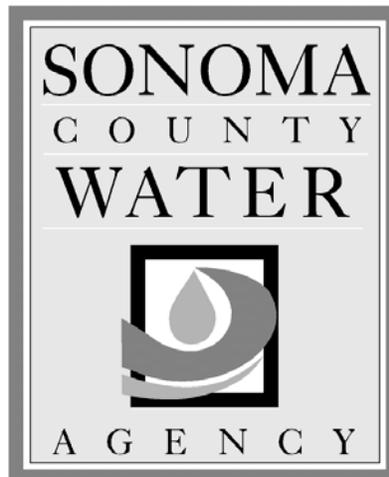


CONTRACT NO.
0-85-7 #1

PROJECT MANUAL
VOLUME 2 OF 3
FOR

**Westside Facility
(9703 Wohler Road)**



JUNE 2014

DOCUMENT 00010

TABLE OF CONTENTS

STANDARD EDITION

(Volume 1 of 3)

INTRODUCTORY INFORMATION

<u>Document</u>	<u>Title</u>
00001	Title Page
00007	Seals Page
00010	Table of Contents

BIDDING REQUIREMENTS

<u>Document</u>	<u>Title</u>
00100	Advertisement for Bids
00200	Instructions to Bidders
00202	Pre-Bid Site Visit Vicinity Map
00203	Bid Submittal Vicinity Map
00210	Indemnity and Release Agreement
00320	Geotechnical Data and Existing Conditions
00400	Bid Form
00411	Bond Accompanying Bid
00420	Bidder Registration Form
00430	Subcontractors List
00450	Statement of Qualifications for Construction Work
00481	Noncollusion Declaration

CONTRACTING REQUIREMENTS

<u>Document</u>	<u>Title</u>
00505	Notice of Intent to Award for Construction
00510	Notice of Award
00520	Agreement
00550	Notice to Proceed
00611	Construction Performance Bond
00612	Construction Labor and Material Payment Bond
00630	Guaranty
00650	Agreement and Release of Any and All Claims
00660	Substitution Request Form
00670	Escrow Bid Documents
00680	Escrow Agreement for Security Deposits in Lieu of Retention

CONDITIONS OF THE CONTRACT

<u>Document</u>	<u>Title</u>
00700	General Conditions
	1. General
	2. Bidding
	3. Contract Award and Commencement of the Work
	4. Bonds and Insurance
	5. Drawings and Specifications
	6. Construction By Owner or by Separate Contractors
	7. Owner and Payment
	8. Control of the Work
	9. Warranty, Guaranty, and Inspection of Work
	10. Contractor's Organization and Equipment
	11. Prosecution and Progress of the Work
	12. Claims by Contractor
	13. Legal and Miscellaneous
	14. Modifications of Contract Documents
	15. Time Allowances
	16. Working Conditions and Prevailing Wages
00800	Supplementary Conditions
00910	Addenda

SPECIFICATIONS

Division 1 - General Requirements

<u>Section</u>	<u>Title</u>
01100	Summary <ul style="list-style-type: none"> - Summary - Submittals - Work Covered by Contract Documents - Bid Items, Allowances, and Alternates - Work Under Other Contracts - Future Work - Work Sequence - Work Days and Hours - Shutdown For Discovery of Cultural Resources - Cooperation of Contractor and Coordination with Other Work - Partial Occupancy/Utilization Requirements - Contractor Use of Site - Air Quality Standards - Construction Staking and Monument Protection - Protection of Existing Structures and Underground Facilities - Permits - Actual Damages - Rights-of-Way - Document Tracking - Products Ordered in Advance - Owner-Furnished Products
01200	Price and Payment Procedures
01250	Modification Procedures
01315	Project Meetings
01320	Progress Schedules and Reports
01330	Submittal Procedures
01410	Regulatory Requirements
01420	References and Definitions
01450	Quality Control
01500	Temporary Facilities and Controls
01540	Site Security and Safety
01600	Product Requirements
01740	Cleaning
01741	Construction Material Waste Management Plan
01750	Starting and Adjusting
01770	Contract Closeout
01780	Project Record Documents
01810	Commissioning

(Volume 2 of 3)

Division 2 - Demolition and Site Work (Not Used)**Division 3 - Concrete**

<u>Section</u>	<u>Title</u>
03 0000	Concrete
03 3100	Concrete Forming And Accessories
03 2000	Concrete Reinforcement
03 3010	Cast-In-Place Concrete
03 3519	Concrete Color Additive

Division 4 - Masonry (Not Used)**Division 5 - Metals**

<u>Section</u>	<u>Title</u>
05 5000	Metal Fabrications
05 5500	Stair Nosings

Division 6 - Wood, Plastics, and Composites

<u>Section</u>	<u>Title</u>
06 2000	Finish Carpentry
06 4100	Architectural Wood Casework

Division 7 - Thermal and Moisture Protection

<u>Section</u>	<u>Title</u>
07 2500	Vapor Retarders
07 6200	Sheet Metal Flashing And Trim
07 9005	Joint Sealers

Division 8 - Openings

<u>Section</u>	<u>Title</u>
08 1100	Steel Doors And Frames
08 1416	Flush Wood Doors
08 3100	Access Doors And Panels
08 3323	Overhead Coiling Doors
08 4313	Aluminum Entrances And Storefronts
08 5113	Aluminum Windows
08 7100	Door Hardware
08 8000	Glazing

Division 9 - Finