radius elbows wherever they fit.
 - 1. Fabricate 90-degree rectangular mitered elbows to include turning vanes.
 - 2. Fabricate 90-degree round elbows with a minimum of three segments for 12 inches (300 mm) and smaller and a minimum of five segments for 14 inches (350 mm) and larger.
- N. Branch Connections: Use lateral or conical branch connections.

END OF SECTION

SECTION 23 52 16

CONDENSING BOILERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Floor mounted, forced draft, water-tube condensing boiler.
- B. Condensing neutralization units.

1.02 SUBMITTALS

- A. Shop Drawings: For boilers, boiler trim and accessories.
 - 1. Include plans, elevations, section and mounting details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.

PART 2 - PRODUCTS

2.01 FLOOR-MOUNTED, WATER-TUBE CONDENSING BOILERS

- A. MUNCHKIN
- B. Description: Factory-fabricated, -assembled, and -tested, water-tube, forced-draft, condensing boiler with heat exchanger sealed pressure tight, built on a steel base, including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls. Units are to be for water-heating service only.
- C. Heat Exchanger: Stainless steel primary and secondary heat exchangers.
- D. Combustion Chamber: Stainless steel, sealed
- E. Burner: Propane gas, forced draft drawing from gas-premixing valve.
- F. Blower: Centrifugal fan to operate during each burner-firing sequence and to prepurge and postpurge the combustion chamber.

2.02 TRIM - FOR HOT-WATER BOILERS

A. Aquastat Controllers:

- 2.03 ELECTRICAL POWER**
- 2.04 VENTING KIT**
- 2.05 CONDENSATE NEUTRALIZATION UNIT**

PART 3 – EXECUTION

- 3.01 BOILER INSTALLATION**
- 3.02 PIPING CONNECTIONS**
- 3.03 DUCT CONNECTIONS**
- 3.04 ELECTRICAL CONNECTIONS**
- 3.05 CONTROL CONNECTIONS**
- 3.06 FIELD QUALITY CONTROL**
- 3.07 DEMONSTRATION**

END OF SECTION

SECTION 23 55 33.16

GAS-FIRED UNIT HEATERS

PART 1 - GENERAL

1.01 SUMMARY

- A. Propane fired, single stage, power vent.
- B. Housing: Steel, with integral fan and inserts for suspension mounting rods
- C. Power venter: Centrifugal aluminized steel fan with stainless steel shaft.
- D. Heat Exchanger: Aluminized
- E. Hot surface ignition with flame rod sensing.
- F. CSA certified, 5 year burner warranty.

PART 2 PRODUCTS

PART 3 EXECUTION

- 3.01 INSTLLATION**
- 3.02 EQUIPMENT MOUNTING**
- 3.03 CONNECTIONS**
- 3.04 FIELD QUALITY CONTROL**

END OF SECTION

SECTION 23 81 29

VARIABLE REFRIGERANT FLOW HVAC SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

- A. Indoor, concealed, ceiling-mounted units for ducting.
- B. Outdoor, air-source heat recovery units
- C. System controls
- D. System refrigerant and oil
- E. System condensate drain piping
- F. System refrigerant piping
- G. Metal hangers and supports

1.02 QUALITY ASSURANCE

- A. Factory-Authorized Service Representative Qualifications.
- B. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by VRF HVAC system manufacturer.
- C. ISO Compliance: System equipment and components furnished by VRF HVAC system manufacturer shall be manufactured in an ISO 9001 and ISO 14001 facility

1.03 WARRANTY

- A. Materials and Workmanship for Compressor: Five years.
- B. Materials and Workmanship for Parts, Including Controls: Five years.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

- A. General: Mitsubishi

2.02 SYSTEM DESCRIPTION

- A. Direct-expansion (DX) VRF HVAC system with variable capacity in response to varying cooling and heating loads. System shall consist of multiple indoor units, concealed ducted fan coil units, one outdoor unit, piping, controls, and electrical power to make complete operating system complying with requirements indicated.
 - 1. Two-pipe system design
 - 2. System operation, heat recovery as indicated.
 - 3. Each system with one refrigerant circuit shared by all indoor units connected to system.

VARIABLE REFRIGERANT FLOW HVAC SYSTEM
23 81 29

2.03 INDOOR, CONCEALED, CEILING-MOUNTED UNITS FOR DUCTING

- A. Description: Factory-assembled[and -tested] complete unit with components, piping, wiring, and controls required for mating to ductwork, piping, power, and controls field connections.
- B. Cabinet:
 - 1. Material: Galvanized painted steel.
 - 2. Duct Connections: Extended collar or flange, or designated exterior cabinet surface, designed for attaching field-installed ductwork.
 - 3. Mounting: Manufacturer-designed provisions for field installation.
 - 4. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
- C. DX Coil Assembly:
- D. Assembly
- E. Fan and Motor Assembly
- F. Filter Assembly
- G. Unit Accessories
- H. Unit Controls
- I. Unit Electrical

2.04 OUTDOOR, AIR-SOURCE HEAT RECOVERY UNITS

- A. Description: Factory-assembled and -tested complete unit with components, piping, wiring, and controls required for mating to piping, power, and controls field connections.
 - 1. Specially designed for use in systems with simultaneous heating and cooling.
 - 2. Systems shall consist of one unit, or multiple unit modules that are designed by variable refrigerant system manufacturer for field interconnection to make a single refrigeration circuit that connects multiple indoor units.
 - 3. All units installed shall be from the same product development generation.
- B. Cabinet:
 - 1. Galvanized steel and coated with a corrosion-resistant finish.
 - a. Coating with documented salt spray test performance of [1000] <Insert number> hours according ASTM B117 surface scratch test (SST) procedure.
 - 2. Mounting: Manufacturer-designed provisions for field installation.

3. Internal Access: Removable panels or hinged doors of adequate size for field access to internal components for inspection, cleaning, service, and replacement.
- C. Compressor and Motor Assembly:
1. One or more positive-displacement, direct-drive and hermetically sealed scroll compressor(s) with inverter drive and turndown percent of rated capacity.
 2. Protection: Integral protection against the following:
 - a. High refrigerant pressure.
 - b. Low oil level.
 - c. High oil temperature.
 - d. Thermal and overload.
 - e. Voltage fluctuations.
 - f. Phase failure and phase reversal.
 - g. Short cycling.
 3. Speed Control: Variable to automatically maintain refrigerant suction and condensing pressures while varying refrigerant flow to satisfy system cooling and heating loads.
 4. Vibration Control: Integral isolation to dampen vibration transmission.
 5. Oil management system to ensure safe and proper lubrication over entire operating range.
 6. Crankcase heaters with integral control to maintain safe operating temperature.
 7. Fusible plug.
- D. Condenser Coil Assembly:
1. Plate Fin Coils:
 - a. Casing: Aluminum
 - b. Fins: Aluminum mechanically bonded to tubes, with arrangement required by performance.
 - c. Tubes: Copper, of diameter and thickness required by performance.
 2. Aluminum Microchannel Coils:
 - a. Series of flat tubes containing a series of multiple, parallel-flow microchannels layered between refrigerant header manifolds.
 - b. Single- or multiple-pass arrangement.
 - c. Construct fins, tubes, and header manifolds of aluminum alloy.
 3. Coating: None
- E. Condenser Fan and Motor Assembly:
1. Fan(s): Propeller type.

- a. Direct-drive arrangement.
 - b. Fabricated from non-ferrous components or ferrous components with corrosion protection finish to match performance indicated for condenser coil.
 - c. Dynamically balanced.
-
- 2. Fan Guards: Removable safety guards complying with OSHA regulations. If using metal materials, coat with corrosion-resistant coating to match performance indicated for condenser coil.
 - 3. Motor(s): Brushless dc or electronically commutated with permanently lubricated bearings and rated for outdoor duty.
 - 4. Motor Protection: Integral protection against thermal, overload, and voltage fluctuations.
 - 5. Vibration Control: Integral isolation to dampen vibration transmission.
- F. Drain Pan: If required by manufacturer's design, provide unit with non-ferrous drain an with bottom sloped to a low point drain connection.
- G. Unit Controls:
- 1. Enclosure: Manufacturer's standard, and suitable for unprotected outdoor locations.
 - 2. Factory-Installed Controller: Configurable digital control.
 - 3. Factory-Installed Sensors:
 - 4. Cable and Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
 - 5. Field Connection: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
- H. Unit Electrical:
- 1. Enclosure: Metal, similar to enclosure, and suitable for unprotected outdoor locations.
 - 2. Field Connection: Single point connection to power entire unit and integral controls.
 - 3. Disconnecting Means: Factory-mounted circuit breaker or switch, complying with NFPA 70.
 - 4. Control Transformer: Manufacturer's standard. Coordinate requirements with field power supply.

5. Wiring: Manufacturer's standard with each connection labeled and corresponding to a unit-mounted wiring diagram.
6. Raceways: Enclose line voltage wiring in metal raceways to comply with NFPA 70.
- I. Unit Hardware: Zinc-plated steel
- J. Unit Piping:
 1. Unit Tubing: Copper tubing with brazed joints.
 2. Unit Tubing Insulation: Manufacturer's standard insulation, of thickness to prevent condensation.
 3. Field Piping Connections: Manufacturer's standard
 4. Factory Charge: Dehydrated air or nitrogen.
 5. Testing: Factory pressure tested and verified to be without leaks.

2.05 SYSTEM CONTROLS

- A. Wired Controllers for Indoor Units:
 1. Single controller capable of controlling multiple indoor units as group.
 2. Auto Timeout Touch Screen LCD: Timeout duration shall be adjustable.
 3. Multiple Language: English
 4. Temperature Units: Fahrenheit
 5. On/Off: Turns indoor unit on or off.
 6. Hold: Hold operation settings until hold is released.
 7. Operation Mode: Cool, Heat, Auto, Fan Only, and Setback.
 8. Temperature Display: 1-degree increments.
 9. Temperature Set-Point: Separate set points for Cooling, Heating, and Setback. Adjustable in 1-degree increments
 10. Fan Speed Setting: Select between available options furnished with the unit.
 11. Airflow Direction Setting: If applicable to unit, select between available options furnished with the unit
 12. Seven-day programmable operating schedule. Operations shall include On/Off, Operation Mode, and Temperature Set-Point.
 13. Auto Off Timer: Operates unit for an adjustable time duration and then turns unit off.
 14. Service Run Tests: Limit use by service personnel to troubleshoot operation.
 15. Setting stored in nonvolatile memory to ensure that settings are not lost if power is lost. Battery backup for date and time only.
 16. Low-voltage power required for controller shall be powered through non-polar connections to indoor unit.

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Sleeves for raceways and cables.
 - 2. Sleeve seals.
 - 3. Grout.
 - 4. Common electrical installation requirements.

1.2 SUBMITTALS

- A. Product Data: For sleeve seals.

PART 2 - PRODUCTS

2.1 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.
- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.
- C. Sleeves for Rectangular Openings: Galvanized sheet steel.
 - 1. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Advance Products & Systems, Inc.
 - b. Calpico, Inc.
 - c. Metraflex Co.
 - d. Pipeline Seal and Insulator, Inc.
 - e. Approved equal
2. Sealing Elements: EPDM or NBR interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
3. Pressure Plates: Carbon steel. Include two for each sealing element.
4. Connecting Bolts and Nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.
- C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.
- D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.
- E. Cut sleeves to length for mounting flush with both surfaces of walls.
- F. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level.
- G. Size pipe sleeves to provide ¼-inch (6.4-mm) annular clear space between sleeve and raceway or cable, unless indicated otherwise.
- H. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07.
- J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Install sleeves and seal raceway and cable penetration sleeves with firestop materials. Comply with requirements in Division 07.
- K. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel or cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

- A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07.

END OF SECTION 26 05 00

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 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 NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

- A. Aluminum and Copper Conductors: Comply with NEMA WC 70.
- B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN, THHN2-THWN, XHHW
- C. Multiconductor Cable: Comply with NEMA WC 70 for Type SO and metal-clad cable, Type MC with ground wire.

2.2 CONNECTORS AND SPLICES

- 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. AFC Cable Systems, Inc.
 - 2. Hubbell Power Systems, Inc.

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

3. O-Z/Gedney; EGS Electrical Group LLC.
 4. 3M; Electrical Products Division.
 5. Tyco Electronics Corp.
 6. Approved equal.
- B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Stranded copper or aluminum as noted in drawings.
- B. Branch Circuits: Stranded copper unless otherwise noted.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN, THHN2-THWN, XHHW, single conductors in raceway.
- B. Exposed Feeders: Type THHN-THWN, THHN2-THWN, XHHW, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, THHN2-THWN, XHHW, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, THHN2-THWN, XHHW, single conductors in raceway.
- E. Exposed Branch Circuits, Including in Crawlspace: Type THHN-THWN, THHN2-THWN, single conductors in raceway.
- F. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, THHN2-THWN, single conductors in raceway, Metal-clad cable, Type MC.
- G. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, THHN2-THWN, single conductors in raceway.
- H. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- I. Class 1 Control Circuits: Type THHN-THWN, THHN2-THWN, single conductors in raceway.
- J. Class 2 Control Circuits: Type THHN-THWN, THHN2-THWN, single conductors in raceway, Power-limited cable, concealed in building finishes, Power-limited tray cable, in cable tray.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.
- B. 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 Division 26 Sections "Hangers and Supports for Electrical Systems."
- F. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."
- 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. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
 - 1. Use oxide inhibitor in each splice and tap conductor for aluminum conductors.
- I. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches (150 mm) of slack.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
- C. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 19

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes methods and materials for grounding systems and equipment.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 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 UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.

2.2 CONNECTORS

- A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.

- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

- A. Ufer Ground (Concrete-Encased Grounding Electrode): Bare copper conductor size as noted on drawings, #4 minimum.
- B. Ground Rods: Copper-clad steel; 5/8 by 96 inches (16 by 2400 mm)] in diameter.
- C. Chemical-Enhanced Grounding Electrodes: Copper tube, straight or L-shaped, charged with nonhazardous electrolytic chemical salts.
 - 1. Termination: Factory-attached No. 4/0 AWG bare conductor at least 48 inches (1200 mm) long.
 - 2. Backfill Material: Electrode manufacturer's recommended material.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger, unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare copper conductor, size as noted on drawings. Bury at least 24 inches (600 mm) below grade.
- C. Isolated Grounding Conductors: Green-colored insulation or green-colored tape. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- D. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors, except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. All conduits.
 - 2. Flexible raceway runs.
 - 3. Armored and metal-clad cable runs.

4. Computer and Rack-Mounted Electronic Equipment Circuits: Install insulated equipment grounding conductor in branch-circuit runs from equipment-area power panels and power-distribution units.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.
- C. Water Heater, Heat-Tracing, and Anti-frost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Isolated Grounding Receptacle Circuits: Install an insulated equipment grounding conductor connected to the receptacle grounding terminal. Isolate conductor from raceway and from panelboard grounding terminals. Terminate at equipment grounding conductor terminal of the applicable derived system or service, unless otherwise indicated.
- E. Signal and Communication Equipment: For telephone, alarm, voice and data, and other communication equipment, comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems."

3.3 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ufer Ground (Concrete-Encased Grounding Electrode): Fabricate according to NFPA 70, using a minimum of 20 feet (6 m) of conductor within the concrete footing. Place near bottom outside edge of footing ensuring a minimum concrete encasement of 3" on all sides.
- C. Ground Rods: Drive rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.
- D. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.
 1. Test Wells: Install at least one test well for each service where ground rods are used, unless otherwise indicated. Install at the ground rod electrically closest to service entrance. Set top of test well flush with finished grade or floor.
- E. Bonding Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

F. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, 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, using a bolted clamp connector or by bolting a lug-type connector to a pipe flange, using one of the lug bolts of the flange.
2. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

G. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install bonding jumper to bond across flexible duct connections to achieve continuity.

3.4 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells.
 - a. Measure ground resistance not less than two full days after last trace of precipitation and without 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.
 - b. Perform tests by fall-of-potential method according to IEEE 81.

B. Report measured ground resistances that exceed the following values:

1. Power and Lighting Equipment or System with Capacity 500 kVA and Less: 10 ohms.
2. Power and Lighting Equipment or System with Capacity 500 to 1000 kVA: 5 ohms.
3. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
4. Power Distribution Units or Panelboards Serving Electronic Equipment: 1 ohm.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Hangers and supports for electrical equipment and systems.
 - 2. Construction requirements for concrete bases.

1.2 PERFORMANCE REQUIREMENTS

- A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.
- B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
- C. Rated Strength: Adequate in tension, shear, and pullout force to resist maximum loads calculated or imposed for this Project, with a minimum structural safety factor of five times the applied force.

1.3 SUBMITTALS

- A. Product Data: For steel slotted support systems.
 - 1. Trapeze hangers. Include Product Data for components.
 - 2. Steel slotted channel systems. Include Product Data for components.
 - 3. Equipment supports.

1.4 QUALITY ASSURANCE

- A. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. 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:
 - a. Allied Tube & Conduit.
 - b. Cooper B-Line, Inc.; a division of Cooper Industries.
 - c. ERICO International Corporation.
 - d. GS Metals Corp.
 - e. Thomas & Betts Corporation.
 - f. Unistrut; Tyco International, Ltd.
 - g. Wesanco, Inc.
 - h. Approved equal.
 2. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
 3. Nonmetallic Coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
 4. Painted Coatings: Manufacturer's standard painted coating applied according to MFMA-4.
 5. Channel Dimensions: Selected for applicable load criteria.
- B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Powder-Actuated Fasteners: Threaded-steel stud, for use in hardened portland cement concrete, steel, or wood, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 - 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) Hilti Inc.
 - 2) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 3) MKT Fastening, LLC.
 - 4) Simpson Strong-Tie Co., Inc.; Masterset Fastening Systems Unit.

- 5) Approved equal.
2. Mechanical-Expansion Anchors: Insert-wedge-type, zinc-coated steel, for use in hardened portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.
 - 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) Cooper B-Line, Inc.; a division of Cooper Industries.
 - 2) Empire Tool and Manufacturing Co., Inc.
 - 3) Hilti Inc.
 - 4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
 - 5) MKT Fastening, LLC.
 - 6) Approved equal.
3. Concrete Inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
4. Clamps for Attachment to Steel Structural Elements: MSS SP-58, type suitable for attached structural element.
5. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
6. Toggle Bolts: All-steel springhead type.
7. Hanger Rods: Threaded steel.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

- A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.
- B. Materials: Comply with requirements in Division 05 for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

- A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.
- B. Minimum rod size shall be 1/4 inch (6 mm) in diameter.
- C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with conduit clamps.

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

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3.2 SUPPORT INSTALLATION

- A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.
- B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and RMC may be supported by openings through structure members, as permitted in NFPA 70.
- C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb (90 kg).
- D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 - 1. To Wood: Fasten with lag screws or through bolts.
 - 2. To New Concrete: Bolt to concrete inserts.
 - 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 - 4. To Existing Concrete: Expansion anchor fasteners.
 - 5. Instead of expansion anchors, powder-actuated driven threaded studs provided with lock washers and nuts may be used in existing standard-weight concrete 4 inches (100 mm) thick or greater. Do not use for anchorage to lightweight-aggregate concrete or for slabs less than 4 inches (100 mm) thick.
 - 6. To Steel: Welded threaded studs complying with AWS D1.1/D1.1M, with lock washers and nuts, and Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
 - 7. To Light Steel: Sheet metal screws.
 - 8. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.
- E. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

- A. Comply with installation requirements in Division 05 for site-fabricated metal supports.
- B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.
- C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated but not less than 4 inches (100 mm) larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000-psi (20.7-MPa), 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 03."
- C. Anchor equipment to concrete base.
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

- A. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - 1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils (0.05 mm).
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33

RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
- B. See Division 26 Section "Underground Ducts and Raceways for Electrical Systems" for exterior ductbanks and manholes, and underground handholes, boxes, and utility construction.

1.2 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.
- B. Shop Drawings: For custom enclosures and cabinets. Include plans, elevations, sections, details, and attachments to other work.

1.3 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 NFPA 70.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. EMT: ANSI C80.3.
- D. FMC: Zinc-coated steel.
- E. LFMC: Flexible steel conduit with PVC jacket.

- F. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
2. Fittings for EMT: Steel set-screw or compression type.

2.2 NONMETALLIC CONDUIT AND TUBING

- A. RNC: NEMA TC 2, Type EPC-40-PVC, unless otherwise indicated.
- B. LFNC: UL 1660.
- C. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.
- D. Fittings for LFNC: UL 514B.

2.3 METAL WIREWAYS

- 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. Cooper B-Line, Inc.
 2. Hoffman.
 3. Square D; Schneider Electric.
 4. Approved equal.
- B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1 or 3R, as required.
- C. 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.
- D. Wireway Covers: Screw-cover type.
- E. Finish: Manufacturer's standard enamel finish.

2.4 SURFACE RACEWAYS

- A. Surface Metal Raceways: Galvanized steel with snap-on covers.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Thomas & Betts Corporation.
 - b. Walker Systems, Inc.; Wiremold Company.
 - c. Approved equal.

2.5 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, ferrous alloy, Type FD, with gasketed cover.
- C. Metal Floor Boxes – In Slab On Grade: Cast metal fully adjustable, rectangular.
- D. Metal Floor Boxes - In Slab Above Grade: Sheet metal fully adjustable, rectangular.
- E. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- F. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, galvanized, cast iron with gasketed cover.
- G. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- H. Cabinets:
 - 1. NEMA 250, Type 1, galvanized-steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit: Rigid steel conduit, and IMC.
 - 2. Concealed Conduit, Aboveground: Rigid steel conduit, IMC, EMT, and FMC.
 - 3. Underground Conduit: Rigid steel conduit, IMC, RNC, Type EPC-40, and 80-PVC, direct buried.
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC, and FMC.
 - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 3R.
- B. Comply with the following indoor applications, unless otherwise indicated:
 - 1. Exposed, Not Subject to Physical Damage: Rigid steel conduit, IMC, and EMT.
 - 2. Exposed, Not Subject to Severe Physical Damage: Rigid steel conduit, IMC, and EMT.

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3. Exposed and Subject to Severe Physical Damage: Rigid steel conduit, and IMC. Includes raceways in the following locations:
 - a. Loading dock.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 4. Concealed in Ceilings and Interior Walls and Partitions: Rigid steel conduit, IMC, EMT, and FMC.
 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC, except use LFMC in damp or wet locations.
 6. Damp or Wet Locations: Rigid steel conduit, IMC, and EMT..
 7. Raceways for Optical Fiber or Communications Cable: Rigid steel conduit, IMC, and EMT.
 8. Boxes and Enclosures: NEMA 250, Type 1, except use NEMA 250, Type 4, in damp or wet locations.
- C. Minimum Raceway Size: 1/2-inch (16-mm) above ground, 3/4-inch (21-mm) underground trade size.
- D. Raceway Fittings: Compatible with raceways and suitable for use and location.
1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.

3.2 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.
- C. Complete raceway installation before starting conductor installation.
- D. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical Systems."
- E. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- F. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- G. Raceways Embedded in Slabs:
 1. Run conduit larger than 1-inch (27-mm) trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.

2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
 3. Change from RNC, Type EPC-40-PVC, to rigid steel conduit, or IMC before rising above the floor.
- H. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- I. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of pull wire.
- J. Raceways for Optical Fiber and Communications Cable: Install as follows:
1. 3/4-Inch (19-mm) Trade Size and Smaller: Install raceways in maximum lengths of 50 feet (15 m).
 2. 1-Inch (25-mm) Trade Size and Larger: Install raceways in maximum lengths of 75 feet (23 m).
 3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes or terminations at distribution frames or cabinets where necessary to comply with these requirements.
- K. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with 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 boundaries of refrigerated spaces.
 2. Where otherwise required by NFPA 70.
- L. Flexible Conduit Connections: Use maximum of 72 inches (1830 mm) of flexible conduit for recessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
1. Use LFMC in damp or wet locations.
- M. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.
- N. Set metal floor boxes level and flush with finished floor surface.

3.3 INSTALLATION OF UNDERGROUND CONDUIT

- A. Direct-Buried Conduit:
1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 for pipe less than 6 inches (150 mm) in nominal

- diameter. All trenches shall slope down away from building so that conduits terminating outside the building terminate below the height of the floor.
2. Install backfill as specified in Division 31."
 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches (300 mm) of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31."
 4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
 5. Warning Tape: Bury warning tape approximately 12 inches (300 mm) above direct-buried conduits.

3.4 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07."

END OF SECTION 26 05 33

SECTION 26 05 43

UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Conduit, ducts, and duct accessories for direct-buried and concrete-encased duct banks, and in single duct runs.
 - 2. Handholes and boxes.
 - 3. Manholes.

1.2 SUBMITTALS

- A. Product Data: For accessories for manholes, handholes, and boxes.
- B. Shop Drawings for Precast or Factory-Fabricated Underground Utility Structures: Include plans, elevations, sections, details, attachments to other work, and accessories, including the following:
 - 1. Duct entry provisions, including locations and duct sizes.
 - 2. Reinforcement details.
 - 3. Frame and cover design and manhole frame support rings.
 - 4. Ladder or Step details.
 - 5. Grounding details.
 - 6. Dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
 - 7. Joint details.
- C. Shop Drawings for Factory-Fabricated Handholes and Boxes: Include dimensioned plans, sections, and elevations, and fabrication and installation details, including the following:
 - 1. Duct entry provisions, including locations and duct sizes.
 - 2. Cover design.
 - 3. Grounding details.
 - 4. Dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI C2.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Rigid Steel Conduit: Galvanized. Comply with ANSI C80.1.
- B. RNC: NEMA TC 2, Type EPC-40-PVC and Type EPC-80-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

- 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. ARNCO Corp.
 - 2. Beck Manufacturing.
 - 3. Cantex, Inc.
 - 4. CertainTeed Corp.; Pipe & Plastics Group.
 - 5. Condux International, Inc.
 - 6. ElecSys, Inc.
 - 7. Electri-Flex Company.
 - 8. IPEX Inc.
 - 9. Lamson & Sessions; Carlon Electrical Products.
 - 10. Manhattan/CDT; a division of Cable Design Technologies.
 - 11. Spiraduct/AFC Cable Systems, Inc.
 - 12. Approved equal.
- B. Duct Accessories:
 - 1. Duct Separators: Factory-fabricated rigid PVC interlocking spacers, sized for type and sizes of ducts with which used, and selected to provide minimum duct spacings indicated while supporting ducts during concreting or backfilling.
 - 2. Warning Tape: Underground-line warning tape specified in Division 26 Section "Identification for Electrical Systems."
 - a. Color: Red dye added to concrete during batching.

2.3 HANDHOLES AND BOXES

- A. Description: Comply with SCTE 77.
 - 1. Color: Gray.
 - 2. Configuration: Units shall be designed for flush burial and have open bottom, unless otherwise indicated.
 - 3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
 - 4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - 5. Cover Legend: Molded lettering, As indicated for each service.

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- B. Fiberglass Handholes and Boxes with Polymer Concrete Frame and Cover: Sheet-molded, fiberglass-reinforced, polyester resin enclosure joined to polymer concrete top ring or frame.
 - 1. 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:
 - a. Armorcast Products Company.
 - b. Carson Industries LLC.
 - c. Christy Concrete Products.
 - d. Synertech Moulded Products, Inc.; a division of Oldcastle Precast.
 - e. Jensen Precast
 - f. Christy; a division of Oldcastle Precast
 - g. Approved equal.
- C. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of fiberglass.
 - 1. 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:
 - a. Carson Industries LLC.
 - b. Nordic Fiberglass, Inc.
 - c. Jensen Precast
 - d. Christy; a division of Oldcastle Precast
 - e. Approved equal.

2.4 PRECAST MANHOLES

- 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. Carder Concrete Products.
 - 2. Elmhurst-Chicago Stone Co.
 - 3. Oldcastle Precast Group.
 - 4. Riverton Concrete Products; a division of Cretex Companies, Inc.
 - 5. Utility Concrete Products, LLC.
 - 6. Utility Vault Co.
 - 7. Wausau Tile, Inc.
 - 8. Jensen Precast
 - 9. Christy; a division of Oldcastle Precast
 - 10. Approved equal.
- B. Comply with ASTM C 858 and with interlocking mating sections, complete with accessories, hardware, and features.

1. Windows: Precast openings in walls, arranged to match dimensions and elevations of approaching ducts and duct banks plus an additional 12 inches (300 mm) vertically and horizontally to accommodate alignment variations.
 - a. Windows shall be located no less than 6 inches (150 mm) from interior surfaces of walls, floors, or roofs of manholes, but close enough to corners to facilitate racking of cables on walls.
 - b. Window opening shall have cast-in-place, welded wire fabric reinforcement for field cutting and bending to tie in to concrete envelopes of duct banks.
 - c. Window openings shall be framed with at least two additional No. 4 steel reinforcing bars in concrete around each opening.
- C. Concrete Knockout Panels: 1-1/2 to 2 inches (38 to 50 mm) thick, for future conduit entrance and sleeve for ground rod.
- D. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.

2.5 UTILITY STRUCTURE ACCESSORIES

- 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. Bilco Company (The).
 2. Campbell Foundry Company.
 3. Carder Concrete Products.
 4. Christy Concrete Products.
 5. East Jordan Iron Works, Inc.
 6. Elmhurst-Chicago Stone Co.
 7. McKinley Iron Works, Inc.
 8. Neenah Foundry Company.
 9. NewBasis.
 10. Oldcastle Precast Group.
 11. Osburn Associates, Inc.
 12. Pennsylvania Insert Corporation.
 13. Riverton Concrete Products; a division of Cretex Companies, Inc.
 14. Strongwell Corporation; Lenoir City Division.
 15. Underground Devices, Inc.
 16. Utility Concrete Products, LLC.
 17. Utility Vault Co.
 18. Wausau Tile, Inc.
 19. Jensen Precast
 20. Christy; a division of Oldcastle Precast
 21. Approved equal.
- B. Manhole Frames, Covers, and Chimney Components: Comply with structural design loading specified for manhole.

1. Frame and Cover: Weatherproof, gray cast iron complying with ASTM A 48/A 48M, Class 30B with milled cover-to-frame bearing surfaces; diameter, 26 inches (660 mm).
 - a. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
 - b. Special Covers: Recess in face of cover designed to accept finish material in paved areas.
 2. Cover Legend: Cast in. Selected to suit system.
 - a. Legend: "ELECTRIC-LV" for duct systems with power wires and cables for systems operating at 600 V and less.
 - b. Legend: "ELECTRIC-HV" for duct systems with medium-voltage cables.
 - c. Legend: "SIGNAL" for communications, data, and telephone duct systems.
 3. Manhole Chimney Components: Precast concrete rings with dimensions matched to those of roof opening.
 - a. Mortar for Chimney Ring and Frame and Cover Joints: Comply with ASTM C 270, Type M, except for quantities less than 2.0 cu. ft. (60 L) where packaged mix complying with ASTM C 387, Type M, may be used.
- C. Manhole Sump: Depression cast in floor.
- D. Pulling Eyes in Concrete Walls: Eyebolt with reinforcing-bar fastening insert, 2-inch- (50-mm-) diameter eye, and 1-by-4-inch (25-by-100-mm) bolt.
1. Working Load Embedded in 6-Inch (150-mm), 4000-psi (27.6-MPa) Concrete: 13,000-lbf (58-kN) minimum tension.
- E. Pulling Eyes in Non-concrete Walls: Eyebolt with reinforced fastening, 1-1/4-inch- (32-mm-) diameter eye, rated 2500-lbf (11-kN) minimum tension.
- F. Pulling-In and Lifting Irons in Concrete Floors: 7/8-inch- (22-mm-) diameter, hot-dip galvanized, bent steel rod; stress relieved after forming; and fastened to reinforcing rod. Exposed triangular opening.
1. Ultimate Yield Strength: 40,000-lbf (180-kN) shear and 60,000-lbf (270-kN) tension.
- G. Bolting Inserts for Concrete Utility Structure Cable Racks and Other Attachments: Flared, threaded inserts of noncorrosive, chemical-resistant, nonconductive thermoplastic material; 1/2-inch (13-mm) ID by 2-3/4 inches (69 mm) deep, flared to 1-1/4 inches (32 mm) minimum at base.
1. Tested Ultimate Pullout Strength: 12,000 lbf (53 kN) minimum.
- H. Expansion Anchors for Installation after Concrete Is Cast: Zinc-plated, carbon-steel-wedge type with stainless-steel expander clip with 1/2-inch (13-mm) bolt, 5300-lbf (24-kN) rated pullout strength, and minimum 6800-lbf (30-kN) rated shear strength.
- I. Cable Rack Assembly: Steel, hot-rolled galvanized, except insulators.

1. Stanchions: T-section or channel; 2-1/4-inch (57-mm) nominal size; punched with 14 holes on 1-1/2-inch (38-mm) centers for cable-arm attachment.
 2. Arms: 1-1/2 inches (38 mm) wide, lengths ranging from 3 inches (75 mm) with 450-lb (204-kg) minimum capacity to 18 inches (460 mm) with 250-lb (114-kg) minimum capacity. Arms shall have slots along full length for cable ties and be arranged for secure mounting in horizontal position at any vertical location on stanchions.
 3. Insulators: High-glaze, wet-process porcelain arranged for mounting on cable arms.
- J. Duct-Sealing Compound: Non-hardening, safe for contact with human skin, not deleterious to cable insulation, and workable at temperatures as low as 35 deg F (2 deg C). Capable of withstanding temperature of 300 deg F (150 deg C) without slump and adhering to clean surfaces of plastic ducts, metallic conduits, conduit coatings, concrete, masonry, lead, cable sheaths, cable jackets, insulation materials, and common metals.
- K. Fixed Manhole Ladders: Arranged for attachment to wall of manhole. Ladder and mounting brackets and braces shall be fabricated from nonconductive, structural-grade, fiberglass-reinforced resin.
- L. Cover Hooks: Heavy duty, designed for lifts 60 lbf (270 N) and greater. Two required.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavation and Backfill: Comply with Division 31 but do not use heavy-duty, hydraulic-operated, compaction equipment.
- B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
- C. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary top-soiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Division 32 Sections "Turf and Grasses" and "Plants."
- D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 01."

3.2 DUCT INSTALLATION

- A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.
- B. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

- C. Duct Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches (250 mm) o.c. for 5-inch (125-mm) ducts, and vary proportionately for other duct sizes.
 - 1. Begin change from regular spacing to end-bell spacing 10 feet (3 m) from the end bell without reducing duct line slope and without forming a trap in the line.
 - 2. Grout end bells into structure walls from both sides to provide watertight entrances.
- D. Building Wall Penetrations: Make a transition from underground duct to rigid steel conduit at least 10 feet (3 m) outside the building wall without reducing duct line slope away from the building, and without forming a trap in the line. Use fittings manufactured for duct-to-conduit transition. Install conduit penetrations of building walls as specified in Division 26 Section "Common Work Results for Electrical."
- E. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.
- F. Pulling Cord: Install 100-lbf- (445-N-) test nylon cord in ducts, including spares.
- G. Concrete-Encased Ducts: Support ducts on duct separators.
 - 1. Separator Installation: Space separators close enough to prevent sagging and deforming of ducts, with not less than 4 spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent floating during concreting. Stagger separators approximately 6 inches (150 mm) between tiers. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 - 2. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - a. Start at one end and finish at the other, allowing for expansion and contraction of ducts as their temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written recommendations, or use other specific measures to prevent expansion-contraction damage.
 - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch (19-mm) reinforcing rod dowels extending 18 inches (450 mm) into concrete on both sides of joint near corners of envelope.
 - 3. Pouring Concrete: Spade concrete carefully during pours to prevent voids under and between conduits and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Use a plank to direct concrete down sides of bank assembly to trench bottom. Allow concrete to flow to center of bank and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-bank application.
 - 4. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
 - 5. Minimum Space between Ducts: 3 inches (75 mm) between ducts and exterior envelope wall, 2 inches (50 mm) between ducts for like services, and 4 inches (100 mm) between power and signal ducts.

6. Depth: Install top of duct bank at least 24 inches (600 mm) below finished grade in areas not subject to deliberate traffic, and at least 30 inches (750 mm) below finished grade in deliberate traffic paths for vehicles, unless otherwise indicated.
7. Stub-Ups: Use manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Extend concrete encasement throughout the length of the elbow.
8. Warning Tape: Bury warning tape approximately 12 inches (300 mm) above all concrete-encased ducts and duct banks. Align tape parallel to and within 3 inches (75 mm) of the centerline of duct bank. Provide an additional warning tape for each 12-inch (300-mm) increment of duct-bank width over a nominal 18 inches (450 mm). Space additional tapes 12 inches (300 mm) apart, horizontally.

H. Direct-Buried Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
2. Space separators close enough to prevent sagging and deforming of ducts, with not less than [4] [5] spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches (150 mm) between tiers.
3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 Section "Earth Moving" for pipes less than 6 inches (150 mm) in nominal diameter.
4. Install backfill as specified in Division 31 Section "Earth Moving."
5. After installing first tier of ducts, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand-place backfill to 4 inches (100 mm) over ducts and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
6. Install ducts with a minimum of 3 inches (75 mm) between ducts for like services and 6 inches (150 mm) between power and signal ducts.
7. Depth: Install top of duct bank at least 24 inches (900 mm) below finished grade, unless otherwise indicated.
8. Set elevation of bottom of duct bank below the frost line.
9. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.

3.3 INSTALLATION OF CONCRETE MANHOLES

- A. Comply with ASTM C 891, unless otherwise indicated.
- B. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.

- C. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- D. Manhole Roof: Install with rooftop at least 15 inches (380 mm) below finished grade.
- E. Manhole Frame: In paved areas and trafficways, set frames flush with finished grade. Set other manhole frames 1 inch (25 mm) above finished grade.
- F. Manholes with Fixed Ladders: Offset access opening from manhole centerlines to align with ladder.
- G. Install chimney, constructed of precast concrete collars and rings to support frame and cover and to connect cover with manhole roof opening. Provide moisture-tight masonry joints and waterproof grouting for cast-iron frame to chimney.
- H. Hardware: Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated.
- I. Fixed Manhole Ladders: Arrange to provide for safe entry with maximum clearance from cables and other items in manholes.
- J. Field-Installed Bolting Anchors: Do not drill deeper than 3-7/8 inches (98 mm) for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.
- K. Warning Sign: Install "Confined Space Hazard" warning sign on the inside surface of each manhole cover.

3.4 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.7-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.
- D. Install handholes and boxes with bottom below the frost line, <Insert depth of frost line below grade at Project site> below grade.
- E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in the enclosure.

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- F. Field-cut openings for ducts and conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.5 GROUNDING

- A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.6 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections:
 - 1. Demonstrate capability and compliance with requirements on completion of installation of underground ducts and utility structures.
 - 2. Pull aluminum or wood test mandrel through duct to prove joint integrity and test for out-of-round duct. Provide mandrel equal to 80 percent fill of duct. If obstructions are indicated, remove obstructions and retest.
 - 3. Test manhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Division 26 Section "Grounding and Bonding for Electrical Systems."
- B. Correct deficiencies and retest as specified above to demonstrate compliance.

3.7 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump. Remove foreign material.

END OF SECTION 26 05 43

SECTION 26 05 44

SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sleeves for raceway and cable penetration of non-fire-rated construction walls and floors.
2. Sleeve-seal systems.
3. Sleeve-seal fittings.
4. Grout.

B. Related Requirements:

1. Division 07 Section "Penetration Firestopping" for penetration firestopping installed in fire-resistance-rated walls, horizontal assemblies, and smoke barriers, with and without penetrating items.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. LEED Submittals:

1. Product Data for Credit EQ 4.1: For sealants, documentation including printed statement of VOC content.
2. Laboratory Test Reports for Credit EQ 4: For sealants, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

PART 2 - PRODUCTS

2.1 SLEEVES

A. Wall Sleeves:

1. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, zinc coated, plain ends.

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- B. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies: Galvanized-steel sheet; 0.0239-inch (0.6-mm) minimum thickness; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.
- C. Sleeves for Rectangular Openings:
 - 1. Material: Galvanized sheet steel.
 - 2. Minimum Metal Thickness:
 - a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and with no side larger than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
 - b. For sleeve cross-section rectangle perimeter 50 inches (1270 mm) or more and one or more sides larger than 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE-SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Advance Products & Systems, Inc.
 - b. CALPICO, Inc.
 - c. Metraflex Company (The).
 - d. Pipeline Seal and Insulator, Inc.
 - e. Proco Products, Inc.
 - 2. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 - 3. Pressure Plates: Carbon steel.
 - 4. Connecting Bolts and Nuts: Carbon steel, with corrosion-resistant coating, of length required to secure pressure plates to sealing elements.

2.3 SLEEVE-SEAL FITTINGS

- A. Description: Manufactured plastic, sleeve-type, waterstop assembly made for embedding in concrete slab or wall. Unit shall have plastic or rubber waterstop collar with center opening to match piping OD.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

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- a. Presealed Systems.

2.4 GROUT

- A. Description: Nonshrink; for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C 1107/C 1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000-psi (34.5-MPa), 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

PART 3 - EXECUTION

3.1 SLEEVE INSTALLATION FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Comply with NECA 1.
- B. Comply with NEMA VE 2 for cable tray and cable penetrations.
- C. Sleeves for Conduits Penetrating Above-Grade Non-Fire-Rated Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 07 Section "Joint Sealants."
 - b. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and raceway or cable unless sleeve seal is to be installed or unless seismic criteria require different clearance.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inches (50 mm) above finished floor level. Install sleeves during erection of floors.
- D. Sleeves for Conduits Penetrating Non-Fire-Rated Gypsum Board Assemblies:

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1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 2. Seal space outside of sleeves with approved joint compound for gypsum board assemblies.
- E. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- F. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- G. Underground, Exterior-Wall and Floor Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between raceway or cable and sleeve for installing sleeve-seal system.

3.2 SLEEVE-SEAL-SYSTEM INSTALLATION

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.3 SLEEVE-SEAL-FITTING INSTALLATION

- A. Install sleeve-seal fittings in new walls and slabs as they are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout, seal the space around outside of sleeve-seal fittings.

END OF SECTION 26 05 44

SECTION 26 05 48

VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes:
 - 1. Isolation pads.
 - 2. Channel support systems.
 - 3. Restraint cables.
 - 4. Hanger rod stiffeners.
 - 5. Anchorage bushings and washers.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic-Restraint Loading:
 - 1. Site Class as Defined in the IBC.
 - 2. Assigned Seismic Use Group or Building Category as Defined in the IBC.
 - 3. Design Spectral Response Acceleration at Short Periods (0.2 Second).
 - 4. Design Spectral Response Acceleration at 1.0-Second Period.

1.3 SUBMITTALS

- A. Product Data: For the following:
 - 1. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
 - 2. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of seismic-restraint component used.
 - a. Tabulate types and sizes of seismic restraints, complete with report numbers and rated strength in tension and shear as evaluated by an evaluation service member of ICC-ES.
 - b. Annotate to indicate application of each product submitted and compliance with requirements.
 - 3. Restrained-Isolation Devices: Include ratings for horizontal, vertical, and combined loads.

1.4 QUALITY ASSURANCE

- A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.
- B. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage pre-approval OPA number from OSHPD, pre-approval by ICC-ES, or pre-approval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If pre-approved ratings are not available, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 VIBRATION ISOLATORS

- 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. Ace Mountings Co., Inc.
 - 2. Amber/Booth Company, Inc.
 - 3. California Dynamics Corporation.
 - 4. Isolation Technology, Inc.
 - 5. Kinetics Noise Control.
 - 6. Mason Industries.
 - 7. Vibration Eliminator Co., Inc.
 - 8. Vibration Isolation.
 - 9. Vibration Mountings & Controls, Inc.
 - 10. Approved equal.
- B. Pads: Arrange in single or multiple layers of sufficient stiffness for uniform loading over pad area, molded with a nonslip pattern and galvanized-steel base plates, and factory cut to sizes that match requirements of supported equipment.
 - 1. Resilient Material: Oil- and water-resistant neoprene, rubber, or hermetically sealed compressed fiberglass.

2.2 SEISMIC-RESTRAINT DEVICES

- 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. Amber/Booth Company, Inc.
 - 2. California Dynamics Corporation.
 - 3. Cooper B-Line, Inc.; a division of Cooper Industries.

4. Hilti Inc.
 5. Loos & Co.; Seismic Earthquake Division.
 6. Mason Industries.
 7. TOLCO Incorporated; a brand of NIBCO INC.
 8. Unistrut; Tyco International, Ltd.
 9. Approved equal.
- B. General Requirements for Restraint Components: Rated strengths, features, and application requirements shall be as defined in reports by an evaluation service member of ICC-ES.
1. Structural Safety Factor: Allowable strength in tension, shear, and pullout force of components shall be at least four times the maximum seismic forces to which they will be subjected.
- C. Channel Support System: MFMA-3, shop- or field-fabricated support assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; and rated in tension, compression, and torsion forces.
- D. Restraint Cables: [ASTM A 603 galvanized] [ASTM A 492 stainless]-steel cables with end connections made of steel assemblies with thimbles, brackets, swivels, and bolts designed for restraining cable service; and with a minimum of two clamping bolts for cable engagement.
- E. Hanger Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod. Do not weld stiffeners to rods.
- F. Bushings for Floor-Mounted Equipment Anchor: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchors and studs.
- G. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices.
- H. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.
- I. Mechanical Anchor: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchors with strength required for anchor and as tested according to ASTM E 488. Minimum length of eight times diameter.
- J. Adhesive Anchor: Drilled-in and capsule anchor system containing polyvinyl or urethane methacrylate-based resin and accelerator, or injected polymer or hybrid mortar adhesive. Provide anchor bolts and hardware with zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Multiple Raceways or Cables: Secure raceways and cables to trapeze member with clamps approved for application by an evaluation service member of ICC-ES.
- B. Hanger Rod Stiffeners: Install hanger rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.
- C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static and seismic loads within specified loading limits.

3.2 SEISMIC-RESTRAINT DEVICE INSTALLATION

- A. Equipment and Hanger Restraints:
 - 1. Install restrained isolators on electrical equipment.
 - 2. Install resilient, bolt-isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch (3.2 mm).
 - 3. Install seismic-restraint devices using methods approved by an evaluation service member of ICC-ES providing required submittals for component.
- B. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.
- C. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.
- D. Drilled-in Anchors:
 - 1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid pre-stressed tendons, electrical and telecommunications conduit, and gas lines.
 - 2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.
 - 3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.
 - 4. Adhesive Anchors: Clean holes to remove loose material and drilling dust prior to installation of adhesive. Place adhesive in holes proceeding from the bottom of the hole and progressing toward the surface in such a manner as to avoid introduction of air pockets in the adhesive.
 - 5. Set anchors to manufacturer's recommended torque, using a torque wrench.

6. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3 ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

- A. Install flexible connections in runs of raceways, cables, wireways, cable trays, and busways where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where they terminate with connection to equipment that is anchored to a different structural element from the one supporting them as they approach equipment.

3.4 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.
 2. Test at least four of each type and size of installed anchors and fasteners selected by Architect.
 3. Test to 90 percent of rated proof load of device.
 4. If a device fails test, modify all installations of same type and retest until satisfactory results are achieved.
- B. Remove and replace malfunctioning units and retest as specified above.

3.5 ADJUSTING

- A. Adjust isolators after isolated equipment is at operating weight.
- B. Adjust restraints to permit free movement of equipment within normal mode of operation.

3.6 ELECTRICAL VIBRATION-CONTROL AND SEISMIC-RESTRAINT DEVICE SCHEDULE

- A. Supported or Suspended Equipment: Main Switchboard 'MSB'
 1. Component Importance Factor: 1.0.
 2. Component Response Modification Factor: 6.0.
 3. Component Amplification Factor: 2.5.
- B. Supported or Suspended Equipment: Distribution Panel
 1. Component Importance Factor: 1.0.
 2. Component Response Modification Factor: 6.0.
 3. Component Amplification Factor: 2.5.
- C. Supported or Suspended Equipment: Panel
 1. Component Importance Factor: 1.0.
 2. Component Response Modification Factor: 6.0.
 3. Component Amplification Factor: 2.5.

- D. Supported or Suspended Equipment: Cable Tray
 - 1. Component Importance Factor: 1.0.
 - 2. Component Response Modification Factor: 6.0.
 - 3. Component Amplification Factor: 2.5.
- E. Supported or Suspended Equipment: Conduit
 - 1. Component Importance Factor: 1.0.
 - 2. Component Response Modification Factor: 2.5.
 - 3. Component Amplification Factor: 1.0.
- F. Supported or Suspended Equipment:
 - 1. Component Importance Factor: [1.0] [1.5].
 - 2. Component Response Modification Factor: [1.5] [2.5] [3.5] [5.0].
 - 3. Component Amplification Factor: [1.0] [2.5].

END OF SECTION 26 05 48

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Identification of power and control cables.
 2. Identification for conductors.
 3. Underground-line warning tape.
 4. Warning labels and signs.
 5. Instruction signs.
 6. Equipment identification labels.
 7. Miscellaneous identification products.

1.2 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.

1.3 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

PART 2 - PRODUCTS

2.1 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape not less than 3 mils (0.08 mm) thick by 2 inches (50 mm) wide.
- B. Snap-Around Labels: Slit, pre-tensioned, flexible, preprinted, acrylic sleeve, with diameter sized to suit diameter of raceway or cable it identifies and to stay in place by gripping action.

2.3 FLOOR MARKING TAPE

- A. 2-inch- (50-mm-) wide, 5-mil (0.125-mm) pressure-sensitive vinyl tape, with black and white stripes and clear vinyl overlay.

2.4 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
 - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
 - 1. Comply with ANSI Z535.1 through ANSI Z535.5.
 - 2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
 - 3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE.

2.5 WARNING LABELS AND SIGNS

- A. Comply with NFPA 70 and 29 CFR 1910.145.
- B. Self-Adhesive Warning Labels: Factory-printed, multicolor, pressure-sensitive adhesive labels, configured for display on front cover, door, or other access to equipment unless otherwise indicated.
- C. Baked-Enamel Warning Signs:
 - 1. Preprinted aluminum signs, punched or drilled for fasteners, with colors, legend, and size required for application.
 - 2. 1/4-inch (6.4-mm) grommets in corners for mounting.
 - 3. Nominal size, 7 by 10 inches (180 by 250 mm).
- D. Metal-Backed, Butyrate Warning Signs:

1. Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch (1-mm) galvanized-steel backing; and with colors, legend, and size required for application.
2. 1/4-inch (6.4-mm) grommets in corners for mounting.
3. Nominal size, 10 by 14 inches (250 by 360 mm).

E. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."

2.6 INSTRUCTION SIGNS

- A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch (1.6 mm) thick for signs up to 20 sq. inches (129 sq. cm) and 1/8 inch (3.2 mm) thick for larger sizes.
1. Engraved legend with black letters on white face.
 2. Punched or drilled for mechanical fasteners.
 3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.7 EQUIPMENT IDENTIFICATION LABELS

- A. Self-Adhesive, Engraved, Laminated Acrylic or Melamine Label: Adhesive backed, with white letters on a dark-gray background. Minimum letter height shall be 3/8 inch (10 mm).

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Paint: Comply with requirements in Division 09 for paint materials and application requirements. Select paint system applicable for surface material and location (exterior or interior).
- B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- B. Apply identification devices to surfaces that require finish after completing finish work.
- C. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- E. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape 12" directly above line. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches (400 mm) overall.
- F. Painted Identification: Comply with requirements in Division 09 for surface preparation and paint application.

3.2 IDENTIFICATION SCHEDULE

- A. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 - 1. Color-Coding for Phase and Voltage Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - a. Color shall be factory applied or field applied for sizes larger than No. 8 AWG.
 - b. Colors for 208/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - c. Colors for 480/277-V Circuits:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - d. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches (150 mm) from terminal points and in boxes where splices or taps are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.
- B. Install instructional sign including the color-code for grounded and ungrounded conductors using adhesive-film-type labels.
- C. Conductors to Be Extended in the Future: Attach marker tape to conductors and list source.
- D. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.

2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- E. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring and optical fiber cable.
1. Limit use of underground-line warning tape to direct-buried cables.
 2. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- F. Workspace Indication: Install floor marking tape to show working clearances in the direction of access to live parts. Workspace shall be as required by NFPA 70 and 29 CFR 1926.403 unless otherwise indicated. Do not install at flush-mounted panelboards and similar equipment in finished spaces.
- G. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Baked-enamel warning signs or Metal-backed, butyrate warning signs.
1. Comply with 29 CFR 1910.145.
 2. Identify system voltage with black letters on an orange background.
 3. Apply to exterior of door, cover, or other access.
 4. For equipment with multiple power or control sources, apply to door or cover of equipment including, but not limited to, the following:
 - a. Power transfer switches.
 - b. Controls with external control power connections.
- H. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- I. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch- (10-mm-) high letters for emergency instructions at equipment used for power transfer and load shedding.
- J. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
1. Labeling Instructions:
 - a. Indoor Equipment: Self-adhesive, engraved, laminated acrylic or melamine label or Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- (13-mm-) high letters on 1-1/2-inch- (38-

- mm-) high label; where two lines of text are required, use labels 2 inches (50 mm) high.
- b. Outdoor Equipment: Engraved, laminated acrylic or melamine label.
- c. Elevated Components: Increase sizes of labels and letters to those appropriate for viewing from the floor.
- d. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.

END OF SECTION 26 05 53

SECTION 26 09 23
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following lighting control devices:
 - 1. Time switches.
 - 2. Outdoor photoelectric switches.
 - 3. Indoor occupancy sensors.
 - 4. Lighting contactors.
- B. See Division 26 Section "Wiring Devices" for wall-box dimmers, wall-switch occupancy sensors, and manual light switches.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and maintenance data.

1.3 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.

PART 2 - PRODUCTS

2.1 TIME SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products approved by the California Energy Commission by one of the following manufacturers:
 - 1. Grasslin Controls Corporation; a GE Industrial Systems Company.
 - 2. Intermatic, Inc.
 - 3. Leviton Mfg. Company Inc.
 - 4. Lightolier Controls; a Genlyte Company.
 - 5. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 6. PCI
 - 7. Square D; Schneider Electric.
 - 8. TORK.

9. Touch-Plate, Inc.
 10. Watt Stopper.
 11. Approved equal.
- B. Electronic Time Switches: Electronic, solid-state programmable units with alphanumeric display; complying with UL 917.
1. Programs: Number of channels as scheduled on drawings; each channel shall be individually programmable with 8 on-off set points on a 24-hour schedule.
 2. Circuitry: Allow connection of a photoelectric relay as substitute for on-off function of a program.
 3. Astronomic Time: Selected channels.
 4. Battery Backup: For schedules and time clock.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products approved by the California Energy Commission by one of the following manufacturers:
1. Grasslin Controls Corporation; a GE Industrial Systems Company.
 2. Intermatic, Inc.
 3. Lithonia Lighting; Acuity Lighting Group, Inc.
 4. Square D; Schneider Electric.
 5. TORK.
 6. Touch-Plate, Inc.
 7. Watt Stopper.
 8. Approved equal.
- B. Description: Solid state, with SPST dry contacts rated for 1800-VA tungsten or 1000-VA inductive, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.
1. Light-Level Monitoring Range: 1.5 to 10 fc (16.14 to 108 lx), with an adjustment for turn-on and turn-off levels within that range, and a directional lens in front of photocell to prevent fixed light sources from causing turn-off.
 2. Time Delay: 15-second minimum, to prevent false operation.
 3. Surge Protection: Metal-oxide varistor, complying with IEEE C62.41.1, IEEE C62.41.2, and IEEE 62.45 for Category A1 locations.
 4. Mounting: ½" threaded nipple for mounting to box with adjustable knuckle to direct sensor to the north sky exposure.

2.3 INDOOR OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products approved by the California Energy Commission by one of the following manufacturers:
1. Hubbell Lighting.
 2. Leviton Mfg. Company Inc.
 3. Lithonia Lighting; Acuity Lighting Group, Inc.

4. RAB Lighting, Inc.
5. Sensor Switch, Inc.
6. TORK.
7. Watt Stopper.
8. Approved equal.

B. General Description: Ceiling-mounting, solid-state units with a separate relay unit.

1. Operation: Unless otherwise indicated, turn lights on when covered area is occupied and off when unoccupied; with a time delay for turning lights off, adjustable over a minimum range of 1 to 15 minutes.
2. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
3. Relay Unit: Dry contacts rated for 20-A ballast load at 120- and 277-V ac, for 13-A tungsten at 120-V ac, and for 1 hp at 120-V ac. Power supply to sensor shall be 24-V dc, 150-mA, Class 2 power source as defined by NFPA 70.
4. Mounting:
 - a. Sensor: Suitable for mounting in any position on a standard outlet box.
 - b. Relay: Externally mounted through a 1/2-inch (13-mm) knockout in a standard electrical enclosure.
 - c. Time-Delay and Sensitivity Adjustments: Recessed and concealed behind hinged door.
5. Indicator: LED, to show when motion is being detected during testing and normal operation of the sensor.
6. Bypass Switch: Override the on/off functions.

C. PIR Type: Detect occupancy by sensing a combination of heat and movement in area of coverage.

1. Detector Sensitivity: Detect occurrences of 6-inch- (150-mm-) minimum movement of any portion of a human body that presents a target of not less than 36 sq. in. (232 sq. cm).
2. Detection Coverage (Room): Detect occupancy anywhere in a circular area of 1000 sq. ft. (93 sq. m) when mounted on a 96-inch- (2440-mm-) high ceiling.
3. Detection Coverage (Corridor): Detect occupancy within 90 feet (27.4 m) when mounted on a 10-foot- (3-m-) high ceiling.

2.4 LIGHTING CONTACTORS

A. Basis-of-Design Product: Subject to compliance with requirements, provide the product indicated on Drawings or a comparable product by one of the following:

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP; a division of Emerson Electric Co.
3. Eaton Electrical Inc.; Cutler-Hammer Products.
4. GE Industrial Systems; Total Lighting Control.
5. Grasslin Controls Corporation; a GE Industrial Systems Company.

6. Hubbell Lighting.
 7. Lithonia Lighting; Acuity Lighting Group, Inc.
 8. MicroLite Lighting Control Systems.
 9. Square D; Schneider Electric.
 10. TORC.
 11. Touch-Plate, Inc.
 12. Watt Stopper (The).
 13. Approved equal.
- B. Description: Electrically operated and electrically held, complying with NEMA ICS 2 and UL 508.
1. Current Rating for Switching: Listing or rating consistent with type of load served, including tungsten filament, inductive, and high-inrush ballast (ballast with 15 percent or less total harmonic distortion of normal load current).
 2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
 3. Enclosure: Comply with NEMA 250.
 4. Provide with control and pilot devices matching the NEMA type specified for the enclosure.

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

- A. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.
- B. When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting sensors to suit actual occupied conditions.

3.2 CONTACTOR INSTALLATION

- A. Mount electrically held lighting contactors with elastomeric isolator pads, to eliminate structure-borne vibration, unless contactors are installed in an enclosure with factory-installed vibration isolators.

3.3 WIRING INSTALLATION

- A. Wiring Method: Comply with Division 26 Section "Low-Voltage Electrical Power Conductors and Cables." Minimum conduit size shall be 1/2 inch (13 mm).
- B. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and non-power limited conductors according to conductor manufacturer's written instructions.
- C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

- D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.4 IDENTIFICATION

- A. Identify components and power and control wiring according to Division 26 Section "Identification for Electrical Systems."
 - 1. Identify controlled circuits in lighting contactors.
- B. Label time switches and contactors with a unique designation.

3.5 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections and prepare test reports:
 - 1. After installing time switches and sensors, and after electrical circuitry has been energized, adjust and test for compliance with requirements.
 - 2. Operational Test: Verify operation of each lighting control device, and adjust time delays.
- B. Lighting control devices that fail tests and inspections are defective work.

END OF SECTION 26 09 23

SECTION 26 24 13
SWITCHBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. Service and distribution switchboards rated 600 V and less.
 2. Transient voltage suppression devices.
 3. Disconnecting and overcurrent protective devices.
 4. Instrumentation.
 5. Control power.
 6. Accessory components and features.
 7. Identification.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Switchboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each switchboard and related equipment.
1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
 2. Include time-current coordination curves for each type and rating of overcurrent protective device included in switchboards.
 3. Include schematic and wiring diagrams for power, signal, and control wiring.
- C. Seismic Qualification Certificates: Submit certification that switchboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA PB 2.
- C. Comply with NFPA 70.
- D. Comply with UL 891.

PART 2 - PRODUCTS

2.1 MANUFACTURED UNITS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Square D switchboard or comparable product by one of the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. Square D; Schneider Electric.
 - 3. Approved equal.
- B. Front-Connected, Front-Accessible Switchboards:
 - 1. Main Devices: Fixed.
 - 2. Branch Devices: Panel mounted.
 - 3. Sections front and rear aligned.
- C. Nominal System Voltage: 208Y/120 V.
- D. Main-Bus Continuous: Amperage as shown on plans.
- E. Enclosure: Steel, NEMA 250, Type 1 or Type 3R as shown on plans.
 - 1. Enclosure Finish: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
 - 2. Enclosure: Downward, rearward sloping roof; bolt-on rear covers for each section, with provisions for padlocking.
- F. Utility Metering Compartment: Fabricated, barrier compartment and section complying with utility company's requirements. If separate vertical section is required for utility metering, match and align with basic switchboard. Provide service entrance label and necessary applicable service entrance features.
- G. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.
- H. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.
- I. Phase and Neutral Buses and Connections: Three phase, four wire unless otherwise indicated.

1. Ground Bus: 1/4-by-2-inch- (6-by-50-mm-) minimum size, hard-drawn copper of 98 percent conductivity, equipped with pressure connectors for feeder and branch-circuit ground conductors.
 2. Main Phase Buses and Equipment Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
 3. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with pressure connectors for outgoing circuit neutral cables.
- J. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

2.2 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
- B. Bolted-Pressure Contact Switch: Operating mechanism uses rotary-mechanical-bolting action to produce and maintain high clamping pressure on the switch blade after it engages the stationary contacts.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Boltswitch, Inc.
 - b. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - c. Square D; a brand of Schneider Electric.
 - d. Approved equal.

2. Operating Mechanism: Manual handle operation to close switch; stores energy in mechanism for opening and closing.
 3. Auxiliary Switches: Factory installed, single pole, double throw, with leads connected to terminal block, and including one set more than quantity required for functional performance indicated.
 4. Service-Rated Switches: Labeled for use as service equipment.
 5. Open-Fuse Trip Device: Arranged to trip switch open if a phase fuse opens.
- C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
- D. Fuses are specified in Division 26 Section "Fuses."

2.3 IDENTIFICATION

- A. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Receive, inspect, handle, store and install switchboards and accessories according to NEMA PB 2.1.
- B. Equipment Mounting: Install switchboards on concrete base, 4-inch (100-mm) nominal thickness. Comply with requirements for concrete base specified in Division 03.
1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch (450-mm) centers around the full perimeter of concrete base.
 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
 3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to switchboards.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from switchboard units and components.
- D. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- E. Install filler plates in unused spaces of panel-mounted sections.
- F. Install overcurrent protective devices, transient voltage suppression devices, and instrumentation.

1. Set field-adjustable switches and circuit-breaker trip ranges to match settings recommended in the coordination study.

G. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing Preparation:
 1. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit.
 2. Test continuity of each circuit.
- B. Tests and Inspections:
 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. 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. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Switchboard will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

END OF SECTION 26 24 13

SECTION 26 24 16

PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes distribution panelboards and lighting and appliance branch-circuit panelboards.

1.2 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Panelboards shall withstand the effects of earthquake motions determined according to SEI/ASCE 7.
 - 1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details for types other than NEMA 250, Type 1.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.
 - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards.
- C. Seismic Qualification Certificates: Submit certification that panelboards, overcurrent protective devices, accessories, and components will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- D. Operation and maintenance data.

1.4 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA PB 1.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Enclosures: Flush- and surface-mounted cabinets as noted on drawings.
 - 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Wash-Down Areas: NEMA 250, Type 4X.
 - d. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 - 2. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 - 3. Directory Card: Inside panelboard door, mounted in transparent card holder.
- B. Phase, Neutral, and Ground Buses: Hard-drawn copper, 98 percent conductivity.
- C. Conductor Connectors: Suitable for use with conductor material and sizes.
 - 1. Material: Hard-drawn copper, 98 percent conductivity.
 - 2. Main and Neutral Lugs: Mechanical type.
 - 3. Ground Lugs and Bus Configured Terminators: Mechanical type.
 - 4. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 5. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- D. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- E. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, and listed and labeled for series-connected short-circuit rating by an NRTL.
- F. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.2 DISTRIBUTION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. Square D; a brand of Schneider Electric.
 - 3. Approved equal.
- B. Panelboards: NEMA PB 1, power and feeder distribution type.
- C. Branch Overcurrent Protective Devices: For Circuit-Breaker Frame Sizes 125 A and Smaller: Bolt-on circuit breakers.
- D. Branch Overcurrent Protective Devices: 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.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. Square D; a brand of Schneider Electric.
 - 3. Approved equal.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.
- E. Column-Type Panelboards: Narrow gutter extension, with cover, to overhead junction box equipped with ground and neutral terminal buses.

2.4 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Eaton Electrical Inc.; Cutler-Hammer Business Unit.
 - 2. Square D; a brand of Schneider Electric.
 - 3. Approved equal.
- B. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time time adjustments.
 4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 5. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 6. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mA trip).
 7. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Comply with UL 1699; 120/240-V, single-pole configuration.
 8. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits. Type HACR for feeding heating, air conditioning, and refrigeration equipment circuits.
 - d. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
 - e. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.
- C. Fused Switch: NEMA KS 1, Type HD; clips to accommodate specified fuses; lockable handle.
1. Fuses, and Spare-Fuse Cabinet: Comply with requirements specified in Division 26 Section "Fuses."

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Receive, inspect, handle, store and install panelboards and accessories according to NEMA PB 1.1.
- B. Comply with mounting and anchoring requirements specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

- C. Mount top of trim 90 inches (2286 mm) above finished floor unless otherwise indicated.
- D. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- E. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges to match settings recommended in the coordination study.
- F. Install filler plates in unused spaces.
- G. Stub four 1-inch (27-GRC) empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four 1-inch (27-GRC) empty conduits into raised floor space or below slab not on grade.
- H. Arrange conductors in gutters into groups and bundle and wrap with wire ties.
- I. Comply with NECA 1.

3.2 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads and incorporating Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
- B. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- C. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. 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. Panelboards will be considered defective if they do not pass tests and inspections.
- E. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action. END OF SECTION 26 24 16

SECTION 26 27 26

WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Receptacles, receptacles with integral GFCI, and associated device plates.
 - 2. Wall-box motion sensors.
 - 3. Snap switches and wall-box dimmers.
 - 4. Solid-state fan speed controls.
 - 5. Wall-switch and exterior occupancy sensors.
 - 6. Communications outlets.
- B. See Division 27 Section "Communications Horizontal Cabling" for workstation outlets.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.3 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 NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
 - 1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
 - 2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
 - 3. Leviton Mfg. Company Inc. (Leviton).
 - 4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

5. Approved equal.

2.2 STRAIGHT BLADE RECEPTACLES

- A. Convenience Receptacles, 125 V, 15 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-15R, and UL 498. Terminals suited for stranded wiring.

2.3 GFCI RECEPTACLES

- A. General Description: Straight blade, feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped. Terminals suited for stranded wiring.
- B. Duplex GFCI Convenience Receptacles, 125 V, 15 A:

2.4 SNAP SWITCHES

- A. Comply with NEMA WD 1 and UL 20. Terminals suited for stranded wiring.
- B. Switches, 120/277 V, 20 A:
- C. Pilot Light Switches, 20 A:
1. Description: Single pole, with neon-lighted handle, illuminated when switch is "ON."
- D. Key-Operated Switches, 120/277 V, 20 A:
1. Description: Single pole, with factory-supplied key in lieu of switch handle.
- E. Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors.
- F. Key-Operated, Single-Pole, Double-Throw, Momentary Contact, Center-Off Switches, 120/277 V, 20 A; for use with mechanically held lighting contactors, with factory-supplied key in lieu of switch handle.

2.5 WALL-BOX DIMMERS

- A. Dimmer Switches: Modular, full-wave, solid-state units with integral, quiet on-off switches, with audible frequency and EMI/RFI suppression filters.
- B. Control: Continuously adjustable slider; with single-pole or three-way switching. Comply with UL 1472.
- C. Fluorescent Lamp Dimmer Switches: Modular; compatible with dimming ballasts; trim potentiometer to adjust low-end dimming; dimmer-ballast combination capable of consistent dimming with low end not greater than 10 percent of full brightness.

2.6 FAN SPEED CONTROLS

- A. Modular, 120-V, full-wave, solid-state units with integral, quiet on-off switches and audible frequency and EMI/RFI filters. Comply with UL 1917.
 - 1. Continuously adjustable rotary knob, 5 A.
 - 2. Three-speed adjustable rotary knob, 1.5 A.

2.7 OCCUPANCY SENSORS

- A. Manufacturers: Subject to compliance with requirements, provide products approved by the California Energy Commission by one of the following manufacturers:
 - 1. Hubbell Lighting.
 - 2. Leviton Mfg. Company Inc.
 - 3. Lithonia Lighting; Acuity Lighting Group, Inc.
 - 4. RAB Lighting, Inc.
 - 5. Sensor Switch, Inc.
 - 6. TORK.
 - 7. Watt Stopper.
 - 8. Lutron
 - 9. Approved equal.
- B. Wall-Switch Sensors:
 - 1. Description: Adaptive-technology type, 120/277 V, adjustable time delay up to 20 minutes, 180-degree field of view, with a minimum coverage area of 900 sq. ft. (84 sq. m). Switches shall be dual level. First level shall activate lights automatically, second level shall require manual activation. Both levels shall shut off automatically.
- C. Long-Range Wall-Switch Sensors:
 - 1. Description: Dual technology, with both passive-infrared- and ultrasonic-type sensing, 120/277 V, adjustable time delay up to 30 minutes, 110-degree field of view, and a minimum coverage area of 1200 sq. ft. (111 sq. m). Switches shall be dual level. First level shall activate lights automatically, second level shall require manual activation. Both levels shall shut off automatically.
- D. Wide-Range Wall-Switch Sensors:
 - 1. Description: Passive-infrared type, 120/277 V, adjustable time delay up to 30 minutes, 150-degree field of view, with a minimum coverage area of 1200 sq. ft. (111 sq. m). Switches shall be dual level. First level shall activate lights automatically, second level shall require manual activation. Both levels shall shut off automatically.

2.8 COMMUNICATIONS OUTLETS

- A. Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper
 - b. Leviton
 - c. Panduit
 - d. Approved equal
2. Description: Single 8-pin modular jack for terminating 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1 complying with Category 5e. Comply with UL 1863.

B. Combination TV and Telephone Outlet:

1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cooper
 - b. Leviton
 - c. Panduit
 - d. Approved equal
2. Description: Single 8-pin modular jack for 100-ohm, balanced, four-pair UTP; TIA/EIA-568-B.1; complying with Category 5e; and one Type F coaxial cable connector.

2.9 WALL PLATES

A. Single and combination types to match corresponding wiring devices.

1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces: Smooth, high-impact nylon.
3. Material for Unfinished Spaces: Galvanized steel.
4. Material for Damp Locations: Cast ferroalloy with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, thermoplastic with lockable cover, weather proof while in use.

2.10 FLOOR SERVICE FITTINGS

- A. Type: Modular, flush-type, dual-service units suitable for wiring method used.
- B. Compartments: Barrier separates power from voice and data communication cabling.
- C. Power Receptacle: NEMA WD 6 configuration 5-15R, unless otherwise indicated.
- D. Voice and Data Communication Outlet: Two modular, keyed, color-coded, 8-pin modular Category 5e jacks for UTP cable.

2.11 FINISHES

1. Wiring Devices Connected to Normal Power System: As selected by Architect, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring Devices Connected to Emergency Power System: Red.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Coordination with Other Trades:
 1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
 4. Existing Conductors:
 - a. Cut back and pigtail, or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailling existing conductors is permitted provided the outlet box is large enough.
- D. Device Installation:
 1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.

5. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
6. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
7. Tighten unused terminal screws on the device.
8. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles down, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

G. Dimmers:

1. Install dimmers within terms of their listing.
2. Verify that dimmers used for fan speed control are listed for that application.
3. Install unshared neutral conductors on line and load side of dimmers according to manufacturers' device listing conditions in the written instructions.

H. Arrangement of Devices: Unless otherwise indicated, mount flush. Group adjacent switches under single, multi-gang wall plates.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacles: Identify panelboard and circuit number from which served.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. Test Instruments: Use instruments that comply with UL 1436.
2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line Voltage: Acceptable range is 105 to 132 V.
2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is not acceptable.
3. Ground Impedance: Values of up to 2 ohms are acceptable.
4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.

6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new, and retest as specified above.

END OF SECTION 26 27 26

SECTION 26 28 13

FUSES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Cartridge fuses rated 600-V ac and less for use in control circuits, enclosed switches, panelboards, switchboards, enclosed controllers, and motor-control centers.

1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA FU 1 for cartridge fuses.
- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cooper Bussmann, Inc.
 - 2. Edison Fuse, Inc.
 - 3. Ferraz Shawmut, Inc.
 - 4. Littelfuse, Inc.
 - 5. Approved equal.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.

PART 3 - EXECUTION

3.1 FUSE APPLICATIONS

- A. Service Entrance: Class L, time delay.
- B. Feeders: Class T.
- C. Motor Branch Circuits: Class RK5, time delay.
- D. Other Branch Circuits: Class RK1, time delay.
- E. Control Circuits: Class CC, fast acting.

3.2 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.3 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems" and indicating fuse replacement information on inside door of each fused switch and adjacent to each fuse block and holder.

END OF SECTION 26 28 13

SECTION 26 51 19
LED INTERIOR LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior solid-state luminaires that use LED technology.
2. Lighting fixture supports.

B. Related Requirements:

1. Section 260923 "Lighting Control Devices" for automatic control of lighting, including time switches, photoelectric relays, occupancy sensors, and multipole lighting relays and contactors.

1.2 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product, arranged by designation.
- B. Shop Drawings: For nonstandard or custom luminaires.
1. Include plans, elevations, sections, and mounting and attachment details.
 2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 3. Include diagrams for power, signal, and control wiring.

- C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale and coordinated with each other, using input from installers of the items involved.
- B. Seismic Qualification Certificates: For luminaires, accessories, and components, from manufacturer.
- C. Product Certificates: For each type of luminaire.
- D. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Luminaires shall withstand the effects of earthquake motions determined according to ASCE/SEI 7.
- B. Seismic Performance: Luminaires and lamps shall be labeled vibration and shock resistant.
 - 1. The term "withstand" means "the luminaire will remain in place without separation of any parts when subjected to the seismic forces specified and the luminaire will be fully operational during and after the seismic event."

2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- B. NRTL Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by an NRTL.
- C. FM Global Compliance: Luminaires for hazardous locations shall be listed and labeled for indicated class and division of hazard by FM Global.
- D. Recessed Fixtures: Comply with NEMA LE 4.
- E. CRI of minimum 80. CCT of 3000 K throughout.
- F. Rated lamp life of 50,000 hours.
- G. Lamps dimmable from 100 percent to 0 percent of maximum light output.
- H. Internal driver.
- I. Nominal Operating Voltage: 120 V ac.
 - 1. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.
- J. Housings:
 - 1. Cold rolled steel housing and heat sink.
 - 2. White painted finish.

2.3 DOWNLIGHT

- A. As indicated on drawings
- B. Minimum 1,000 lumens. Minimum allowable efficacy of 60 lumens per watt.
- C. Universal mounting bracket.
- D. Integral junction box with conduit fittings.

2.4 RECESSED LINEAR

- A. As indicated on drawings.
- B. Minimum 3,000 lumens unless otherwise noted. Minimum allowable efficacy of 85 lumens per watt.
- C. Integral junction box with conduit fittings.

2.5 SURFACE MOUNT, LINEAR

- A. As indicated on drawings.
- B. Minimum 3000 lumens. Minimum allowable efficacy of 80 lumens per watt.

C. Integral junction box with conduit fittings.

2.6 MATERIALS

A. Metal Parts:

1. Free of burrs and sharp corners and edges.
2. Sheet metal components shall be steel unless otherwise indicated.
3. Form and support to prevent warping and sagging

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Diffusers, and Globes:

1. Prismatic acrylic.
2. Acrylic: One hundred percent virgin acrylic plastic, with high resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.
3. Glass: Annealed crystal glass unless otherwise indicated.
4. Lens Thickness: At least 0.125-inch minimum unless otherwise indicated.
5. Inverted lens for kitchen areas for smooth wipe down cleaning.

D. Housings:

1. Cold rolled steel housing and heat sink.
2. White painted finish.

2.7 METAL FINISHES

A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.8 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch (13-mm) steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A 641/A 641 M, Class 3, soft temper, zinc-coated steel, 12 gauge (2.68 mm).

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Install lamps in each luminaire.
- D. Supports: Sized and rated for luminaire weight.
- E. Flush-Mounted Luminaire Support: Secured to outlet box.
- F. Ceiling-Mounted Luminaire Support:
 - 1. Surface ceiling mounted. Refer to detail on drawings.
- G. Ceiling-Grid-Mounted Luminaires:
 - 1. Secure to any required outlet box.
 - 2. Secure luminaire using approved fasteners in a minimum of four locations, spaced near corners of luminaire.
- H. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.2 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION

SECTION 27 15 00
COMMUNICATIONS HORIZONTAL CABLING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Pathways.
2. UTP cabling.
3. Multiuser telecommunications outlet assemblies.
4. Cable connecting hardware, patch panels, and cross-connects.
5. Telecommunications outlet/connectors.
6. Cabling identification products.
7. Cabling administration system

B. Related Sections:

1. Division 27 Section "Communications Backbone Cabling" for voice and data cabling associated with system panels and devices.

1.2 HORIZONTAL CABLING DESCRIPTION

A. Horizontal cable and its connecting hardware provide the means of transporting signals between the telecommunications outlet/connector and the horizontal cross-connect located in the communications equipment room. This cabling and its connecting hardware are called "permanent link," a term that is used in the testing protocols.

1. TIA/EIA-568-B.1 requires that a minimum of two telecommunications outlet/connectors be installed for each work area.
2. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the telecommunications outlet/connector.
3. Bridged taps and splices shall not be installed in the horizontal cabling.

1.3 PERFORMANCE REQUIREMENTS

A. General Performance: Horizontal cabling system shall comply with transmission standards in TIA/EIA-568-B.1, when tested according to test procedures of this standard.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings:

1. System Labeling Schedules: Electronic copy of labeling schedules, in software and format selected by Owner.
 2. Cabling administration drawings and printouts.
 3. Wiring diagrams to show typical wiring schematics, including the following:
 - a. Cross-connects.
 - b. Patch panels.
 - c. Patch cords.
 4. Cross-connects and patch panels. Detail mounting assemblies, and show elevations and physical relationship between the installed components.
 5. Cable tray layout, showing cable tray route to scale, with relationship between the tray and adjacent structural, electrical, and mechanical elements. Include the following:
- C. Qualification Data: For Installer, installation supervisor.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Cabling Installer must have personnel certified by BICSI on staff.
1. Layout Responsibility: Preparation of Shop Drawings, Cabling Administration Drawings, and field testing program development by an RCDD.
 2. Installation Supervision: Installation shall be under the direct supervision of Level 2 Installer, who shall be present at all times when Work of this Section is performed at Project site.
 3. Installers: Trained and certified by cabling manufacturer.
- B. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
1. Flame-Spread Index: 25 or less.
 2. Smoke-Developed Index: [50] [450] or less.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- D. Telecommunications Pathways and Spaces: Comply with TIA/EIA-569-A.
- E. Grounding: Comply with ANSI-J-STD-607-A.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Test cables upon receipt at Project site. Test each pair of UTP cable for open and short circuits.

PART 2 - PRODUCTS

2.1 PATHWAYS

- A. Cable Support: NRTL labeled for support of Category 6 cabling, designed to prevent degradation of cable performance and pinch points that could damage cable.
 - 1. Support brackets with cable tie slots for fastening cable ties to brackets.
 - 2. Lacing bars, spools, J-hooks, and D-rings.
 - 3. Straps and other devices.
- B. Cable Trays:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Cable Management Solutions, Inc.
 - b. Cablofil Inc.
 - c. Cooper B-Line, Inc.
 - d. Cope - Tyco/Allied Tube & Conduit.
 - e. GS Metals Corp.
 - f. Approved equal.
 - 2. Cable Tray Materials: Metal, suitable for indoors, and protected against corrosion.
 - a. Basket Cable Trays: Size as indicated on the Drawings. Wire mesh spacing shall not exceed 2 by 4 inches (50 by 100 mm).
 - b. Trough Cable Trays: Size as indicated on the Drawings.
 - c. Ladder Cable Trays: Size as indicated on the Drawings. and a rung spacing of 12 inches (305 mm).
 - d. Channel Cable Trays: One-piece construction, size as indicated on the Drawings.. Slot spacing shall not exceed 4-1/2 inches (115 mm) o.c.
 - e. Solid-Bottom Cable Trays: One-piece construction, Size as indicated on the Drawings..
- C. Conduit and Boxes: Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems."
 - 1. Outlet boxes shall be no smaller than 4 inches (50 mm) wide, 4 inches (75 mm) high, and 2-1/2 inches (64 mm) deep.

2.2 BACKBOARDS

- A. Backboards: Plywood, fire-retardant treated, 3/4 by 48 by 96 inches (19 by 1220 by 2440 mm). Comply with requirements in Division 06 for plywood backing panels.

2.3 UTP CABLE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Belden CDT Inc.; Electronics Division.
 2. Berk-Tek; a Nexans company.
 3. CommScope, Inc.
 4. Draka USA.
 5. Genesis Cable Products; Honeywell International, Inc.
 6. KRONE Incorporated.
 7. Mohawk; a division of Belden CDT.
 8. Nordex/CDT; a subsidiary of Cable Design Technologies.
 9. Superior Essex Inc.
 10. SYSTIMAX Solutions; a CommScope, Inc. brand.
 11. 3M.
 12. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
 13. Panduit
 14. Approved equal.
- B. Description: 100-ohm, 4-pair UTP, covered with a blue thermoplastic jacket.
1. Comply with ICEA S-90-661 for mechanical properties.
 2. Comply with TIA/EIA-568-B.1 for performance specifications.
 3. Comply with TIA/EIA-568-B.2, Category 6.
 4. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - a. Communications, General Purpose: Type CM or CMG.
 - b. Communications, Plenum Rated: Type CMP, complying with NFPA 262.
 - c. Communications, Riser Rated: Type CMR, complying with UL 1666.
 - d. Communications, Limited Purpose: Type CMX.
 - e. Multipurpose: Type MP or MPG.
 - f. Multipurpose, Plenum Rated: Type MPP, complying with NFPA 262.
 - g. Multipurpose, Riser Rated: Type MPR, complying with UL 1666.

2.4 UTP CABLE HARDWARE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. American Technology Systems Industries, Inc.
 2. Dynacom Corporation.
 3. Hubbell Premise Wiring.
 4. KRONE Incorporated.
 5. Leviton Voice & Data Division.
 6. Molex Premise Networks; a division of Molex, Inc.
 7. Nordex/CDT; a subsidiary of Cable Design Technologies.
 8. Panduit Corp.

9. Tyco Electronics/AMP Netconnect; Tyco International Ltd.
 10. Approved equal.
- B. General Requirements for Cable Connecting Hardware: Comply with TIA/EIA-568-B.2, IDC type, with modules designed for punch-down caps or tools. Cables shall be terminated with connecting hardware of same category or higher.
- C. Connecting Blocks: 110-style IDC for Category 6. Provide blocks for the number of cables terminated on the block, plus 25 percent spare. Integral with connector bodies, including plugs and jacks where indicated.
- D. **Cross-Connect: Modular array of connecting blocks arranged to terminate building cables and permit interconnection between cables.**
1. Number of Terminals per Field: One for each conductor in assigned cables.
- E. Patch Panel: Modular panels housing multiple-numbered jack units with IDC-type connectors at each jack for permanent termination of pair groups of installed cables.
1. Number of Jacks per Field: One for each four-pair UTP cable indicated plus spares and blank positions adequate to suit specified expansion criteria.
- F. Jacks and Jack Assemblies: Modular, color-coded, eight-position modular receptacle units with integral IDC-type terminals.
- G. Patch Cords: Factory-made, four-pair cables in 36-inch (900 mm) lengths; terminated with eight-position modular plug at each end.
1. Patch cords shall have bend-relief-compliant boots and color-coded icons to ensure Category 6 performance. Patch cords shall have latch guards to protect against snagging.

2.5 CONSOLIDATION POINTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. American Technology Systems Industries, Inc.
 2. Chatsworth Products, Inc.
 3. Dynacom Corporation.
 4. Hubbell Premise Wiring.
 5. Molex Premise Networks; a division of Molex, Inc.
 6. Nordex/CDT; a subsidiary of Cable Design Technologies.
 7. Ortronics, Inc.
 8. Panduit Corp.
 9. Approved equal.
- B. Description: Consolidation points shall comply with requirements for cable connecting hardware.

1. Number of Terminals per Field: One for each conductor in assigned cables.
2. Number of Connectors per Field:
 - a. One for each four-pair conductor group of indicated cables, plus 25 percent spare positions.
3. Mounting: As shown on Drawings.
4. NRTL listed as complying with UL 50 and UL 1863.
5. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.6 MULTIUSER TELECOMMUNICATIONS OUTLET ASSEMBLY (MUTOA)

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Chatsworth Products, Inc.
 2. Hubbell Premise Wiring.
 3. Molex Premise Networks; a division of Molex, Inc.
 4. Nordex/CDT; a subsidiary of Cable Design Technologies.
 5. Ortronics, Inc.
 6. Panduit Corp.
 7. Approved equal.
- B. Description: MUTOAs shall meet the requirements for cable connecting hardware.
 1. Number of Terminals per Field: One for each conductor in assigned cables.
 2. Number of Connectors per Field:
 - a. One for each four-pair conductor group of indicated cables, plus 25 percent spare positions.
 3. Mounting: As shown on Drawings.
 4. NRTL listed as complying with UL 50 and UL 1863.
 5. Label shall include maximum length of work area cords, based on TIA/EIA-568-B.1.
 6. When installed in plenums used for environmental air, NRTL listed as complying with UL 2043.

2.7 TELECOMMUNICATIONS OUTLET/CONNECTORS

- A. Jacks: 100-ohm, balanced, twisted-pair connector; four-pair, eight-position modular. Comply with TIA/EIA-568-B.1.
- B. Workstation Outlets: multi-port connector assemblies mounted in faceplate.
 1. Faceplate: Coordinate with Division 26 Section "Wiring Devices."
 2. For use with snap-in jacks accommodating any combination of UTP work area cords.
 - a. Flush mounting jacks, positioning the cord at a 45-degree angle.
 3. Legend: Snap-in, clear-label covers and machine-printed paper inserts.

2.8 GROUNDING

- A. Comply with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems" for grounding conductors and connectors.
- B. Comply with ANSI-J-STD-607-A.

2.9 IDENTIFICATION PRODUCTS

- A. Comply with TIA/EIA-606-A and UL 969 for a system of labeling materials, including label stocks, laminating adhesives, and inks used by label printers.
- B. Comply with requirements in Division 26 Section "Identification for Electrical Systems."

2.10 SOURCE QUALITY CONTROL

- A. Factory test UTP cables on reels according to TIA/EIA-568-B.1.
- B. Factory test UTP cables according to TIA/EIA-568-B.2.

PART 3 - EXECUTION

3.1 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by communications service provider.

3.2 WIRING METHODS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters and except in accessible ceiling spaces, in attics, and in gypsum board partitions where unenclosed wiring method may be used. Conceal raceway and cables except in unfinished spaces.
 - 1. Install plenum cable in environmental air spaces, including plenum ceilings.
 - 2. Comply with requirements for raceways and boxes specified in Division 26 Section "Raceway and Boxes for Electrical Systems."
- B. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.
- C. Wiring within Enclosures: Bundle, lace, and train cables to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Provide and use lacing bars and distribution spools.

3.3 INSTALLATION OF PATHWAYS

- A. Cable Trays: Comply with NEMA VE 2 and TIA/EIA-569-A-7.
- B. Comply with requirements for demarcation point, pathways, cabinets, and racks specified in Division 27 Section "Communications Equipment Room Fittings." Drawings indicate general arrangement of pathways and fittings.
- C. Comply with TIA/EIA-569-A for pull-box sizing and length of conduit and number of bends between pull points.
- D. Comply with requirements in Division 26 Section "Raceway and Boxes for Electrical Systems" for installation of conduits and wireways.
- E. Install manufactured conduit sweeps and long-radius elbows whenever possible.
- F. Pathway Installation in Communications Equipment Rooms:
 - 1. Position conduit ends adjacent to a corner on backboard where a single piece of plywood is installed, or in the corner of room where multiple sheets of plywood are installed around perimeter walls of room.
 - 2. Install cable trays to route cables if conduits cannot be located in these positions.
 - 3. Secure conduits to backboard when entering room from overhead.
 - 4. Extend conduits 3 inches (76 mm) above finished floor.
 - 5. Install metal conduits with grounding bushings and connect with grounding conductor to grounding system.
- G. Backboards: Install backboards with 96-inch (2440-mm) dimension vertical. Butt adjacent sheets tightly, and form smooth gap-free corners and joints.

3.4 INSTALLATION OF CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA/EIA-568-B.1.
 - 2. Comply with BICSI ITSIM, Ch. 6, "Cable Termination Practices."
 - 3. Install 110-style IDC termination hardware unless otherwise indicated.
 - 4. MUTOA shall not be used as a cross-connect point.
 - 5. Consolidation points may be used only for making a direct connection to telecommunications outlet/connectors:
 - a. Do not use consolidation point as a cross-connect point, as a patch connection, or for direct connection to workstation equipment.
 - b. Locate consolidation points for UTP at least 49 feet (15 m) from communications equipment room.
 - 6. Terminate conductors; no cable shall contain unterminated elements. Make terminations only at indicated outlets, terminals, cross-connects, and patch panels.

7. Cables may not be spliced. Secure and support cables at intervals not exceeding 30 inches (760 mm) and not more than 6 inches (150 mm) from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
8. Install lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
9. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIM, "Cabling Termination Practices" Chapter. Install lacing bars and distribution spools.
10. Do not install bruised, kinked, scored, deformed, or abraded cable. Do not splice cable between termination, tap, or junction points. Remove and discard cable if damaged during installation and replace it with new cable.
11. Cold-Weather Installation: Bring cable to room temperature before dispensing. Heat lamps shall not be used for heating.
12. In the communications equipment room, install a 10-foot- (3-m-) long service loop on each end of cable.
13. Pulling Cable: Comply with BICSI ITSIM, Ch. 4, "Pulling Cable." Monitor cable pull tensions.

C. UTP Cable Installation:

1. Comply with TIA/EIA-568-B.2.
2. Do not untwist UTP cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

D. Open-Cable Installation:

1. Install cabling with horizontal and vertical cable guides in telecommunications spaces with terminating hardware and interconnection equipment.
2. Suspend UTP cable not in a wireway or pathway a minimum of 8 inches (200 mm) above ceilings by cable supports not more than 60 inches (1524 mm) apart.
3. Cable shall not be run through structural members or in contact with pipes, ducts, or other potentially damaging items.

E. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Coil cable 6 feet (1800 mm) long not less than 12 inches (300 mm) in diameter below each feed point.

F. Group connecting hardware for cables into separate logical fields.

G. Separation from EMI Sources:

1. Comply with BICSI TDMM and TIA/EIA-569-A for separating unshielded copper voice and data communication cable from potential EMI sources, including electrical power lines and equipment.
2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:

- a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 24 inches (610 mm).
3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 6 inches (150 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 12 inches (300 mm).
4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2 kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5 kVA: A minimum of 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5 kVA: A minimum of 6 inches (150 mm).
5. Separation between Communications Cables and Electrical Motors and Transformers, 5 kVA or HP and Larger: A minimum of 48 inches (1200 mm).
6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).

3.5 FIRESTOPPING

- A. Comply with requirements in Division 07."
- B. Comply with TIA/EIA-569-A, Annex A, "Firestopping."
- C. Comply with BICSI TDMM, "Firestopping Systems" Article.

3.6 GROUNDING

- A. Install grounding according to BICSI TDMM, "Grounding, Bonding, and Electrical Protection" Chapter.
- B. Comply with ANSI-J-STD-607-A.
- C. Locate grounding bus bar to minimize the length of bonding conductors. Fasten to wall allowing at least 2-inch (50-mm) clearance behind the grounding bus bar. Connect grounding bus bar with a minimum No. 3/0 AWG copper grounding electrode conductor from grounding bus bar to suitable electrical building ground.

- D. Bond metallic equipment to the grounding bus bar, using not smaller than No. 6 AWG equipment grounding conductor.

3.7 IDENTIFICATION

- A. Identify system components, wiring, and cabling complying with TIA/EIA-606-A. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
 - 1. Class 1 has only one equipment room and no backbone cabling to telecommunications rooms. Class 2 includes backbone cabling from equipment room to multiple telecommunications rooms within one building. Administration Class: [1] [2].
 - 2. Color-code cross-connect fields. Apply colors to voice and data service backboards, connections, covers, and labels.
- B. Comply with requirements in Division 09 for painting backboards. For fire-resistant plywood, do not paint over manufacturer's label.
- C. Paint and label colors for equipment identification shall comply with TIA/EIA-606-A.
- D. Cable Schedule: Post in prominent location in each equipment room and wiring closet. List incoming and outgoing cables and their designations, origins, and destinations. Protect with rigid frame and clear plastic cover. Furnish an electronic copy of final comprehensive schedules for Project.
- E. Cabling Administration Drawings: Show building floor plans with cabling administration-point labeling. Identify labeling convention and show labels for telecommunications closets, backbone pathways and cables, entrance pathways and cables, terminal hardware and positions, horizontal cables, work areas and workstation terminal positions, grounding buses and pathways, and equipment grounding conductors. Follow convention of TIA/EIA-606-A. Furnish electronic record of all drawings, in software and format selected by Owner.
- F. Cable and Wire Identification:
 - 1. Label each cable within 4 inches (100 mm) of each termination and tap, where it is accessible in a cabinet or junction or outlet box, and elsewhere as indicated.
 - 2. Each wire connected to building-mounted devices is not required to be numbered at device if color of wire is consistent with associated wire connected and numbered within panel or cabinet.
 - 3. Exposed Cables and Cables in Cable Trays and Wire Troughs: Label each cable at intervals not exceeding 15 feet (4.5 m).
 - 4. Label each terminal strip and screw terminal in each cabinet, rack, or panel.
 - a. Individually number wiring conductors connected to terminal strips, and identify each cable or wiring group being extended from a panel or cabinet to a building-mounted device shall be identified with name and number of particular device as shown.
 - b. Label each unit and field within distribution racks and frames.

5. Identification within Connector Fields in Equipment Rooms and Wiring Closets: Label each connector and each discrete unit of cable-terminating and connecting hardware. Where similar jacks and plugs are used for both voice and data communication cabling, use a different color for jacks and plugs of each service.
 6. Uniquely identify and label work area cables extending from the MUTOA to the work area. These cables may not exceed the length stated on the MUTOA label.
- G. Labels shall be preprinted or computer-printed type with printing area and font color that contrasts with cable jacket color but still complies with requirements in TIA/EIA-606-A.
1. Cables use flexible vinyl or polyester that flex as cables are bent.

3.8 FIELD QUALITY CONTROL

A. Tests and Inspections:

1. Visually inspect UTP cable jacket materials for NRTL certification markings. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-B.1.
2. Visually confirm Category marking of outlets, cover plates, outlet/connectors, and patch panels.
3. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords, and labeling of all components.
4. Test UTP backbone copper cabling for DC loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination but not cross-connection.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-B.2. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
5. UTP Performance Tests:
 - a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-B.1 and TIA/EIA-568-B.2:
 - 1) Wire map.
 - 2) Length (physical vs. electrical, and length requirements).
 - 3) Insertion loss.
 - 4) Near-end crosstalk (NEXT) loss.
 - 5) Power sum near-end crosstalk (PSNEXT) loss.
 - 6) Equal-level far-end crosstalk (ELFEXT).
 - 7) Power sum equal-level far-end crosstalk (PSELFEXT).
 - 8) Return loss.
 - 9) Propagation delay.

10) Delay skew.

- B. Document data for each measurement. Data for submittals shall be printed in a summary report that is formatted similar to Table 10.1 in BICSI TDMM, or transferred from the instrument to the computer, saved as text files, and printed and submitted.
- C. Prepare test and inspection reports.

END OF SECTION 27 15 00

SECTION 28 31 11

DIGITAL, ADDRESSABLE FIRE-ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-alarm control unit.
2. Manual fire-alarm boxes.
3. System smoke detectors.
4. Heat detectors.
5. Notification appliances.
6. Remote annunciator.
7. Addressable interface device.
8. Digital alarm communicator transmitter.

1.2 SYSTEM DESCRIPTION

- A. Non-coded, addressable system, with multiplexed signal transmission, dedicated to fire-alarm service only.

1.3 PERFORMANCE REQUIREMENTS

- A. Seismic Performance: Fire-alarm control unit and raceways shall withstand the effects of earthquake motions determined according to [SEI/ASCE 7] <Insert requirement>.
1. The term "withstand" means "the unit will remain in place without separation of any parts from the device when subjected to the seismic forces specified and the unit will be fully operational after the seismic event."

1.4 SUBMITTALS

A. General Submittal Requirements:

1. Submittals shall be approved by authorities having jurisdiction prior to submitting them to Architect.
2. Shop Drawings shall be prepared by persons with the following qualifications:
 - a. Trained and certified by manufacturer in fire-alarm system design.
 - b. NICET-certified fire-alarm technician, Level III minimum.

- B. Product Data: For each type of product indicated.

- C. Shop Drawings: For fire-alarm system. Include plans, elevations, sections, details, and attachments to other work.
1. Comply with recommendations in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72.
 2. Include voltage drop calculations for notification appliance circuits.
 3. Include battery-size calculations.
 4. Include performance parameters and installation details for each detector, verifying that each detector is listed for complete range of air velocity, temperature, and humidity possible when air-handling system is operating.
 5. Include plans, sections, and elevations of heating, ventilating, and air-conditioning ducts, drawn to scale and coordinating installation of duct smoke detectors and access to them. Show critical dimensions that relate to placement and support of sampling tubes, detector housing, and remote status and alarm indicators. Locate detectors according to manufacturer's written recommendations.
 6. Include floor plans to indicate final outlet locations showing address of each addressable device. Show size and route of cable and conduits.
- D. Qualification Data: For qualified Installer.
- E. Seismic Qualification Certificates: For fire-alarm control unit, accessories, and components, from manufacturer.
- F. Field quality-control reports.
- G. Operation and Maintenance Data: For fire-alarm systems and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01:
1. Comply with the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 2. Provide "Record of Completion Documents" according to NFPA 72 article "Permanent Records" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter.
 3. Record copy of site-specific software.
 4. Provide "Maintenance, Inspection and Testing Records" according to NFPA 72 article of the same name and include the following:
 - a. Frequency of testing of installed components.
 - b. Frequency of inspection of installed components.
 - c. Requirements and recommendations related to results of maintenance.
 - d. Manufacturer's user training manuals.
 5. Manufacturer's required maintenance related to system warranty requirements.
 6. Abbreviated operating instructions for mounting at fire-alarm control unit.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: Personnel shall be trained and certified by manufacturer for installation of units required for this Project.
- B. Source Limitations for Fire-Alarm System and Components: Obtain fire-alarm system from single source from single manufacturer. Components shall be compatible with, and operate as, an extension of existing system.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

1.6 SOFTWARE SERVICE AGREEMENT

- A. Comply with UL 864.
- B. Technical Support: Beginning with Substantial Completion, provide software support for two years.
- C. Upgrade Service: Update software to latest version at Project completion. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system. Upgrade shall include new or revised licenses for use of software.
 - 1. Provide 30 days' notice to Owner to allow scheduling and access to system and to allow Owner to upgrade computer equipment if necessary.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - 1. Amseco - a Potter brand; Potter Electric Signal Company.
 - 2. Bosch Security Systems.
 - 3. Commercial Products Group/CPG Life Safety Signals.
 - 4. Faraday; Siemens Building Technologies, Inc.
 - 5. Federal Signal Corporation.
 - 6. Fire Control Instruments, Inc.; a Honeywell company.
 - 7. Fire Lite Alarms; a Honeywell company.
 - 8. Gamewell; a Honeywell company.
 - 9. GE Infrastructure; a unit of General Electric Company.
 - 10. Gentex Corporation.
 - 11. Harrington Signal, Inc.
 - 12. NOTIFIER; a Honeywell company.
 - 13. Siemens Building Technologies, Inc.; Fire Safety Division.
 - 14. Silent Knight; a Honeywell company.

15. SimplexGrinnell LP; a Tyco International company.
16. Approved equal.

2.2 SYSTEMS OPERATIONAL DESCRIPTION

- A. Fire-alarm signal initiation shall be by one or more of the following devices and systems:
1. Manual stations.
 2. Heat detectors.
 3. Smoke detectors.
 4. Duct smoke detectors.
 5. Automatic sprinkler system water flow.
 6. Fire-extinguishing system operation.
- B. Fire-alarm signal shall initiate the following actions:
1. Continuously operate alarm-notification appliances.
 2. Identify alarm at the fire-alarm control unit and remote annunciators.
 3. Transmit an alarm signal to the remote alarm receiving station.
 4. Unlock electric door locks in designated egress paths.
 5. Release fire and smoke doors held open by magnetic door holders.
 6. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.
 7. Recall elevators to primary or alternate recall floors.
 8. Record events in the system memory.
- C. Supervisory signal initiation shall be by one or more of the following devices and actions:
1. Valve supervisory switch.
 2. Low-air-pressure switch of a dry-pipe sprinkler system.
 3. Elevator shunt-trip supervision.
- D. System trouble signal initiation shall be by one or more of the following devices and actions:
1. Open circuits, shorts, and grounds in designated circuits.
 2. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.
 3. Loss of primary power at fire-alarm control unit.
 4. Ground or a single break in fire-alarm control unit internal circuits.
 5. Abnormal ac voltage at fire-alarm control unit.
 6. Break in standby battery circuitry.
 7. Failure of battery charging.
 8. Abnormal position of any switch at fire-alarm control unit or annunciator.
 9. Fire-pump power failure, including a dead-phase or phase-reversal condition.
 10. Low-air-pressure switch operation on a dry-pipe or pre-action sprinkler system.
- E. System Trouble and Supervisory Signal Actions: Initiate notification appliance and annunciate at fire-alarm control unit and remote annunciators.

2.3 FIRE-ALARM CONTROL UNIT

A. General Requirements for Fire-Alarm Control Unit:

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864 and listed and labeled by an NRTL.
 - a. System software and programs shall be held in flash electrically erasable programmable read-only memory (EEPROM), retaining the information through failure of primary and secondary power supplies.
 - b. Include a real-time clock for time annotation of events on the event recorder and printer.
2. Addressable control circuits for operation of mechanical equipment.

B. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.

1. Annunciator and Display: Liquid-crystal type, 2 lines of 40 characters, minimum.
2. Keypad: Arranged to permit entry and execution of programming, display, and control commands and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters.

C. Circuits:

1. Initiating Device, Notification Appliance, and Signaling Line Circuits: NFPA 72, Class A.
 - a. Initiating Device Circuits: Style E.
 - b. Notification Appliance Circuits: Style Z.
 - c. Signaling Line Circuits: Style 6.
 - d. Install no more than 50 addressable devices on each signaling line circuit.

D. Notification Appliance Circuit: Operation shall sound in a temporal pattern.

E. Elevator Recall:

1. Smoke detectors at the following locations shall initiate automatic elevator recall. Alarm-initiating devices, except those listed, shall not start elevator recall.
 - a. Elevator lobby detectors except the lobby detector on the designated floor.
 - b. Smoke detector in elevator machine room.
 - c. Smoke detectors in elevator hoistway.
2. Elevator lobby detectors located on the designated recall floors shall be programmed to move the cars to the alternate recall floor.
3. Water-flow alarm connected to sprinkler in an elevator shaft and elevator machine room shall shut down elevators associated with the location without time delay.

- a. Water-flow switch associated with the sprinkler in the elevator pit may have a delay to allow elevators to move to the designated floor.
- F. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke barrier walls shall be connected to fire-alarm system.
- G. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
- H. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, supervisory signals supervisory and digital alarm communicator transmitters and digital alarm radio transmitters shall be powered by 24-V dc source.
 - 1. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
- I. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.
 - 1. Batteries: Sealed lead calcium.
- J. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.

2.4 MANUAL FIRE-ALARM BOXES

- A. General Requirements for Manual Fire-Alarm Boxes: Comply with UL 38. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
 - 1. Single-action mechanism, breaking-glass or plastic-rod or pull-lever type. With integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
 - 2. Station Reset: Key- or wrench-operated switch.

2.5 SYSTEM SMOKE DETECTORS

- A. General Requirements for System Smoke Detectors:
 - 1. Comply with UL 268; operating at 24-V dc, nominal.
 - 2. Detectors shall be four or two-wire type as required.
 - 3. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

4. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
5. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
6. Integral Visual-Indicating Light: LED type indicating detector has operated[and power-on status].

B. Photoelectric Smoke Detectors:

1. Detector address shall be accessible from fire-alarm control unit and shall be able to identify the detector's location within the system and its sensitivity setting.
2. An operator at fire-alarm control unit, having the designated access level, shall be able to manually access the following for each detector:
 - a. Primary status.
 - b. Device type.
 - c. Present average value.
 - d. Present sensitivity selected.
 - e. Sensor range (normal, dirty, etc.).

2.6 HEAT DETECTORS

- A. General Requirements for Heat Detectors: Comply with UL 521.
- B. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F (57 deg C) or a rate of rise that exceeds 15 deg F (8 deg C) per minute unless otherwise indicated.
1. Mounting: Adapter plate for outlet box mounting.
 2. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.

2.7 NOTIFICATION APPLIANCES

- A. General Requirements for Notification Appliances: Connected to notification appliance signal circuits, zoned as indicated, equipped for mounting as indicated and with screw terminals for system connections.
1. Combination Devices: Factory-integrated audible and visible devices in a single-mounting assembly, equipped for mounting as indicated and with screw terminals for system connections.
- B. Chimes, High-Level Output: Vibrating type, 81-dBA minimum rated output.
- C. Horns: Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Comply with UL 464. Horns shall produce a sound-pressure level

of 90 dBA, measured 10 feet (3 m) from the horn, using the coded signal prescribed in UL 464 test protocol.

- D. Visible Notification Appliances: Xenon strobe lights comply with UL 1971, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- (25-mm-) high letters on the lens.
1. Rated Light Output:
 - a. Indicated on Drawings.
 2. Mounting: Wall mounted unless otherwise indicated.
 3. For units with guards to prevent physical damage, light output ratings shall be determined with guards in place.
 4. Flashing shall be in a temporal pattern, synchronized with other units.
 5. Strobe Leads: Factory connected to screw terminals.
 6. Mounting Faceplate: Factory finished.

2.8 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting, and testing.
1. Mounting: Flush cabinet, NEMA 250, Type 1.
- B. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.

2.9 ADDRESSABLE INTERFACE DEVICE

- A. Description: Microelectronic monitor module, NRTL listed for use in providing a system address for alarm-initiating devices for wired applications with normally open contacts.
- B. Integral Relay: Capable of providing a direct signal to elevator controller to initiate elevator recall and to circuit-breaker shunt trip for power shutdown.

2.10 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture two telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report

telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Address of the alarm-initiating device.
2. Address of the supervisory signal.
3. Address of the trouble-initiating device.
4. Loss of ac supply or loss of power.
5. Low battery.
6. Abnormal test signal.
7. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

PART 3 - EXECUTION

3.1 EQUIPMENT INSTALLATION

A. Comply with NFPA 72 for installation of fire-alarm equipment.

B. Equipment Mounting: Install fire-alarm control unit on finished floor with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.

1. Comply with requirements for seismic-restraint devices specified in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."

C. Smoke- or Heat-Detector Spacing:

1. Comply with NFPA 72, "Smoke-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for smoke-detector spacing.
2. Comply with NFPA 72, "Heat-Sensing Fire Detectors" Section in the "Initiating Devices" Chapter, for heat-detector spacing.
3. Smooth ceiling spacing shall not exceed 30 feet (9 m).
4. Spacing of detectors for irregular areas, for irregular ceiling construction, and for high ceiling areas shall be determined according to Appendix A [or Appendix B] in NFPA 72.
5. HVAC: Locate detectors not closer than 3 feet (1 m) from air-supply diffuser or return-air opening.

- 6. Lighting Fixtures: Locate detectors not closer than 12 inches (300 mm) from any part of a lighting fixture.
- D. Heat Detectors in Elevator Shafts: Coordinate temperature rating and location with sprinkler rating and location.
- E. Single-Station Smoke Detectors: Where more than one smoke alarm is installed within a dwelling or suite, they shall be connected so that the operation of any smoke alarm causes the alarm in all smoke alarms to sound.
- F. Remote Status and Alarm Indicators: Install near each smoke detector and each sprinkler water-flow switch and valve-tamper switch that is not readily visible from normal viewing position.
- G. Audible Alarm-Indicating Devices: Install not less than 6 inches (150 mm) below the ceiling. Install bells and horns on flush-mounted back boxes with the device-operating mechanism concealed behind a grille.
- H. Visible Alarm-Indicating Devices: Install adjacent to each alarm bell or alarm horn and at least 6 inches (150 mm) below the ceiling.
- I. Device Location-Indicating Lights: Locate in public space near the device they monitor.
- J. Fire-Alarm Control Unit: Surface mounted, with tops of cabinets not more than 72 inches (1830 mm) above the finished floor.
- K. Annunciator: Install with top of panel not more than 72 inches (1830 mm) above the finished floor.

3.2 CONNECTIONS

- A. For fire-protection systems related to doors in fire-rated walls and partitions and to doors in smoke partitions, comply with requirements in Division 08." Connect hardware and devices to fire-alarm system.
 - 1. Verify that hardware and devices are NRTL listed for use with fire-alarm system in this Section before making connections.
- B. Make addressable connections with a supervised interface device to the following devices and systems. Install the interface device less than 3 feet (1 m) from the device controlled. Make an addressable confirmation connection when such feedback is available at the device or system being controlled.
 - 1. Alarm-initiating connection to smoke-control system (smoke management) at firefighter smoke-control system panel.
 - 2. Alarm-initiating connection to elevator recall system and components.
 - 3. Supervisory connections at valve supervisory switches.
 - 4. Supervisory connections at low-air-pressure switch of each dry-pipe sprinkler system.
 - 5. Supervisory connections at elevator shunt trip breaker.

6. Supervisory connections at fire-pump power failure including a dead-phase or phase-reversal condition.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- B. Install framed instructions in a location visible from fire-alarm control unit.

3.4 GROUNDING

- A. Ground fire-alarm control unit and associated circuits; comply with IEEE 1100. Install a ground wire from main service ground to fire-alarm control unit.

3.5 FIELD QUALITY CONTROL

- A. Field tests shall be witnessed by authorities having jurisdiction.
- B. Tests and Inspections:
 1. Visual Inspection: Conduct visual inspection prior to testing.
 - a. Inspection shall be based on completed Record Drawings and system documentation that is required by NFPA 72 in its "Completion Documents, Preparation" Table in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter.
 - b. Comply with "Visual Inspection Frequencies" Table in the "Inspection" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72; retain the "Initial/Reacceptance" column and list only the installed components.
 2. System Testing: Comply with "Test Methods" Table in the "Testing" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
 3. Test audible appliances for the public operating mode according to manufacturer's written instructions. Perform the test using a portable sound-level meter complying with Type 2 requirements in ANSI S1.4.
 4. Test visible appliances for the public operating mode according to manufacturer's written instructions.
 5. Factory-authorized service representative shall prepare the "Fire Alarm System Record of Completion" in the "Documentation" Section of the "Fundamentals of Fire Alarm Systems" Chapter in NFPA 72 and the "Inspection and Testing Form" in the "Records" Section of the "Inspection, Testing and Maintenance" Chapter in NFPA 72.
- C. Fire-alarm system will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Provide U.L. listing for installed system.

END OF SECTION 28 31 11

SECTION 31-00-00

EARTHWORK

PART 1 - GENERAL

1.01 INCLUSION OF OTHER CONTRACT DOCUMENTS

- A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 31 23 33, Trenching and Backfilling.
- B. Section 32 16 00, Site Concrete.

1.03 REFERENCES AND STANDARDS

- A. Site Visitation: All bidders interfacing with existing conditions shall visit the site prior to bid to verify general conditions of improvements. Discrepancies must be reported prior to the bid for clarification.
- B. ANSI/ASTM D698-e1 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (56,000 ft-lbf/ft³ (2,700 kN-m/m³)).
- C. ANSI/ASTM D1556-e1 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- D. ANSI/ASTM 698-12e2 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³ (600 kN-m/m³)).
- E. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).
- F. ANSI/ASTM D 4318-10e1 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.
- G. CALTRANS Standard Specifications Section 17.
- H. CAL-OSHA, Title 8, Section 1590 (e).

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Engineered Fill Materials: All fill shall be free from debris, and concentrations of clay and organics; and contain rocks no larger than 3-inches in greatest dimension. The soil and rock should be thoroughly blended so that all rock is surrounded by soil. This may require mixing of the soil and rock with a dozer prior to placement and compaction. Clods, rocks, hard lumps or cobbles exceeding 3-inches in final size shall not be allowed in the upper 12 inches of any fill. Native

clay or clayey soils will not be permitted within the upper 24 inches of building pad areas or paved areas.

- B. Water: Furnish all required water for construction purposes, including compaction and dust control. Water shall be potable.
- C. Aggregate Base: Provide Class 2 3/4" Aggregate Base conforming to standard gradation as specified in Cal Trans Standard Specifications, Section 26,-1.02A.

PART 3 – EXECUTION

3.01 INSPECTION LAYOUT AND PREPARATION

- A. Prior to installation of the work of this Section, carefully inspect and verify by field measurements that installed work of all other trades is complete to the point where this installation may properly commence
- B. Layout all work, establish grades, locate existing underground utilities, set markers and stakes, setup and maintain barricades and protection facilities; all prior to beginning actual earthwork operations. Layout and staking shall be done by a licensed Land Surveyor or Professional Civil Engineer.
- C. Verify that specified items may be installed in accordance with the approved design.
- D. In event of discrepancy, immediately notify Owner and the Architect. Do not proceed in discrepant areas until discrepancies have been fully resolved.

3.02 PERFORMANCE

- A. GENERAL:
 - 1. General: Do all grading, excavating and cutting necessary to conform finish grade and contours as shown. All cuts shall be made to true surface of subgrade.
 - 2. Degree of Compaction: Percentage of maximum density, hereinafter specified as degree of compaction required, means density equivalent to that percentage of maximum dry density determined by ASTM D1557 Compaction Test method, and such expressed percentage thereof will be minimum acceptable compaction for specified work.
 - 3. Moisture Content: Moisture content shall be as noted below. Moisture content shall be maintained until subgrade is covered by surfacing materials.

3.03 DEMOLITION, DISPOSAL AND DISPOSITION OF UNDESIRABLE MAN-MADE FEATURES

All other obstructions, such as abandoned utility lines, light poles, concrete walks, and the like shall be removed from site. Excavations resulting from these removal activities shall be cleaned of all loose materials, dish shaped, and widened as necessary to permit access for compaction equipment. Areas exposed by any required over-excavation should be scarified to a depth of 12", moisture-conditioned to optimum moisture content, and recompacted to at least 90% of the maximum dry density.

3.04 TESTING AND OBSERVATION

- A. Field compaction tests shall be made by the Geotechnical Engineer or his representative. If moisture content and/or compaction are not satisfactory, Contractor will be required to change equipment or procedure or both, as required to obtain specified moisture or compaction. Notify Geotechnical Engineer at least 48 hours in advance of any filling operation.
- B. If the Contractor should fail to meet the compaction or design requirements embodied in this document and on the applicable plans, he shall make the necessary readjustments until all work is deemed satisfactory, as determined by the Geotechnical Engineer or Architect/Engineer.
- C. After each rain event Geotechnical Engineer shall test fill material for optimum moisture. Do not place any fill material until desired moisture is achieved.

3.05 SUBGRADE PREPARATION

- A. Grade compact and finish all subgrades within a tolerance of 0.10' of grades as indicated on Drawings and so as not to pool water. Subgrade within concrete walks shall be within 0.05' of grades indicated.

3.06 PLACING, SPREADING AND COMPACTING FILL MATERIAL IN PAVEMENT AREAS

- A. Selected fill material shall be moisture-conditioned to specified moisture content. Selected fill material shall be unfrozen. When moisture content of fill material is below that specified, add water until proper moisture content is achieved. When moisture content is above that specified, aerate by blading or other methods mentioned in 3.08 B until moisture content is satisfactory.
- B. After each layer has been placed, mixed and spread evenly, it shall be thoroughly compacted to a minimum of 90% as determined by the ASTM D1557 Compaction Test. Compact each layer over its entire area until desired density has been obtained.
- C. Re-compaction of Fill in Trenches: Where trenches must be excavated, backfill with material excavated. Place in lifts that when compacted do not exceed 6", moisture conditioned to optimum moisture content, and compact to a minimum of 90% relative compaction in building pad and paved areas, and to 90% relative compaction in landscape areas.
- D. Jetting of fill materials will not be allowed.

3.08 FINAL SUBGRADE COMPACTION

- A. Paved Areas: Upper 6" of all final subgrades supporting pavement sections and all other flatwork shall be brought to specified moisture content and shall be uniformly compacted to not less than 95% of maximum dry density, regardless of whether final subgrade elevation is attained by filling, excavation, or is left at existing grade. After acceptance of final compaction test, contractor shall maintain the required moisture content of subgrade until concrete flatwork is placed.
- B. Gravel Fill: Do not place compacted gravel fill until after underground work and foundations are in place. Compact gravel fill with vibratory plate or similar equipment to preclude settlement.

END OF SECTION

TRENCHING AND BACKFILLING

31 23 33

PART 1 – GENERAL

1.01 INCLUSION OF OTHER CONTRACT DOCUMENTS

- A. The general conditions, supplementary conditions and Division 1 are fully applicable to this section as if repeated herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 31 00 00, Earthwork.

1.03 QUALITY ASSURANCE

1.04 SUBMITTALS

- A. Submit Manufacturers data and shop drawings.

1.05 WARRANTY

- A. Submit fully executed warranty for work and materials in this section.

1.06 REFERENCES AND STANDARDS

- A. California Building Code 2022 edition.

1.07 DELIVERY, STORAGE AND HANDLING

1.08 PROJECT CONDITIONS

1.09 PROTECTION

1.10 TRENCH SAFETY PROVISIONS

1.11 SEASONAL LIMITS

1.12 TESTING

- A. General: Refer to Section 31 00 00 Earthwork.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Backfill materials: Pipeline and conduit trench backfill as shown on the plans and as specified below.
 - 1. $\frac{3}{4}$ inch crush rock.
 - 2. Native Materials: Soil native to Project Site, free of wood, organics, and other deleterious substances. Rocks shall not be greater than ___-inches.
 - 3. Sand: Fine granular material, free of organic matter, mica, loam or clay.

TRENCHING AND BACKFILLING

31 23 33

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4. Lean Mix Concrete/Controlled Density Backfill: 2 sacks cement slurry.
 5. Class 2 aggregate base, ¾" rock, per Caltrans section 26-1.02B
- B. Water: Furnish all required water for construction purposes, including compaction and dust control. Water shall be potable.

PART 3 – EXECUTION

3.01 INSPECTION

- A. Verification of Conditions:
1. Examine areas and conditions under which work is to be performed.
 2. Identify conditions detrimental to proper or timely completion of work and coordinate with General Contractor to rectify.

3.02 COORDINATION

- A. General Contractor shall coordinate work as herein specified, in accordance with drawings and as required to complete scope of work with all related trades.

3.03 INSTALLATION

- A. Perform work in accordance with pipe manufacturer's recommendations, as herein specified and in accordance with drawings.

3.04 TRENCHING

- A. Make all trenches open vertical construction with sufficient width to provide free working space at both sides of trench around installed item as required for caulking, joining, backfilling and compacting; not less than 12 inches wider than pipe or conduit diameter, unless otherwise noted.

3.05 BACKFILL

- A. Pipe Trench Backfill is divided into three zones:
- B. Bedding: Type of material and degree of compaction for bedding backfill shall be as defined in the Details and Specifications.
- C. Pipe Zone and Upper Zone Backfill:
- D. Backfill Compaction:

3.06 TRENCH AND SITE RESTORATION

- A. Finished surface of trenches shall be restored to a condition equal to, or better than the condition as existed prior to excavation work.

3.07 PROTECTION

3.08 SURPLUS MATERIAL

3.09 CLEANING

END OF SECTION

TRENCHING AND BACKFILLING

31 23 33

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SECTION 31 23 00

EXCAVATION, BACKFILLING AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.01 SUMMARY

- A. Trenching and backfilling for site utilities.
- B. Provide all necessary shoring and bracing of excavations over five feet in depth.
- D. Place pipe bedding material extending from bottom of trench to 12 inches above top of pipe. Pipe bedding material shall be self-compacting meeting the following gradations: 75% to 95% passing 3/8" sieve, 10% to 25% passing #4 sieve and 0 to 8% passing #200 sieve.
- E. Trench backfill material from 12 inches above top of pipe to subgrade. Trench backfill material shall be class 2 aggregate base in accordance with Section 26 of the Caltrans Standard Specification.
- F. Trench backfill shall be placed in lifts with a maximum uncompacted thickness of 8 inches. Each layer shall be spread evenly and thoroughly mixed to obtain a near uniform condition in each layer. Backfill shall then be brought to a uniform moisture content of about 2 to 5 percent over optimum, mixed as required to establish uniform moisture and compacted to a minimum of 90 percent of the maximum dry density as determined by ASTM D1557.
- G. Bury all utilities to the grades indicated on the plans or a minimum of twenty-four inches below finish grade.
- H. Support utility lines for entire length on undisturbed original soil or compacted backfill.
- I. Provide thrust blocks for lines under liquid pressure.

END OF SECTION

EXCAVATION, BACKFILLING AND COMPACTING FOR UTILITIES

31 23 00

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SECTION 31 25 00

EROSION CONTROL

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. General: Provide all materials, equipment and labor necessary to furnish and install straw wattles or silt fence barriers at locations shown on the Drawings and on Contractors Storm Water Pollution Prevention Plan.
- B. Permit: Prepare a Storm Water Pollution Prevention Plan (SWPPP) tailored to the Contractor's operations, methods and equipment. Comply with State Water Resources Control Board requirements. Obtain and pay for permit in Owner's name from State Water Resources Control Board.
- C. Storm Water Pollution Prevention Plan (SWPPP): The SWPPP shall be provided by the Contractor prior to the start of work. The SWPPP shall be tailored to the contractor's approach to the work in this contract. The Contractor shall as a minimum address:
 - 1. Cut and fill operations
 - 2. Temporary stockpiles
 - 3. Vehicle and equipment storage, maintenance and fueling operations
 - 4. Concrete, plaster, mortar and paint disposal
 - 5. Dust control
 - 6. Tracking of dirt, mud on off-site streets
 - 7. Pipe flushing

1.02 QUALITY ASSURANCE

- A. General: Comply with governing codes and regulations.

1.03 SUBMITTALS

- A. Storm Water Pollution Prevention Plan: The Contractor shall submit and obtain the Storm Water Pollution Prevention Permit prior to beginning work on site.
- B. Notice Of Intent (NOI): The Contractor shall submit a NOI to the State Water Resources Control Board prior to beginning work on site.

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Straw Wattles: Shall be new manufactured straw roles in compliance with state requirements for sediment control.
- B. Silt Fences: Shall be as detailed in the Drawings.
- C. Filter Bag: Shall be as required by Sacramento County Standards.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Straw Wattles: Shall be installed per the drawings and/or as required by the SWPPP.
- B. Silt Fences: Shall be installed per the Drawings and/or as required by the SWPPP. Bales shall be placed so that the top of the bale placed around an inlet is not higher than the lowest point of the surrounding grade.
- C. Filter Bags: Shall be installed as required by manufactures requirements.

3.02 MAINTENANCE AND REMOVAL:

- A. General: Maintain and repair existing and new erosion control facilities throughout the construction period. Remove silt build up at straw wattles and/or silt fences as needed. Repair damage to earth slopes and banks. Erosion control measures shall be left in place until final paving and landscaping are complete.
- B. Monitoring: Provide monitoring of erosion control measures before and after storm events. Provide a daily log of construction activities and impact on erosion control measures. Update SWPPP continuously throughout construction period.
- C. Cleaning: Keep area clean of debris.
- D. Remove erosion control measures prior to placing finish landscaping.

END OF SECTION

SECTION 32 12 00

FLEXIBLE PAVING (HOT MIX ASPHALT)

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Flexible paving, hot mix asphalt (HMA)
 - 2. Aggregate subbase course
 - 3. Pavement marking
- B. In accordance with Caltrans 2018 Standard Specifications, except as noted herein.

1.02 SUBMITTALS

PART 2 PRODUCTS

2.01 NO MATERIALS SHALL BE DELIVERED TO THE SITE THAT ARE NOT IN CONFORMANCE WITH THESE SPECIFICATIONS, OR UNLESS ACCEPTED BY THE ENGINEER IN WRITING.

- A. Caltrans Section 39, do not use Revised Standard Specification (RSS).
- B. Method process per Caltrans Section 39.
- C. Hot mix asphalt, Type A, 1/2-inch
- D. Asphalt binder, PG64-10.
- E. Provide tack coat per Caltrans Section 39.
- F. Class 2 aggregate base per Caltrans Section 26-1.02B, 3/4 inch aggregate size.
- G. Pavement markings per Caltrans Section 84, thermoplastic.

PART 3 EXECUTION

3.01 GENERAL

- A. In accordance with applicable Caltrans Sections 26 and 39.

END OF SECTION

FLEXIBLE PAVING (HOT MIX ASPHALT)

32 12 00

SECTION 32 16 00

CURBS, GUTTERS, SIDEWALKS, AND DRIVEWAYS

PART 1 GENERAL

1.1 DESCRIPTION

- A. The work shall include furnishing and placing all materials and labor and equipment to construct cast in place concrete, including concrete, reinforcement, formwork, finishing and appurtenances.
- B. Except as specified herein, all concrete work shall be performed in accordance with the applicable sections of the Caltrans 2018 Standard Specifications.

1.2 STANDARDS

- A. Caltrans Section 52 Reinforcement
- B. Caltrans Section 73 Concrete Curbs and Sidewalks
- C. Caltrans Section 90 Concrete

1.3 SUBMITTALS

- A. Delivery Certifications (Load Slips) for all concrete supplied.

PART 2 PRODUCTS

2.1 GENERAL

- A. Unless specified otherwise all products used for cast in place concrete shall conform to the Caltrans material specifications.

2.2 CONCRETE CLASSIFICATIONS

- A. Unless otherwise specified, concrete used on the project for flatwork, concrete collars for utilities, concrete thrust blocks, concrete pads, shall be considered minor concrete, and of Type II cement and mineral admixture, and shall have a minimum compressive strength of 2,500 psi.

PART 3 EXECUTION

3.1 GENERAL

- A. Unless specified otherwise, execution of work for cast in place concrete shall conform to the Caltrans Standard Specifications.

END OF SECTION

CURBS, GUTTERS, SIDEWALKS, AND DRIVEWAYS

32 16 00

SECTION 32-31-11

GATE OPERATOR

PART 2 GENERAL

1.1 SUBMITTALS

- A. Action Submittals:
 - 1. Shop Drawings: Illustrate products, installation, and relationship to adjacent construction.
 - 2. Product Data: Manufacturer's descriptive data and product attributes.
- B. Closeout Submittals:
 - 1. Operation and Maintenance Data.

1.2 QUALITY ASSURANCE

- A. Installer Qualifications: Firm specializing in work of this Section, with minimum five years experience.

1.3 WARRANTY

- A. Manufacturer's seven year warranty against material and manufacturing defects.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Contract Documents are based on products by LiftMaster. www.LiftMaster.com
- B. Substitutions: Division 01 60 00

2.2 MANUFACTURED UNITS

- A. Gate Operators:
 - 1. Model: CSW200UL

PART 3 EXECUTION

3.1 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

3.2 CLOSEOUT ACTIVITIES

END OF SECTION

SECTION 32 31 13

CHAIN LINK FENCES AND GATES

PART 1 – GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Chain link fences, gates, grade beams, accessories, and hardware
- B. Related Sections:
 - 1. Section 02 41 19 Selective Demolition
 - 2. Section 03 30 00 Cast-In-Place Concrete
 - 3. Section 09 96 00 High Performance Coatings

1.2 REFERENCES

- A. ASTM A121 Metallic-Coated Carbon Steel Barbed Wire
- B. ASTM A123 Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
- C. ASTM A153 Zinc (Hot Dip Galvanized) Coatings on Iron and Steel Products
- D. ASTM A392 Zinc Coated Steel Chain Link Fence Fabric
- E. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
- F. ASTM A1011 - Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
- G. ASTM A817 - Metallic-Coated Steel Wire for Chain-Link Fence Fabric and Marcellled Tension Wire
- H. ASTM A824 - Metallic-Coated Steel Marcellled Tension Wire for Use with Chain Link Fence
- I. ASTM F1083 - Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded for Fence Structures
- J. AISI 430 - Stainless Steel
- K. California Department of Transportation (Caltrans) Standard Specifications
- L. SSPC - The Society for Protective Coatings

CHAIN LINK FENCES AND GATES

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1.3 SUBMITTALS

- A. Submit under provisions of Sections 01 33 00 and 01 33 23.

1.4 QUALITY ASSURANCE

1.5 QUALIFICATIONS

1.6 MOCK-UPS

1.7 FIELD MEASUREMENTS

1.8 DELIVERY, STORAGE, AND HANDLING

1.9 PROJECT CONDITIONS

1.10 WARRANTY

PART 2 – PRODUCTS

2.1 MATERIALS

- A. Framework:

1. Unless specified otherwise, framework must be Type I pipe or Type II pipe at Contractor's option.
2. Type I Pipe:
 - a. ASTM F1083 standard weight (Schedule 40), plain ends
3. Type II Pipe:
 - a. ASTM A1011, or ASTM A653, Grade D; cold formed, electric welded; minimum yield strength 50,000 psi
5. Terminal Posts (End, Corner, and Angle Posts):
6. Line Posts:
7. Gate Posts: Type I Pipe; minimum 4.000-inch OD where gate leaf width is 6 feet or less and fabric height of fence and gate leaf extends 12 feet or less above finish grade; minimum 6.625-inch OD elsewhere.

CHAIN LINK FENCES AND GATES

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- 8. Rails (Intermediate and Bottom) and Braces: 2.375-inch OD.
- 9. Tension Wire: ASTM A824; Type II, Class 3.
- B. Fabric:
 - 1. Standard:
 - a. ASTM A392; Class 2 zinc coating
 - b. Two inch diamond mesh, No. 9-gauge wire
 - c. Knuckled bottom selvage; twisted and barbed top selvage except knuckled top selvage where indicated
 - 2. No Climb Fence Fabric:
 - a. Wire Diameter: 0.192-inch
 - b. Mesh Size: 3/8-inch
 - c. Weight of Metallic (Zinc) Coating: ASTM A392, Type II, Class 2, 2.0 oz/sq. foot with zinc coating
- C. Barbed Wire: ASTM A121; 12.5-gauge; 14-gauge four point round barbs, 5-inch spacing; class 3 coating.
- D. Barbed Tape:
- E. Bottom Rail Anchors: No. 3 reinforcing bars, U-shape with hooks on each end.

2.2 ACCESSORIES

- A. Fittings:
- B. Tension (Stretcher) Bars: One piece lengths equal to full height of fabric with a minimum cross section of 1/4-inch by 3/4-inch.
- C. Tension (Stretcher) Bar Bands: Steel, 3/4-inch x 1/10-inch nominal to secure tension bars to posts.
- D. Extension Arms:
- E. Post Tops:
- F. Truss Assembly: Capable of withstanding 2,000 pounds tension consisting of minimum 1/2 inch truss rod with truss tightener or turnbuckle.

- G. Boulevard Clamps: Two piece clamp, minimum 12 gauge with 5/16 inch carriage bolts and nuts.
- H. Brace Bands: One inch size minimum 12 gauge with 5/16 x 1-1/2 inch carriage bolts and nuts.
- I. Rail Ends: Weather tight closure for tubular rails and braces.
- J. Hog Rings: 18-gauge stainless steel for attachment of barbed tape; 9-gauge galvanized steel at all other locations.
- K. Tie Wire: 6-gauge galvanized steel wire, unless otherwise indicated.

2.3 GATES

- A. Gate Frames: Type I pipe members, 2.375-inches OD unless otherwise indicated.

2.4 GATE HARDWARE

- A. Hinges:
 - 1. Rated heavy duty and sized for the supported gate, with large bearing surfaces for clamping in position.
- B. Latches:
 - 1. Padlockable vertical slide bolt assembly
- C. Hold-Open-Stop
 - 1. Padlocks must be Master Padlock #6230.

2.5 GATE-HARDWARE GROUPS

2.6 FINISHES

PART 3 – EXECUTION

3.1 INSPECTION

3.2 INSTALLATION

- A. Install chain link fences and gates as indicated on the approved shop drawings and as follows.
- B. Erect fencing in straight lines between angle points.

- C. Postholes:
- D. Grade Beams: At all locations without concrete or asphalt paving on both sides.
- E. Posts:
- F. Terminal Posts:
- G. Tension Wire:
- H. Rails, Braces, and Truss Assemblies:
- I. Bottom Rail:
- J. Intermediate Rail: Install intermediate rail at mid height.
- K. Threaded Connectors and Accessories
 - 1. Peen threaded connectors and accessories after installation.
- L. Fence Fabric:
 - 1. Allow concrete to obtain sufficient strength before installing fence fabric.
 - 2. Fasten fabric to terminal and gate posts with tension bars and tension bar bands.
- M. Extension Arms and Post Caps:
 - 1. Anchor to prevent rotation and removal. Welding must not be acceptable.

3.3 ERECTION TOLERANCES

3.4 BARBED WIRE (BW) AND WIRE MESH (WM) FENCE

3.5 FENCE FABRIC DEFLECTION TEST

3.6 GRAVITY BAR TEST

3.7 MANUFACTURER'S REPRESENTATIVE

3.8 ADJUSTING

.

END OF SECTION

SECTION 32-31-19

ORNAMENTAL WROUGHT IRON FENCING AND GATES

PART 1 – GENERAL

1.01 SUMMARY

- A. The manufacturer shall supply a total fence system of *Welded and Rackable* Ornamental Steel design per plans. The system shall include all components (i.e., panels, posts, gates and hardware) required.
- B. The contractor shall provide all labor, materials and appurtenances necessary for installation of the welded ornamental steel fence system defined herein.

1.02 MATERIALS

- A. Steel material for fence panels and posts shall conform to the requirements of ASTM A653/A653M, with a minimum yield strength of 45,000 psi (310 MPa) and a minimum zinc (hot-dip galvanized) coating weight of 0.60 oz/ft² (184 g/m²), Coating Designation G-60.
- B. Material for pickets shall be 1/2" square x 18 Ga. tubing. The rails shall be steel channel, 1" square x 14 Ga. Picket holes in the rail shall be spaced to per plans. Fence posts shall be 4"x4" structural tube with cap per plans. Gate posts shall be 3" structural tube 12 ga. per plans.

1.03 INSTALLATION

- A. Fence post shall be spaced according to manufacturer instructions. For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade. Fence panels shall be attached to posts with brackets supplied by the manufacturer. Posts shall be set in concrete footers having a minimum depth of 36" The "Earthwork" and "Concrete" sections of this specification shall govern material requirements for the concrete footer. Posts setting by other methods such as plated posts or grouted core-drilled footers are permissible only if shown by engineering analysis to be sufficient in strength for the intended application.

END OF SECTION

SECTION 32 80 00

IRRIGATION

PART 1 – GENERAL

Construction Documents and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification sections, apply to this section.

1.01 DESCRIPTION

- A. Scope of Work: Furnish all labor, materials, tools, equipment, and transportation required to perform and complete the installation of an automatic sprinkler irrigation system, including all piping, sprinkler heads, controls, connections, testing, etc. as shown on the Drawings and as specified herein. The water source for this project is potable water.
- B. Utilize and accept as standards manufacturer's recommendations and/or installation details for any information not specifically detailed on the Drawings.

1.02 RELATED SECTIONS

- A. SUBMITTAL PROCEDURES: Section 01 33 00.
- B. EXECUTION AND CLOSEOUT REQUIREMENTS: Section 01 70 00.
- C. EARTH MOVING: Section 31 20 00.
- D. LANDSCAPING: Section 32 90 00.

1.03 GUARANTEE

- A. Guarantee all workmanship and materials hereunder against defective workmanship and materials, including damage by leaks and settlement of irrigation trenches, for the duration specified in Division 01 of these Specifications. (The Contractor is not responsible for vandalism or theft after date of final acceptance.)

1.04 QUALITY CONTROL

- A. Qualifications of Contractor: Provide proof of five years continuous experience in landscaping and irrigation of projects of similar size.
- B. Work Force: Ensure that an experienced foreman is present at all times during installation. Keep the same foreman and workers on the job from commencement to completion.

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- C. Reviews: Specifically request reviews of all items listed below in "Inspection Requirements" prior to progressing to the next level of work.
- D. Certification: Ensure that the contractor installing the Central Control System is trained and certified in the installation of the Central Control System. The training and certification must have been completed within two years prior to the installation date.
- E. Standards:
 - 1. Provide work and material in full accordance with the rules and regulations of the National Electric Code; the Uniform Plumbing Code; and other applicable state or local laws or regulations.
 - 2. Furnish, without extra charge, additional material and labor required to comply with these rules and regulations, though the work may not be specifically indicated in the Specifications or Drawings.
 - 3. Where the Specification requirements exceed those of the above-mentioned codes and regulations, comply with the requirements in the Specifications.
- F. Delivery, Storage, and Handling:
 - 1. Use all means necessary to protect irrigation system materials before, during, and after installation and to protect related work and material.
 - 2. Handle plastic pipe carefully, especially protecting it from prolonged exposure to sunlight. Store pipe on beds that are the full length of the pipe, and keep pipe flat and off the ground with blocks.
- G. Comply with the requirements of Section 01 70 00 – EXECUTION AND CLOSEOUT REQUIREMENTS.

1.05 INSPECTION REQUIREMENTS

- A. Request and hold a pre-construction meeting prior to beginning the work of this Section. Parties required to be in attendance are the Landscape Contractor, Project Inspector, Owner's Representative, and the Landscape Architect.
- B. Prior to commencement of the work of this Section, obtain written verification from the project Civil Engineer that the rough grade in landscape areas is in conformance with Section 31 20 00 - EARTH MOVING.
- C. Obtain verification from Project Inspector for the following at the appropriate times during construction and prior to further progression of work in this Section:
 - 1. Pressure testing of all mainlines and lateral lines (See "Hydrostatic Tests – Open Trench" in Part 3.15 of this Section),

2. Trench depth,
 3. Sleeves under pavement,
 4. Flushing of all mainlines and lateral lines,
 5. Backfill and pipe bedding,
 6. Operation of system and coverage adjustments (with Landscape Architect) after system is fully automated and operational, backfill of trenching is completed, and surface has been restored to original grades.
- D. In case of failure to obtain any verification by the Project Inspector as required above, remove and replace work as necessary to obtain the verification at no additional cost to the Owner.

1.06 SUBMITTALS AND SUBSTITUTIONS

- A. Comply with requirements of Section 01 33 00 – SUBMITTAL PROCEDURES.
- B. Product names are used as standards; provide proof as to equality of any proposed material and do not use other materials or methods unless approved in writing by the Owner's Representative. Submit no more than one request for substitution for each item. The decision of the Owner's Representative is final.
- C. Use equipment capacities specified herein as the minimum acceptable standards.
- D. List materials in the order in which they appear in Specifications; include substitutions. Submit the list for approval by the Owner's Representative.
- E. Make any mechanical, electrical, or other changes required for installation of any approved, substituted equipment to satisfaction of Owner's Representative and without additional cost to Owner. Approval by Owner's Representative of substituted equipment and/or dimensional drawing does not waive these requirements.
- F. Do not construe approval of material as authorization for any deviations from Specifications unless attention of Owner's Representative has been directed to specified deviations.

1.07 PROJECT CONDITIONS, AND PROTECTION

- A. Information on Drawings relative to existing conditions is approximate. During progress of construction, make deviations necessary to conform to actual conditions, as approved by Owner's Representative, without additional cost to Owner. Accept responsibility for any damage caused to existing services. Promptly notify Owner's Representative if services are found which are not shown on Drawings.

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- B. Protect existing trees-to-remain as specified in "Existing Tree Protection" in Part 3.02 of this Section.
- C. Protect existing utilities within construction area. Repair damages to utility lines that occur as a result of operations of this work.
- D. Verify dimensions at building site and check existing conditions before beginning work. Make changes necessary to install work in harmony with other crafts after receiving approval by Owner's Representative.

1.08 MAINTENANCE AND OPERATING INSTRUCTIONS

- A. Furnish three complete sets of operating maintenance instructions bound in a hardback binder and indexed. Start compiling data upon approval of list of materials. Do not request final inspection until booklets are approved by Owner's Representative.
- B. Incorporate the following information in these sets:
 - 1. Complete operating instructions for each item of irrigation equipment.
 - 2. Typewritten maintenance instructions for each item of irrigation equipment.
 - 3. Manufacturer's bulletins which explain installation, service, replacement parts, and maintenance.
 - 4. Service telephone numbers and/or addresses posted in an appropriate place as designated by Owner's Representative.

1.09 RECORD DRAWINGS

Upon completion of work, and as a precedent to final payment, deliver to Owner's Representative one complete set of reproducible originals of Drawings showing work exactly as installed. (See "Record Drawings" in Part 3.18 of this Section)

PART 2 – PRODUCTS

2.01 GENERAL

Use materials as specified; any deviation from the Specifications must first be approved by the Owner's Representative in writing. All material containers or certificates shall be clearly marked by manufacturer as to contents for inspection.

2.02 MATERIALS

- A. Automatic Control Valves: As indicated on Drawings.
- B. Gate Valve: As indicated on Drawings.

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C. Pipe and Fittings:

1. PVC pipe: As indicated on Drawings.
2. PVC fittings three-inch (3") size and smaller: High impact, standard weight, Schedule 40, molded PVC as manufactured by George Fischer, Lasco, Spears, or approved equal.
3. All plastic pipe and fittings: Continuously and permanently marked with manufacturer's name, type of material, IPS size, schedule, NSF approval, and code number.
4. Threaded PVC pipe and nipples: IPS Schedule 80 when necessary to use threaded connections to gauges, valves, or control valves. Threaded adapters may be used in place of nipples when making pipe to valve connections.
5. Use 45-degree fittings for changes in depth of pipe, and at transition from main line to automatic control valves.
6. Piping above ground: Schedule 40 galvanized steel with cast-iron fittings.
7. Piping used for electrical purposes to be Schedule 40 PVC Rigid Nonmetallic Conduit electrical conduit.

D. PVC Primer: Weld-On P-70 Purple Primer or approved equal.

E. PVC Glue: Weld-On 711 Gray heavy bodied PVC Cement or approved equal.

F. Sleeves: As indicated on Drawings.

G. All Valve Boxes and Covers: Manufactured, green with "Irrigation – Non-Potable" permanently embossed on cover. Carson, Rainbird or approved equal.

H. Automatic Sprinkler Control Wire:

1. Connections between remote control valves and controller: UF-14 direct burial plastic coated wire. Common wire to be white, and lead wire to be colored. If multiple controllers are used, a different color is to be used for each controller's lead wire. (Use red for the first controller). Spare wires are to be yellow.
2. UL Listed waterproof sealing pack for wire connections: 3M DBR/Y-6, or approved equal.
3. Provide adequate working space around electrical equipment in compliance with local codes and ordinances.
4. Electrical, other than low voltage, such as power wiring, conduit, fuses,

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thermal overloads and disconnect switches, is included under Division 26 of these Specifications.

- I. Unions And Flanges:
 - 1. Steel unions and flanges two inches (2") and smaller: 150 lb. screwed black (brass to iron seat) or galvanized malleable iron (ground joint).
 - 2. Steel unions and flanges two and one-half inches (2 ½") and larger: 150 lb. black flange union, flat-faced, full gasket.
 - 3. Gaskets: One-sixteenth inch (1/16") thick rubber Garlock No. 122, Johns-Manville or approved equal.
 - 4. Flange Bolts: Open-hearth bolt steel, square heads with cold pressed hexagonal nuts, cadmium plated in ground. Provide copper-plated steel bolts and nuts or brass bolts and nuts for brass flanges.
- J. Valve Identification Tags: Christy's irrigation ID tags, standard yellow color or approved equal.
- K. Sand for Trench Backfill: Natural sand, free of roots, bark, sticks, rags, or other extraneous material.

PART 3 – EXECUTION

3.01 SITE CONDITIONS

Locations of existing utilities and other improvements shown on the Drawings are approximate. Verify existing conditions and, should any utilities be encountered that are not indicated on the plans, notify the Owner's Representative immediately. Accept responsibility for any damages caused to existing services.

3.02 PREPARATION

- A. Scheduling: Notify the Project Inspector prior to commencing and/or continuing the work of this Section. Remove and replace, at no cost to Owner, any work required as a result of failure to give the appropriate notification.
- B. Examination: Examine conditions of work in place before beginning work; report defects.
- C. Measurements: Take field measurements; report variance between plan and field dimensions.
- D. Protection: Maintain warning signs, shoring and barricades as required. Prevent injury to, or defacement of, existing improvements. At no additional cost to Owner,

repair or replace items damaged by installation operations.

E. Existing Tree Protection:

1. Avoid unnecessary root disturbance, compaction of soils within drip line, or limb breakage.
2. Do not store material or dispose of any material other than clean water within the drip line.
3. Provide adequate irrigation during construction.
4. Replace any tree damaged during construction with a tree of equal size and value at no additional cost to Owner.
5. Adjust trench locations in field to minimize damage to existing elements and plant roots of trees-to-remain at no additional cost to Owner.

F. Surface Preparation: Prior to beginning sprinkler irrigation work, complete placement of topsoil as specified in Section 31 20 00 – EARTH MOVING. Notify Project Inspector of irregularities if any.

3.03 GRADING

Install all irrigation features to their finished grade and at depths indicated. Complete and /or accommodate all rough grading and/or finish grading before commencing with trenching.

3.04 LAYOUT

- A. Lay out work as accurately as possible to Drawings. Drawings are generally diagrammatic to extent that swing joint offsets and fittings are not shown. Record all changes on the Record Drawings.
- B. Do not willfully install the irrigation system as shown on Drawings when it is obvious, in the field, that obstructions or other discrepancies exist which may not have been considered in the design. Notify Owner's Representative of discrepancies before proceeding.

3.05 EXCAVATING AND TRENCHING

- A. General: Perform excavations as required for installation of work included under this Section, including shoring of earth banks to prevent cave-ins. Restore surfaces, existing underground installations, etc., damaged or cut as result of this work to their original condition and in a manner approved by the Landscape

Architect.

B. Width:

1. Make trenches wide enough to allow a minimum of six inches (6") between parallel pipelines and three inches (3") between side of pipe and side of trench. Do not allow stacking of pipe within trench.
2. Allow a minimum clearance of twelve inches (12") in any direction from parallel pipes of other trades.

C. Preparation of Excavations: Remove rubbish and rocks from trenches. Bed pipe on a minimum of three inches (3") of clean, rock-free soil to provide a firm, uniform bearing for entire length of pipeline. Cover pipe with a minimum of three inches (3") of clean, rock-free soil. If clean, rock-free soil is not available, use sand for pipe bedding and three inches (3") of backfill above the pipe. The remainder of the trench backfill material can be native soil. Do not allow wedging or blocking of pipe.

D. Minimum depth of cover: Unless shown otherwise, provide the following minimums:

1. Mainline: twenty-four inches (24") cover.
2. Lateral line: twelve inches (12") cover.

E. Conflicts with other trades:

1. Hand-excavate trenches where potential conflict with other underground utilities exist.
2. Where other utilities interfere with irrigation trenching and piping work, adjust the trench depth as instructed by Owner's Representative.

3.06 BACKFILL AND COMPACTING

A. General: Do not begin until hydrostatic tests are completed. When system is operating and after required tests and inspections have been made, backfill trenches under paving areas to the compaction rate specified in Section 31 20 00 – EARTH MOVING.

B. Place backfill in six-inch (6") layers and compact with an acceptable mechanical compactor.

1. Compact backfill material in landscape areas to eighty-five percent (85%) maximum dry density of the soil.

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2. If settlement occurs along trenches, make adjustments in pipes, valves, and sprinkler heads, soil, sod or paving as necessary to bring the system, soil, sod or paving to the proper level or the permanent grade, without additional cost to the Owner.
- C. Excess Soil: Remove all rocks, debris, and excess soil that results from sprinkler irrigation trenching operations, landscape planting, and soil preparation operations off site at no additional cost to the Owner. If soil meets topsoil requirements in Section 31 20 00 – EARTH MOVING, it may be used for finish grading.
- D. Finishing: Dress-off areas to eliminate construction scars.

3.07 CONTROL WIRE

- A. General: Install control wires beneath sprinkler main line whenever possible; tape wires to mainline pipe. Provide one spare wire for each controller.
- B. Slack Wire: Provide eighteen inches (18") of slack wire for each wire connected to automatic control valve. Slack wire shall be coiled and left in the valve box. Tape wires in bundles every ten feet (10'); do not tape wire in sleeves.
- C. Expansion and Contraction: Snake wire in trench to allow for contraction of wire.
- D. Wire Passing Under Existing or Future Paving or Construction: Encase in PVC Schedule 40 or galvanized steel conduit extending at least twelve inches (12") beyond edges of paving or construction.
- E. Wire Connections: Install wire connections in a waterproof sealing pack.
- F. Wire Splicing: Permit splicing only on runs exceeding 500 feet. Locate all splices within valve boxes.
- G. Wire Termination: Install wire in a valve box with eighteen inches (18") of slack wire coiled and individually capped with approved waterproof sealing pack.

3.08 FLUSHING LINES

Thoroughly flush lines prior to installing valves, performing hydrostatic testing, or installing sprinklers. Divert water to prevent washouts.

3.09 AUTOMATIC CONTROL VALVES

- A. Install where shown and where practical; place no closer than twelve inches (12") to walk edges, building walls, or fences. Refer to detail for example.
- B. Thoroughly flush mainline before installing valve.
- C. Install valves in ground cover areas where possible.

3.10 PIPING

- A. General: Install in conformance with reference standards, manufacturer's written directions, as shown on Drawings and as herein specified.
- B. Workmanship:
 - 1. General: Install sprinkler irrigation equipment in planted areas throughout the site.
 - 2. Coordination: Organize location of sleeves with other trades as required.
- C. Pipe Line Assembly:
 - 1. General:
 - a. Cutting: Cut pipe square; remove rough edges or burrs.
 - b. Solvent-welded Connections: Use materials and methods recommended by the pipe manufacturer.
 - c. Brushes: Use non-synthetic brushes to apply solvents and primer.
 - d. Cleaning: Clean pipe and fittings of dirt, moisture, and debris prior to applying solvent or primer.
 - e. Assembly: Allow pipe to be assembled and welded on the surface or in the trench.
 - f. Expansion and Contraction: Snake pipe from side to side of trench to allow for expansion and contraction.
 - g. Location: Locate pipes as shown on Drawings except where existing supply valves, utilities or obstructions prohibit or where slight changes are approved to better suit field conditions.
 - 2. Connections:
 - a. Threaded Plastic Pipe Connection:
 - 1.) Use Teflon tape or pipe joint compound.
 - 2.) When assembling to threaded pipe, take up joint no more than one full turn beyond hand-tight.
 - b. Metal Valves and Plastic Pipe: Use threaded plastic male adapters.
 - c. Metal to Metal Connections:

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- 1.) Use specific joint compound or gasket material for type of joint made. Where pipe of dissimilar metals are connected, use dielectric fittings.
- 2.) Where assembling, do not allow more than three full threads to show when joint is made up.
- d. Where assembling soft metal (brass or copper) or plastic pipe, use strap-type friction wrench only; do not use a metal-jawed wrench.
- e. Threading:
 - 1.) Do not permit the use of field-threading of plastic pipe or fittings. Use only factory-formed threads.
 - 2.) Use factory-made nipples wherever possible. Permit the use of field-cut threads in metallic pipe only where absolutely necessary. When field-threading, cut threads accurately on axis with sharp dies.
 - 3.) Use pipe joint compound for all threaded joints. Apply compound to male thread only.
3. Sleeves and conduits:
 - a. Use sleeves of adequate size to accommodate retrieval for repair of wiring or piping and extend a minimum of twelve inches (12") beyond edges of walls or paving.
 - b. Provide removable, non-decaying plug at end of sleeve to prevent entrance of soil.
4. Unions: Locate unions for easy removal of equipment or valve.
5. Capping: Plug or seal opening as lines are installed to prevent entrance materials that would obstruct pipe. Leave in place until removal is necessary for completion of installation.

3.11 FIELD QUALITY CONTROL

- A. Visual Inspection: Verify that all pipe is homogenous throughout and free from visual cracks, holes, or foreign materials. Inspect each length of pipe. All materials are subject to impact test at the discretion of the Landscape Architect.
- B. Hydrostatic Tests – Open Trench:

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1. Center-load piping with a small amount of backfill to prevent arching or slipping under pressure.
 2. Request the presence of the Project Inspector in writing at least forty-eight hours in advance of testing.
 3. At no additional cost to Owner, test in the presence of the Project Inspector.
 4. Apply continuous static water pressure of 100 psi when welded plastic joints have cured at least twenty-four hours, and with the risers capped, as follows: test main lines and submains for four hours; test lateral lines for two hours.
 5. Repair leaks resulting from tests; and repeat tests.
 6. Test to determine that all sprinkler heads function according to manufacturer's data and give full coverage according to intent of Drawings. Replace any sprinklers not functioning as specified with ones that do, or otherwise correct system to provide satisfactory performance.
- C. Continuity Testing: Test locating device and control wires for continuity prior to and after back-filling operations.

3.12 CLEAN-UP

Remove debris resulting from work of this Section.

3.13 ADJUSTMENTS AND MAINTENANCE

- A. Adjusting System: Prior to acceptance, satisfactorily adjust and regulate entire system. Set watering schedule on controller appropriate to types of plants and season of year. Adjust remote control valves to operate sprinkler heads at optimum performance based on pressure and simultaneous demands through supply lines.
- B. System Layout: Provide reduced prints of Record Document irrigation plans, laminated in four (4) mil. plastic, of size to fit controller door. Enlarge remote-control valve designations as necessary for legibility. Color-code areas covered by each station. Affix plans to inside of controller door.
- C. Instructions: Upon completion of work, instruct maintenance personnel on operation and maintenance procedures for entire system.
- D. Flow Charts: Record and prepare an accurate flow-rate chart for each automatic control valve.

3.14 RECORD DRAWINGS

- A. Regularly update plans of the system and any changes made to the system throughout the project. Record all changes on this plan before trenches are back-filled.
- B. Record the as-built information on reproducible plans provided by the Architect. Complete and submit the Record Drawings to the Architect before applying for payment for work installed.
- C. Show the following on the Record Drawings accurately to scale and dimensioned from two permanent points of reference:
 - 1. Distance of mainline from nearby hardscape.
 - 2. Location of automatic control valves, quick couplers, and gate valves.
 - 3. Location and size of all sleeves.
 - 4. Location of automatic control wires and spares.

3.15 OPERATION MANUALS

Deliver two complete sets of manufacturer's warranties, Contractor guarantees, instruction sheets, parts lists and operation manuals to the Architect before requesting final acceptance of the project. Do not request final inspection until the sets are approved.

END OF SECTION

SECTION 32 90 00

LANDSCAPING

PART 1 – GENERAL

Construction Documents and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications sections, apply to this section.

1.01 DESCRIPTION

- A. Scope of Work: Furnish all labor, materials, tools, equipment, and transportation required to perform and complete the following work as specified herein:
 - 1. Soil Preparation and Fertilization
 - 2. Planting
 - 3. Weed Control
 - 4. Mulch
 - 5. Clean-up
 - 6. Landscape Maintenance Period
 - 7. Guarantee
- B. Work not included in this Section: Landscape elements such as concrete walks, fencing, outdoor lighting, rough grading, and clearing are not a part of this Section unless shown on the landscape Drawings.

1.02 RELATED SECTIONS

- A. SUBMITTAL REQUIREMENTS: Section 01 33 00.
- B. EXECUTION AND CLOSEOUT REQUIREMENTS: Section 01 70 00.
- C. EARTH MOVING: Section 31 20 00.
- D. IRRIGATION: Section 32 80 00.

1.03 GUARANTEE

1.04 QUALITY CONTROL

1.05 INSPECTION REQUIREMENTS

1.06 SUBMITTALS AND SUBSTITUTIONS

1.07 PROTECTION AND CLEAN-UP

1.08 PLANTING SCHEDULE / ENVIRONMENTAL REQUIREMENTS

1.09 LANDSCAPE MAINTENANCE PERIOD REQUIREMENTS

- A. Beginning of Landscape Maintenance Period:
 - 1. General: Landscape Maintenance Period does not begin until all work is installed, as determined by Landscape Architect, in writing.
- B. Duration of Landscape Maintenance Period:

The Landscape Maintenance Period shall continue for a minimum of ninety (90) calendar days. During this time, continuously maintain all areas involved until final acceptance of the work by the Owner's Representative. See Landscape Maintenance Period procedure in Part 3.09 of this Section.
- C. Final Acceptance of the Landscape Maintenance Period:

Request the final inspection forty-eight (48) hours in advance. If items require attention, hold on-site meetings until Landscape Architect can certify, in writing, and in concurrence with the Owner's Representative, the successful completion of the Landscape Maintenance Period.

1.10 RECORD DRAWINGS

PART 2

PART 3 – PRODUCTS

3.01 GENERAL

Use material in new and perfect condition as specified. Any deviations or substitutions from the Specification and Drawings must first be approved by Owner's Representative in writing prior to use.

3.02 SOIL PREPARATION MATERIALS

- A. Topsoil: Fertile; friable; natural loam surface soil; reasonably free of subsoil, clay lumps, brush, weeds and other litter; and free of roots, stumps, stones/rocks, and other extraneous or toxic matter harmful to plant growth.
- B. Soil Amendment: One-percent nitrogen-impregnated bark product with a ninety-percent (90%) bark base and zero to one-quarter inch (0-1/4") particle size, or approved equivalent. Do not spread until testing requirements have been satisfied.
- C. Fertilizer/Soil Conditioner: Gro-Power Plus or approved equal.

D. Fertilizer for Trees and Shrubs: Seven-gram Gro-Power Planting Tablets (12-8-8 NPK) or approved equal.

E. Vitamin B-1: "Superthrive", "Liquinox Start", "Cal-Liquid", or approved equal.

3.03 MISCELLANEOUS LANDSCAPE MATERIALS

3.04 PLANT MATERIAL:

A. Nursery Plant Stock:

1. As indicated on Drawings. Do not remove container-grown stock from containers until planting time. Plants shall be true to name.

PART 4 – EXECUTION

4.01 SITE CONDITIONS

4.02 SOIL TESTING

4.03 PREPARATION

A. Finish Grading for all Planting areas

B. Planting Pits for Trees:

C. Planting Pits for Shrubs/Groundcover:

4.04 PLANTING

A. Trees, Shrubs, and Groundcover:

- a. antiseptic, adhesive, elastic and free of kerosene, coal tar, creosote, and other substances harmful to plants. Do not use shellac.

- b. Stake or guy trees immediately after planting, as indicated on Drawings.

2. Grooming of Shrubs:

- a. Prune, thin-out and shape shrubs in accordance with standard horticultural practice. Prune shrubs to retain natural character and to accomplish their use in landscape design. The required plant size is its size after pruning.

- b. Remove and replace excessively pruned or malformed new plants resulting from improper pruning.

- B. Request review by the Landscape Architect after locating, but prior to planting all trees. Under the direction of the Landscape Architect, make slight adjustments to plant material location as necessary to reflect original intention of Drawings.

4.05 WEED CONTROL

4.06 BARK MULCH

4.07 CLEAN-UP

4.08 LANDSCAPE MAINTENANCE

- A. The Landscape Maintenance Period will begin when all the Landscape Maintenance Period Requirements have been met (See Part 1 of these Specifications).
- B. Cleaning: Maintain cleanliness on paving areas and other public areas used by equipment and immediately remove all spillage. Remove from project site all rubbish and debris found thereon and all material and debris resulting from landscaping work, leaving the site in a safe and clean condition.
- C. Maintenance:
 - 1. Sprinkler Irrigation System:
 - 2. Trees and Shrubs:
 - 3. Insecticide and Herbicide Application:
 - 4. Pre-scheduled On-site Meetings: Hold regularly-scheduled (monthly or bimonthly as determined by the Landscape Architect) on-site meetings with the Landscape Architect, Project Inspector and Owner's Representative. Dates and times will be jointly agreed upon.
 - 5. Request, forty-eight hours (48 hrs.) in advance, on-site visits by the Landscape Architect to determine the end of the Landscape Maintenance Period.

END OF SECTION

SECTION 33 00 00

SITE UTILITIES

PART 1 – GENERAL

1.01 INCLUSION OF OTHER CONTRACT DOCUMENTS

- A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

1.02 SCOPE OF WORK

- A. The work includes, but is not necessarily limited to, the following:
 - 1. Domestic water piping system.
 - 2. Fire protection piping systems.
 - 3. Sewer piping system.
- B. Other items that may be specified or shown on the Drawings.

1.03 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01 50 00, Construction Facilities and Temporary Controls.
- B. Section 31 23 33, Trenching and Backfilling.
- C. Section 32 16 00, Site Concrete.
- D. Section 33 00 00, Earthwork.

1.04 QUALITY ASSURANCE

1.05 SUBMITTALS

- A. Refer to Section 01 33 00.

1.06 FEES, PERMITS, AND UTILITY SERVICES

1.07 WARRANTY

- A. Refer to General Conditions and Section 01 78 36.

1.08 REFERENCES AND STANDARDS

1.09 DELIVERY, STORAGE AND HANDLING

1.10 PROJECT CONDITIONS

1.11 EXISTING SITE CONDITIONS

1.12 PROTECTION

1.13 SEASONAL LIMITS

1.14 RECORD DRAWINGS

PART 2 – PRODUCTS

2.01 MATERIALS – GENERAL

2.02 VALVE BOXES

2.03 PIPES AND FITTINGS

- A. Sanitary Sewer: PVC sewer pipe and fittings with Ring-Tite joints, ASTM D3034 SDR35.
- B. Domestic water Lines 3 1/2" and smaller: Type K copper tubing, hard temper, with wrought copper fittings. Schedule 80 PVC.
- C. Water lines 4" and larger: AWWA C-900 Class 150/DR18 with rubber gasket joints.
- D. Fire lines 4" and larger: AWWA C-900 Class 200/DR14 with rubber gasket joints.
- E. Solder: Lead Free. 95/5; 95% Tin / 5% Antimony.
- F. Ductile Iron Pipe; Class 350, Cement Lined
- G. Ductile Iron Pipe Fittings; AWWA C110, C153, Ebba Iron, Star Romac, Sigma, or approved equal.

2.04 SANITARY SEWER MANHOLES

- A. Shall be constructed as shown on plan details.

2.05 CLEANOUTS

- A. Cleanouts of same diameter as pipe up to 8" in size shall be installed in all horizontal soil and waste lines where indicated and at all points of change in direction. Cleanouts shall be located not less than 18" from building so as to provide sufficient space for rodding. No horizontal run over 100 feet shall be without cleanout whether shown on drawings or not.

2.06 UNIONS

- A. Furnish and install one union at each threaded or soldered connection to equipment and 2 unions, one on each side of valves on pipes ½" to 3".
- B. Locate unions so that piping can be easily disconnected for removal of equipment or valve. Provide type specified in following schedule:

2.07 VALVES

2.07 FIRE HYDRANTS

2.08 TAPPING SLEEVE

2.09 SERVICE SADDLES

2.10 TRACER WIRE

- A. No. 10 THW solid copper wire. Solder all joints

PART 3 - EXECUTION

3.01 DRAWINGS AND COORDINATION

3.02 ACCESS

3.03 EXCAVATING AND BACKFILLING

- A. Excavation and Bedding:
- B. Laying of Pipe:
- C. Backfilling:

3.04 INSTALLATION OF WATER PIPING

3.05 CLOSING IN OF UNINSPECTED WORK

3.06 CARE AND CLEANING

3.07 SEWER INTERNAL INSPECTIONS

3.08 TEST OF PIPING

3.09 WATER SYSTEM STERILIZATION

- A. Public Water Mains: Shall be flushed and disinfected per the local jurisdiction requirements
- B. Clean and disinfect all site water systems connected to the domestic water systems in accordance with AWWA Standard C651 and as required by the local Building and Health Department Codes, and EPA.
- C. Domestic water sterilization shall be performed by a licensed “qualified applicator” as required by CAL-EPA Pesticide Enforcement Branch for disinfecting and sterilizing drinking water.
- D. Disinfecting Agent: Chlorine product that is a registered product with Cal-EPA for use in California potable water lines, such as Bacticide, CAL-EPA Registration No. 37982-20001.

3.10 CLEANING

END OF SECTION

SECTION 33 14 15

SITE WATER DISTRIBUTION PIPING SYSTEM

PART 1 - GENERAL

1.01 SUMMARY

- A. Piping for potable-water service outside the building..
- B. Well for domestic and fire protection water supply (See Fire specs).

1.02 SYSTEM PERFORMANCE

- A. Potable-Water-Service Minimum Working-Pressure Rating: 160 psig.

1.03 SUBMITTALS

- A. Coordination Drawings.

1.04 MATERIALS

- A. Pipe and Fittings:
 - 1. Ductile-iron pipe and push-on fittings with gasketed joints.
 - 2. Drawn-Temper Copper Tube: ASTM B88, Type K and ASTM B88, Type L.
Wrought - Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.

1.05 COMPONENTS

- A. Piping Specialties:
 - 1. Flexible connectors.
 - 2. Dielectric Fittings: Unions, Flanges, Couplings and Nipples.
- B. Polyethylene encasement for ductile-iron piping.
- C. Valves:
 - 1. AWWA gate valves, non-rising stem.
 - 2. Valve boxes.

PART 2 PRODUCTS

2.0 PERFORMANCE RERQUIREMENTS

- A. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
- B. Comply with standards of authorities having jurisdiction for domestic water-service piping, including materials, installation, testing, and disinfection.
- C. Piping materials to bear label, stamp, or other markings of specified testing agency.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
- E. Comply with ASTM F645 for selection, design, and installation of thermoplastic water piping.
- F. All piping and appurtenances intended to convey or dispense water for human consumption are to comply with the U.S. Safe Drinking Water Act (SDWA), with requirements of the Authority Having Jurisdiction (AHJ), and with NSF 61/NSF 372 or are certified in compliance with NSF 61/NSF 372 by an ANSI-accredited third-party certification body, that the weighted average lead content at wetted surfaces is less than or equal to 0.25 percent.

2.02 PIPING MATERIAL

- A. Comply with requirements in "Piping Applications" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and service sizes.
- B. Potable-water piping and components comply with NSF 14, NSF 61, and NSF 372. Include marking "NSF-pw" on piping.

2.03 COPPER TUBING AND FITTINGS

- A. Drawn-Temper Copper Tube: ASTM B88, Type K and ASTM B88, Type L .
- B. Cast-Copper, Solder-Joint Fittings: ASME B16.18, pressure fittings.
- C. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings
- D. Bronze Flanges: ASME B16.24, Class 150, with solder-joint end. Furnish Class 300 flanges if required to match piping.
- E. Cast-Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock-body, ball and-socket, metal-to-metal seating surfaces; and solder-joint or threaded ends.
Wrought-Copper Unions: ASME B16.22

2.04 WATER METER
2.05 WATER METER BOXES

PART 3 – EXECUTION

3.01 EARTHWORK

- A. Comply with excavating, trenching, and backfilling requirements in Section 312000 “Earth Moving.”

3.02 PIPING APPLICATIONS

- A. Transition couplings with pressure ratings at least equal to piping pressure rating may be used unless otherwise indicated.
- B. Do not use flanges or unions for underground piping.
- C. Flanges, unions, and grooved-end-pipe couplings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- D. Underground water-service piping NPS ¾ to NPS 3 to be any of the following:
 - 1. Soft copper tube, ASTM B88, Type K ; wrought-copper, solder-joint fittings; and brazed copper, pressure-seal fittings; and pressure-sealed] joints.
- E. Underground water-service piping NPS 4 to NPS 8 to be any of the following:
 - 1. Soft copper tube, ASTM B88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
 - 2. Ductile-iron, push-on-joint pipe; ductile-iron, push-on-joint fittings; and gasketed; mechanical-joint pipe; ductile-iron, mechanical-joint fittings; and mechanical; grooved-end pipe; ductile-iron-pipe appurtenances; and grooved joints.
- F. Water Meter Box Water-Service Piping: NPS ¾ to NPS 2 to be same as underground water-service piping.
- G. Aboveground water-service piping NPS ¾ to NPS 3 to be any of the following:
 - 1. Hard copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and brazed copper, pressure-seal fittings; and pressure-sealed joints.
- H. Aboveground water-service piping NPS 4 to NPS 8 to be any of the following:

1. Hard copper tube, ASTM B88, Type L; wrought-copper, solder-joint fittings; and brazed joints.
2. Ductile-iron, grooved-end pipe; ductile-iron, grooved-end appurtenances; and grooved joints.

3.03 PIPING SYSTEMS - COMMON REQUIREMENTS

- A. Comply with Section 330500 "Common Work Results for Utilities" for piping-system common requirements.
- B. Provide a continuous bare copper or aluminum tracer wire not less than 0.10 inch (2.5 mm) in diameter in sufficient length over each separate run of nonmetallic pipe.

3.03 INSTALLATION OF PIPING

3.04 INSTALLATION OF HANGERS AND SUPPORTS

3.05 JOINT CONSTRUCTION

3.06 INSTALLATION OF ANCHORAGE

3.07 CONNECTIONS

3.08 FIELD QUALITY CONTROL

3.09 IDENTIFICATION

3.10 CLEANING

END OF SECTION

SECTION 33 40 00

SITE DRAINAGE

PART 1 – GENERAL

1.01 INCLUSION OF OTHER CONTRACT DOCUMENTS

- A. The General Conditions, Supplementary Conditions and Division 1 are fully applicable to this Section, as if repeated herein.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 01 50 00, Construction Facilities and Temporary Controls.
- B. Section 31 23 33, Trenching and Backfilling.
- C. Section 32 12 00, Asphalt Concrete Paving.
- D. Section 32 16 00, Site Concrete

1.03 QUALITY ASSURANCE

1.04 SUBMITTALS

1.05 WARRANTY

- A. Refer to General Conditions and Section 01 78 36.

1.06 REFERENCES AND STANDARDS

- A. ANSI/ASTM D698-00 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb (2.49 Kg) Rammer and 12 inch (304.8 mm) Drop.
- B. ANSI/ASTM D1556-00 - Test Method for Density of Soil in Place by the Sand-Cone Method.
- C. ANSI/ASTM D1557-02 - Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (4.54 Kg) Rammer and 18 inch (457 mm) Drop.
- D. ANSI/ASTM D 3017-05 Test Methods for Moisture Content of Soils and Soil-Aggregate Mixture by Nuclear Methods (Shallow Depth).
- E. ANSI/ASTM D 4318-05 Test Method for Liquid Limit, Plastic Limit, and Plasticity Limit.

- F. CALTRANS Standard Specifications.
- G. CAL-OSHA, Title 8, Section 1590 (e).
- H. Any work within the street, highway or right-of-way shall be performed in accordance with the requirement of the governmental agencies having jurisdiction, and shall not begin until all of those governing authorities have been notified.
- I. California Plumbing Code current edition.

1.07 DELIVERY, STORAGE AND HANDLING

1.08 PROJECT CONDITIONS

1.09 EXISTING SITE CONDITIONS

1.10 PROTECTION

1.11 SEASONAL LIMITS

1.12 TESTING

1.13 RECORD DRAWINGS

PART 2 – PRODUCTS

2.01 MATERIALS

- A. Pipe: Use one of the following, unless noted on the Drawings otherwise.
 - 1. Polyvinyl Chloride Pipe (PVC): SDR35 conforming to ASTM D3034 with elastomeric joints conforming to ASTM D3212. Sun damaged pipe will be rejected.
 - 2. High density polyethylene pipe (HDPE): The pipe shall be corrugated exterior/smooth interior pipe and water tight per ASTM D3212 with dual wall water tight gasket fittings.
- B. Manhole: Shall be as shown on the drawing details.
- C. Drop Inlet: Shall be as shown on the drawing details.
- D. Mortar: For pipe connections to concrete drainage structures, conform to ASTM C270 type N mortar. Place within one half hour after adding water.
- E. Crushed Rock: Imported washed crushed rock. Minimum 100% passing 3/4 inch

sieve.

- F. Area Drains: Shall be as shown on the drawing details.
- G. Clean-outs: Shall be as shown on the drawing details.

PART 3 – EXECUTION

3.01 INSPECTION LAYOUT AND PREPARATION

3.02 INSTALLATION

- A. General: Installation shall be in strict conformance with referenced standards, the manufacturer's written directions, as shown on the drawings and as herein specified.
- B. Verify invert elevations at points of connection to existing systems prior to any excavation. If invert elevations differ from that shown on drawings, notify Architect immediately.
- C. Excavation and Bedding:
- D. Laying of Pipe:
- E. Backfilling:
 - 1. General: Do not start backfill operations until required testing has been accomplished.
 - 2. Trenches and Excavations: Backfill with material as detailed on plans, filling both sides of the pipe at the same time, carefully tamping to hold pipe in place without movement. Refer to Section 31 23 33 – TRENCHING AND BACKFILLING for fill above this layer.
- F. Grouting of Pipes:

3.03 TOLERANCES

- A. Storm Drain structure grates
- B. Cleanout Boxes and Lids

3.04 DEWATERING

3.05 FLUSHING

3.06 CLEANING

END OF SECTION

SECTION 33 42 11

STORMWATER GRAVITY PIPING

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. HDPE Stormwater Piping
- B. In accordance with Caltrans 2018 Standard Specifications, except as noted herein.

1.02 SUBMITTALS

- A. Stormwater piping submittal per Caltrans Section 64-2.01C.

PART 2 PRODUCTS

- 2.01 NO MATERIALS SHALL BE DELIVERED TO THE SITE THAT ARE NOT IN CONFORMANCE WITH THESE SPECIFICATIONS, OR UNLESS ACCEPTED BY THE ENGINEER IN WRITING.

- A. HDPE Stormwater piping per Caltrans Section 64, Type S.

PART 3 EXECUTION

3.01 GENERAL

- A. In accordance with applicable Caltrans Sections 64.

END OF SECTION

SECTION 33 44 43

VORTEX-TYPE HYDRODYNAMIC SEPARATORS

PART 1 GENERAL

1.01 SCOPE

- A. Work described in this section includes furnishing all labor, equipment, materials, tools, and incidentals required for a complete an operable installation of the First Defense® High Capacity (FD-HC) stormwater treatment system, or approved equal, as shown on the drawings and specified herein.
- B. The manufacturer shall design and supply the equipment specified herein.

1.02 GENERAL REQUIREMENTS

- A. The treatment system shall use an induced vortex rotational flow to separate pollutants from stormwater runoff. The system shall be self-activating with no mechanical parts or external power requirements.

PART 2 PRODUCTS

2.01 GENERAL

- A. Treatment Device – The treatment device shall use an inlet chute and outlet chute to create a rotational flow within a cylindrical treatment chamber, with dual integrated bypass weirs. Access to the sump shall be via a central round access port, free of obstructions, located directly beneath the manhole access casting. No entry shall be required to maintain the Device and no internal parts moved or removed to access the sump.

2.02 PERFORMANCE REQUIREMENTS

- A. The Device shall be sized based on treating the WQF calculated using the locally approved methods, or standard methods outlined in the applicable design guides and regulations.

PART 3 EXECUTION

3.01 GENERAL

- A. The system shall be installed in strict accordance with the site plans, and the manufacturer's general arrangement drawings and handling, storage and installation instructions. The Contractor shall be responsible for installing the equipment and all necessary site connections.

END OF SECTION

VORTEX-TYPE HYDRODYNAMIC SEPARATORS

33 44 43

SECTION 33 46 11
STORMWATER PONDS

PART 1 GENERAL

1.01 SUMMARY

- A. This work includes furnishing and installing bioretention soil media (BSM) to the dimensions shown on the plans. BSM must comply with the plans and these specifications.
- B. Earthwork and grading for the stormwater retention pond shall be in accordance with the plans, and Section 31 11 11, Earthwork.

PART 2 PRODUCTS

2.01 MATERIALS

- A. BSM shall be comprised of:

Material	Percent By Volume
Mature Compost	30 - 40%
Sand	60 - 70%

PART 3 EXECUTION

3.01 CONSTRUCTION

- A. BSM shall not be mixed on site.
- B. Scarify subgrade 12" before installing BSM.
- C. Compact BSM in 6" lifts with landscape roller or by light wetting, to the thickness shown on the drawings. Do not over-compact or allow heavy equipment over BSM.
- D. Allow BSM to dry overnight before any planting is installed.

END OF SECTION

SILVA COST CONSULTING, INC.

1521 Corporate Way, Suite 210
Sacramento, CA 95831

P: 916.444.1130

F: 916.444.1131

White Mountain Fire Station - PEMB

Benton, CA

DRAFT Preliminary Cost Estimate

Revision 2 - Reduced

March 25, 2025

Prepared for:

HMR Architects

2130 21st Street

Sacramento, CA 95818

SILVA COST CONSULTING, INC.

1521 Corporate Way, Suite 210
Sacramento, CA 95831

P: 916.444.1130
F: 916.444.1131

March 25, 2025

Grant Watkins

HMR Architects

2130 21st Street
Sacramento, CA 95818

Reference: **White Mountain Fire Station - PEMB**

Subject: **DRAFT Preliminary Cost Estimate**

Dear Grant,

Thank you for the opportunity to provide you with this Cost Estimate for the above referenced project. The estimate is broken up into several sections as follows:

The narrative portion, which lists:

- The information used in preparing the estimate
- The estimate qualifications and assumptions
- The exclusions to the estimate

The estimate portion, which contains:

- The Project Summary (which summarizes the estimate items in the estimate)
 - The Estimate Summary (which summarizes the various sections for each item)
 - The Estimate Detail (which lists the line items and unit prices for the estimate)

Once again I would like to thank you for this opportunity to offer my services. Please review the attached estimate and comment. Feel free to call me at 916-444-1130 should you have any questions, comments or concerns. Thank you.

Sincerely,

SILVA COST CONSULTING, INC.

Javier Silva
Principal

ITEMS USED IN PREPARING THE ESTIMATE

Specifications:	None	
Reports:	New Building Feasibility Study, prepared by HMR Architects	1/24/2025
Civil Drawings:	None	
Landscape Drawings:	None	
Architectural Drawings:	AS1.0, AS1.1, A1, A1.1, A-5, A-5.1, prepared by HMR Architects	1/25/2025
Structural Drawings:	None	
Mechanical Drawings:	Mechanical/Plumbing Report, prepared by Sacramento Engineering Consultants	12/17/2024
Plumbing Drawings:	Mechanical/Plumbing Report, prepared by Sacramento Engineering Consultants	12/17/2024
Electrical Drawings:	Electrical Report, prepared by Sacramento Engineering Consultants	12/17/2024

ESTIMATE QUALIFICATIONS

- The project is located in Benton, CA.
- The estimate was priced using prevailing wage rates.
- The delivery method for this project is Design-Bid-Build.
If the delivery method changes, then this estimate is null and void.
- Start date of construction is assumed to be in the summer of 2026.
- Construction duration is assumed to be 12 months.
- The project will be done in one continuous phase.
- Work areas are to be un-occupied during construction.
- Work to be performed during normal business hours, 8 hours per day, 40 hours per week
- We include a design contingency of 12.5%.
- The estimate is escalated 8.52%.
- Due to the nature of construction pricing this estimate is deemed to be accurate for a period of 90 days. After 90 days, please contact us to see if the estimate needs a pricing update.
- This estimate represents what you would expect from a bid from a general contractor and not including owners costs.
- This estimate assumes the building structures for the apparatus bay and the barracks building will be a pre-engineered metal building, with standard finish.

ITEMS SPECIFICALLY EXCLUDED FROM THE ESTIMATE

- Fees for architectural, structural, civil, mechanical, electrical, or other design fees.
- Permit fees, or inspection fees.
- Utility hook up fees.
- Premiums for overtime work.
- Off-site work.
- Playground Equipment & Markings
- Special Construction
- Conveying
- Items not specifically shown in estimate.
- FF&E - This is considered an owners cost.
- PG&E service connection fee.
- Storage mezzanine and ladder.

PREFACE TO THE ESTIMATE

The estimate hereunder has been compiled from drawings and specifications (if available) believed to be an accurate portrayal of the project as drawn and indicated by the architect and/or engineers. If said drawings and specifications are incomplete, the project cost engineer has included those items as would usually appear in final drawings and specifications for a complete project in a manner ordinarily prudent under the circumstances. Specialty items unknown to the cost engineer will not normally be included unless communicated through the architect and/or engineer.

The user is cautioned that changes in the scope of the project or the drawings and specifications after the estimate has been submitted can cause cost changes and the cost engineer should be notified for appropriate addenda to be issued to the estimate.

The estimate has also been adjusted for geographical location based on local material and labor rates as well as local construction practice.

Estimates based on a competitive bid situation, involving 4 or more bidders with 4 sub bids per trade, is considered a normalized estimate. Costs may increase or decrease significantly depending on the actual number of bidders. Use the following percentages as a guide:

1 bid	+15% to +40%
2-3 bids	+5% to +15%
4-5 bids	+5% to -5%
6-7 bids	-5% to -15%
7+ bids	-15% or more

PROJECT SUMMARY				
PROJECT:	White Mountain Fire Station - PEMB		DATE:	3/25/2025
LEVEL:	DRAFT Preliminary		ESTIMATOR:	Javier Silva
CLIENT:	HMR Architects		SCHEDULE:	12 Months
ITEM NO.	ITEM DESCRIPTION	AREA (SF)	ITEM COST	\$/SF
1	Sitework	30,000	1,746,349	58
2	Apparatus Bay Building - Pre-Engineered Metal Bldg	3,150	2,103,836	668
3	Barracks Building - Pre-Engineered Metal Bldg	1,050	1,148,266	1,094
	TOTAL CONSTRUCTION COST:		4,998,451	
ALT. NO.	ALTERNATE DESCRIPTION		ALT COST	\$/SF
1				
2				
3				
	TOTAL ALTERNATES COST:			

ESTIMATE DETAIL					
PROJECT:	White Mountain Fire Station - PEMB			DATE:	3/25/2025
LEVEL:	DRAFT Preliminary			ESTIMATOR:	Javier Silva
CLIENT:	HMR Architects			SCHEDULE:	12 Months
LOCATION:	Sitework			AREA (SF):	30,000
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL AMOUNT
1.0	GENERAL CONDITIONS		\$/SF:	1.00	30,000
2.0	SITE DEMOLITION		\$/SF:	4.84	145,231
31.0	EARTHWORK AND GRADING		\$/SF:	2.14	64,200
32.1	AC PAVING AND PARKING		\$/SF:	4.66	139,715
32.2	SITE CONCRETE		\$/SF:	1.52	45,507
32.3	SITE METALS		\$/SF:	0.71	21,400
32.4	LANDSCAPING AND IRRIGATION		\$/SF:	0.83	25,000
32.5	FENCES AND GATES		\$/SF:	2.00	59,900
32.6	PLAYGROUND EQUIPMENT & MARKINGS		\$/SF:		
32.7	SITE FURNISHINGS		\$/SF:	1.05	31,420
32.8	SITE STRUCTURES		\$/SF:	1.14	34,240
33.1	STORM DRAINAGE		\$/SF:	2.50	75,000
33.2	WATER DISTRIBUTION		\$/SF:	6.75	202,503
33.3	SANITARY SEWERAGE		\$/SF:	0.43	12,947
33.4	GAS DISTRIBUTION		\$/SF:	1.67	50,000
33.5	SITE MECHANICAL PIPING		\$/SF:		
33.6	SITE ELECTRICAL		\$/SF:	8.37	251,100
	SUBTOTAL				1,188,163
	GENERAL CONDITIONS			10.0%	118,816
	BONDS & INSURANCE			2.0%	26,140
	OVERHEAD AND PROFIT			7.3%	97,318
	DESIGN CONTINGENCY			12.5%	178,805
	ESCALATION			8.5%	137,107
	TOTAL CONSTRUCTION COST				1,746,349
				TOTAL \$/SF:	58.21

ESTIMATE DETAIL					
PROJECT:	White Mountain Fire Station - PEMB			DATE:	3/25/2025
LEVEL:	DRAFT Preliminary			ESTIMATOR:	Javier Silva
CLIENT:	HMR Architects			SCHEDULE:	12 Months
LOCATION:	Sitework			AREA (SF):	30,000
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL AMOUNT
1.0	GENERAL CONDITIONS				
	Erosion control	30,000	sf	1.00	30,000
	Subtotal General Conditions		\$/SF:	1.00	30,000
2.0	SITE DEMOLITION				
	Demo apparatus barn	3,210	sf	21.40	68,690
	Demo quonset hut	1,439	sf	10.70	15,392
	Demo training building	1,934	sf	21.40	41,383
	Demo concrete driveway	1,503	sf	5.35	8,041
	Clear and grub	21,915	sf	0.54	11,724
	Subtotal Site Demolition		\$/SF:	4.84	145,231
31.0	EARTHWORK AND GRADING				
	Site grading	30,000	sf	2.14	64,200
	Subtotal Earthwork And Grading		\$/SF:	2.14	64,200
32.1	AC PAVING AND PARKING				
	AC paving	8,504	sf	16.05	136,489
	Parking sign	2	ea	642.00	1,284
	Parking stall	3	ea	74.90	225
	Parking stall, ada	2	ea	214.00	428
	Wheel stop	5	ea	160.50	803
	Diagonal striping	91	sf	5.35	487
	Subtotal Ac Paving And Parking		\$/SF:	4.66	139,715
32.2	SITE CONCRETE				
	Concrete paving, pedestrian	964	sf	21.40	20,630
	Concrete curbs	410	lf	42.80	17,548
	Concrete curb ramps	69	sf	107.00	7,330
	Subtotal Site Concrete		\$/SF:	1.52	45,507
32.3	SITE METALS				
	Bollards - allowance	20	ea	1,070.00	21,400

ESTIMATE DETAIL					
PROJECT:	White Mountain Fire Station - PEMB			DATE:	3/25/2025
LEVEL:	DRAFT Preliminary			ESTIMATOR:	Javier Silva
CLIENT:	HMR Architects			SCHEDULE:	12 Months
LOCATION:	Sitework			AREA (SF):	30,000
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL AMOUNT
	Subtotal Site Metals		\$/SF:	0.71	21,400
32.4	LANDSCAPING AND IRRIGATION				
	Landscaping and irrigation	1	ls	25,000.00	25,000
	Subtotal Landscaping And Irrigation		\$/SF:	0.83	25,000
32.5	FENCES AND GATES				
	CL fence	558	lf	50.00	27,900
	CL gates	4	ea	8,000.00	32,000
	Subtotal Fences And Gates		\$/SF:	2.00	59,900
32.7	SITE FURNISHINGS				
	Flag pole, 30'	1	ea	6,420.00	6,420
	Station sign	1	ea	25,000.00	25,000
	Hose drying rack				OFOI
	Subtotal Site Furnishings		\$/SF:	1.05	31,420
32.8	SITE STRUCTURES				
	Trash enclosure	160	sf	214.00	34,240
	Subtotal Site Structures		\$/SF:	1.14	34,240
33.1	STORM DRAINAGE				
	Storm drain system	30,000	sf	2.50	75,000
	Subtotal Storm Drainage		\$/SF:	2.50	75,000
33.2	WATER DISTRIBUTION				
	Fire Water				
	POC existing	1	ea	12,840.00	12,840
	POC building	1	ea	1,070.00	1,070
	30000 gallon tank, foundation, complete	1	ea	64,200.00	64,200
	Fire pump	1	ea	53,500.00	53,500
	Fire hydrants	1	ea	5,136.00	5,136
	Fire water piping	200	lf	160.50	32,100
	Valves and accessories	1	ls	16,884.60	16,885

ESTIMATE DETAIL					
PROJECT:	White Mountain Fire Station - PEMB			DATE:	3/25/2025
LEVEL:	DRAFT Preliminary			ESTIMATOR:	Javier Silva
CLIENT:	HMR Architects			SCHEDULE:	12 Months
LOCATION:	Sitework			AREA (SF):	30,000
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL AMOUNT
	Domestic Water				
	POC existing	1	ea	2,140.00	2,140
	POC building	1	ea	1,070.00	1,070
	Domestic water piping	100	lf	74.90	7,490
	Valves and accessories	1	ls	1,070.00	1,070
	Irrigation Water				
	POC existing	1	ea	2,140.00	2,140
	Stub	1	ea	1,070.00	1,070
	Irrigation water main	25	lf	53.50	1,338
	Valves and accessories	1	ls	454.75	455
	Subtotal Water Distribution		\$/SF:	6.75	202,503
33.3	SANITARY SEWERAGE				
	Sewer piping	100	lf	117.70	11,770
	Clean outs and accessories	1	ls	1,177.00	1,177
	Subtotal Sanitary Sewerage		\$/SF:	0.43	12,947
33.4	GAS DISTRIBUTION				
	Propane system - incl. 500 gallon tank	1	ls	50,000.00	50,000
	Subtotal Gas Distribution		\$/SF:	1.67	50,000
33.6	SITE ELECTRICAL				
	Electrical-Power				
	2-5"C UG	100	lf	214.00	21,400
	1-5"C UG	100	lf	107.00	10,700
	3'x5' pullbox	1	ea	4,622.40	4,622
	Power to tanks	1	ea	10,000.00	10,000
	Electrical-Low Voltage				
	2-4"C telecom/catv	100	lf	171.20	17,120
	2'x3' pullbox	2	ea	1,848.96	3,698
	1-4"C telecom/catv	100	lf	85.60	8,560
	Emergency				
	Emergency generator and enclosure	1	ls	175,000.00	175,000
	Subtotal Site Electrical		\$/SF:	8.37	251,100

ESTIMATE DETAIL					
PROJECT:	White Mountain Fire Station - PEMB			DATE:	3/25/2025
LEVEL:	DRAFT Preliminary			ESTIMATOR:	Javier Silva
CLIENT:	HMR Architects			SCHEDULE:	12 Months
LOCATION:	Apparatus Bay Building - Pre-Engineered Metal Bldg			AREA (SF):	3,150
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL AMOUNT
1.0	GENERAL CONDITIONS		\$/SF:		
2.0	DEMOLITION		\$/SF:		
3.0	CONCRETE		\$/SF:	76.28	240,288
4.0	MASONRY		\$/SF:		
5.0	METALS		\$/SF:		
6.R	ROUGH CARPENTRY		\$/SF:	14.64	46,117
6.F	FINISH CARPENTRY		\$/SF:		
7.0	THERMAL & MOISTURE PROTECTION		\$/SF:	9.50	29,933
8.0	OPENINGS		\$/SF:	43.14	135,890
9.0	FINISHES		\$/SF:	41.14	129,604
10.0	SPECIALTIES		\$/SF:	2.00	6,300
11.0	EQUIPMENT		\$/SF:		
12.0	FURNISHINGS		\$/SF:		
13.0	SPECIAL CONSTRUCTION		\$/SF:	107.00	337,050
14.0	CONVEYING		\$/SF:		
21.0	FIRE SUPPRESSION		\$/SF:	10.70	33,705
22.0	PLUMBING		\$/SF:	25.00	78,750
23.0	MECHANICAL		\$/SF:	50.00	157,500
26.0	ELECTRICAL		\$/SF:	50.00	157,500
27.0	COMMUNICATIONS		\$/SF:	10.00	31,500
28.0	ELECTRONIC SAFETY & SECURITY		\$/SF:	15.00	47,250
	SUBTOTAL				1,431,387
	GENERAL CONDITIONS			10.0%	143,139
	BONDS & INSURANCE			2.0%	31,491
	OVERHEAD AND PROFIT			7.3%	117,239
	DESIGN CONTINGENCY			12.5%	215,407
	ESCALATION			8.5%	165,174
	TOTAL CONSTRUCTION COST				2,103,836
				TOTAL \$/SF:	667.88

ESTIMATE DETAIL					
PROJECT:	White Mountain Fire Station - PEMB			DATE:	3/25/2025
LEVEL:	DRAFT Preliminary			ESTIMATOR:	Javier Silva
CLIENT:	HMR Architects			SCHEDULE:	12 Months
LOCATION:	Apparatus Bay Building - Pre-Engineered Metal Bldg			AREA (SF):	3,150
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL AMOUNT
3.0	CONCRETE				
	Slab on grade - apparatus bay - 12"	3,150	sf	51.36	161,784
	Footings and grade beams	3,150	sf	21.40	67,410
	Equipment pads	50	sf	25.00	1,250
	Curbs	230	lf	42.80	9,844
	Subtotal Concrete		\$/SF:	76.28	240,288
6.R	ROUGH CARPENTRY				
	Walls				
	Exterior wall furring	4,600	sf	8.56	39,376
	Miscellaneous rough carpentry	3,150	sf	2.14	6,741
	Subtotal Rough Carpentry		\$/SF:	14.64	46,117
7.0	THERMAL & MOISTURE PROTECTION				
	Exterior wall insulation	4,600	sf	3.21	14,766
	Roof insulation	3,150	sf	4.28	13,482
	Sealants and caulking	3,150	sf	0.54	1,685
	Subtotal Thermal & Moisture Protection		\$/SF:	9.50	29,933
8.0	OPENINGS				
	Doors				
	Exterior doors, frames and hardware	1	ea	7,490.00	7,490
	Apparatus bay doors	6	ea	21,400.00	128,400
	Subtotal Openings		\$/SF:	43.14	135,890
9.0	FINISHES				
	Drywall Assemblies				
	Drywall to wall framing	4,600	sf	5.35	24,610
	Flooring				
	Concrete sealer	3,150	sf	2.68	8,426
	Walls				
	Paint walls	4,600	sf	2.68	12,305
	Ceilings				

ESTIMATE DETAIL					
PROJECT:	White Mountain Fire Station - PEMB			DATE:	3/25/2025
LEVEL:	DRAFT Preliminary			ESTIMATOR:	Javier Silva
CLIENT:	HMR Architects			SCHEDULE:	12 Months
LOCATION:	Apparatus Bay Building - Pre-Engineered Metal Bldg			AREA (SF):	3,150
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL AMOUNT
	Drywall ceiling	3,150	sf	26.75	84,263
	Subtotal Finishes		\$/SF:	41.14	129,604
10.0	SPECIALTIES				
	Signage	3,150	sf	2.00	6,300
	Subtotal Specialties		\$/SF:	2.00	6,300
13.0	SPECIAL CONSTRUCTION				
	Pre-engineered metal building, incl. structure, exterior wall finish, roof finish and sheetmetal	3,150	sf	107.00	337,050
	Subtotal Special Construction		\$/SF:	107.00	337,050
21.0	FIRE SUPPRESSION				
	Wet pipe fire sprinkler system	3,150	sf	10.70	33,705
	Subtotal Fire Suppression		\$/SF:	10.70	33,705
22.0	PLUMBING				
	Plumbing systems, complete	3,150	sf	25.00	78,750
	Subtotal Plumbing		\$/SF:	25.00	78,750
23.0	MECHANICAL				
	Mechanical system, complete	3,150	sf	50.00	157,500
	Subtotal Mechanical		\$/SF:	50.00	157,500
26.0	ELECTRICAL				
	Electrical-Equipment	3,150	sf	10.00	31,500
	Electrical-Power	3,150	sf	20.00	63,000
	Electrical-Lighting	3,150	sf	20.00	63,000
	Subtotal Electrical		\$/SF:	50.00	157,500
27.0	COMMUNICATIONS				

ESTIMATE DETAIL					
PROJECT:	White Mountain Fire Station - PEMB			DATE:	3/25/2025
LEVEL:	DRAFT Preliminary			ESTIMATOR:	Javier Silva
CLIENT:	HMR Architects			SCHEDULE:	12 Months
LOCATION:	Apparatus Bay Building - Pre-Engineered Metal Bldg			AREA (SF):	3,150
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL AMOUNT
	Telecom	3,150	sf	10.00	31,500
	Subtotal Communications		\$/SF:	10.00	31,500
28.0	ELECTRONIC SAFETY & SECURITY				
	Fire Alarm	3,150	sf	15.00	47,250
	Subtotal Electronic Safety & Security		\$/SF:	15.00	47,250

ESTIMATE DETAIL					
PROJECT:	White Mountain Fire Station - PEMB			DATE:	3/25/2025
LEVEL:	DRAFT Preliminary			ESTIMATOR:	Javier Silva
CLIENT:	HMR Architects			SCHEDULE:	12 Months
LOCATION:	Barracks Building - Pre-Engineered Metal Bldg			AREA (SF):	1,050
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL AMOUNT
1.0	GENERAL CONDITIONS		\$/SF:		
2.0	DEMOLITION		\$/SF:		
3.0	CONCRETE		\$/SF:	49.29	51,754
4.0	MASONRY		\$/SF:		
5.0	METALS		\$/SF:	73.76	77,448
6.R	ROUGH CARPENTRY		\$/SF:	90.62	95,152
6.F	FINISH CARPENTRY		\$/SF:	10.00	10,500
7.0	THERMAL & MOISTURE PROTECTION		\$/SF:	19.40	20,367
8.0	OPENINGS		\$/SF:	62.67	65,805
9.0	FINISHES		\$/SF:	86.51	90,836
10.0	SPECIALTIES		\$/SF:	39.09	41,048
11.0	EQUIPMENT		\$/SF:		
12.0	FURNISHINGS		\$/SF:		
13.0	SPECIAL CONSTRUCTION		\$/SF:	107.00	112,350
14.0	CONVEYING		\$/SF:		
21.0	FIRE SUPPRESSION		\$/SF:	10.70	11,235
22.0	PLUMBING		\$/SF:	50.00	52,500
23.0	MECHANICAL		\$/SF:	65.00	68,250
26.0	ELECTRICAL		\$/SF:	50.00	52,500
27.0	COMMUNICATIONS		\$/SF:	15.00	15,750
28.0	ELECTRONIC SAFETY & SECURITY		\$/SF:	15.00	15,750
	SUBTOTAL				781,245
	GENERAL CONDITIONS			10.0%	78,125
	BONDS & INSURANCE			2.0%	17,187
	OVERHEAD AND PROFIT			7.3%	63,989
	DESIGN CONTINGENCY			12.5%	117,568
	ESCALATION			8.5%	90,151
	TOTAL CONSTRUCTION COST				1,148,266
				TOTAL \$/SF:	1,093.59

ESTIMATE DETAIL					
PROJECT:	White Mountain Fire Station - PEMB			DATE:	3/25/2025
LEVEL:	DRAFT Preliminary			ESTIMATOR:	Javier Silva
CLIENT:	HMR Architects			SCHEDULE:	12 Months
LOCATION:	Barracks Building - Pre-Engineered Metal Bldg			AREA (SF):	1,050
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL AMOUNT
3.0	CONCRETE				
	Slab on grade - remainder of bldg - 5"	1,050	sf	21.40	22,470
	Footings and grade beams	1,050	sf	21.40	22,470
	Equipment pads	50	sf	25.00	1,250
	Curbs	130	lf	42.80	5,564
	Subtotal Concrete		\$/SF:	49.29	51,754
5.0	METALS				
	Metals				
	Metal shade canopy	360	sf	107.00	38,520
	Guardrails	59	lf	642.00	37,878
	Miscellaneous metals	1,050	sf	1.00	1,050
	Subtotal Metals		\$/SF:	73.76	77,448
6.R	ROUGH CARPENTRY				
	Exterior wall framing and sheathing	1,140	sf	31.03	35,374
	Interior wall framing	996	sf	25.68	25,577
	Storage mezzanine	970	sf	25.00	24,250
	Wood stairs	36	sf	214.00	7,704
	Miscellaneous rough carpentry	1,050	sf	2.14	2,247
	Subtotal Rough Carpentry		\$/SF:	90.62	95,152
6.F	FINISH CARPENTRY				
	Casework allowance	1,050	sf	10.00	10,500
	Subtotal Finish Carpentry		\$/SF:	10.00	10,500
7.0	THERMAL & MOISTURE PROTECTION				
	Roof insulation	1,050	sf	12.84	13,482
	Exterior wall insulation	1,140	sf	3.21	3,659
	Interior wall insulation	996	sf	2.68	2,664
	Sealants and caulking	1,050	sf	0.54	562
	Subtotal Thermal & Moisture Protection		\$/SF:	19.40	20,367
8.0	OPENINGS				

ESTIMATE DETAIL					
PROJECT:	White Mountain Fire Station - PEMB			DATE:	3/25/2025
LEVEL:	DRAFT Preliminary			ESTIMATOR:	Javier Silva
CLIENT:	HMR Architects			SCHEDULE:	12 Months
LOCATION:	Barracks Building - Pre-Engineered Metal Bldg			AREA (SF):	1,050
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL AMOUNT
	Doors				
	Exterior doors, frames and hardware	3	ea	7,490.00	22,470
	Interior doors, frames and hardware	6	ea	3,210.00	19,260
	Windows				
	Exterior windows	150	sf	160.50	24,075
	Subtotal Openings		\$/SF:	62.67	65,805
9.0	FINISHES				
	Drywall Assemblies				
	Drywall to wood wall framing	3,132	sf	5.35	16,756
	Flooring				
	Ceramic tile	66	sf	32.10	2,119
	Concrete sealer	100	sf	2.68	268
	Resilient flooring	697	sf	16.05	11,187
	Base				
	Tile base	33	lf	32.10	1,059
	Rubber base	228	lf	6.42	1,464
	Walls				
	Ceramic tile wainscot	528	sf	32.10	16,949
	FRP wallcovering	200	sf	34.24	6,848
	Paint walls	2,280	sf	2.68	6,099
	Ceilings				
	Drywall ceiling	1,050	sf	26.75	28,088
	Subtotal Finishes		\$/SF:	86.51	90,836
10.0	SPECIALTIES				
	Folding shower seat	1	ea	1,391.00	1,391
	Grab bar	1	ea	749.00	749
	Shower rod and curtain	1	ea	428.00	428
	Signage	1,050	sf	2.00	2,100
	Toilet room accessories	8	ea	3,210.00	25,680
	Turn out lockers	4	ea	2,675.00	10,700
	Subtotal Specialties		\$/SF:	39.09	41,048
11.0	EQUIPMENT				

ESTIMATE DETAIL					
PROJECT:	White Mountain Fire Station - PEMB			DATE:	3/25/2025
LEVEL:	DRAFT Preliminary			ESTIMATOR:	Javier Silva
CLIENT:	HMR Architects			SCHEDULE:	12 Months
LOCATION:	Barracks Building - Pre-Engineered Metal Bldg			AREA (SF):	1,050
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL AMOUNT
	Extractor				OFOI
	Hose storage				OFOI
	Kitchen appliance				OFOI
	Response flip board				OFOI
	Subtotal Equipment		\$/SF:		
12.0	FURNISHINGS				
	Window coverings				OFOI
	Subtotal Furnishings		\$/SF:		
13.0	SPECIAL CONSTRUCTION				
	Pre-engineered metal building, incl. structure, exterior wall finish, roof finish and sheetmetal	1,050	sf	107.00	112,350
	Subtotal Special Construction		\$/SF:	107.00	112,350
21.0	FIRE SUPPRESSION				
	Wet pipe fire sprinkler system	1,050	sf	10.70	11,235
	Subtotal Fire Suppression		\$/SF:	10.70	11,235
22.0	PLUMBING				
	Plumbing systems, complete	1,050	sf	50.00	52,500
	Subtotal Plumbing		\$/SF:	50.00	52,500
23.0	MECHANICAL				
	Mechanical system, complete	1,050	sf	65.00	68,250
	Subtotal Mechanical		\$/SF:	65.00	68,250
26.0	ELECTRICAL				
	Electrical-Equipment	1,050	sf	10.00	10,500
	Electrical-Power	1,050	sf	20.00	21,000
	Electrical-Lighting	1,050	sf	20.00	21,000

ESTIMATE DETAIL					
PROJECT:	White Mountain Fire Station - PEMB			DATE:	3/25/2025
LEVEL:	DRAFT Preliminary			ESTIMATOR:	Javier Silva
CLIENT:	HMR Architects			SCHEDULE:	12 Months
LOCATION:	Barracks Building - Pre-Engineered Metal Bldg			AREA (SF):	1,050
ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL AMOUNT
	Subtotal Electrical		\$/SF:	50.00	52,500
27.0	COMMUNICATIONS				
	Telecom	1,050	sf	10.00	10,500
	TV	1,050	sf	5.00	5,250
	Subtotal Communications		\$/SF:	15.00	15,750
28.0	ELECTRONIC SAFETY & SECURITY				
	Fire Alarm	1,050	sf	15.00	15,750
	Subtotal Electronic Safety & Security		\$/SF:	15.00	15,750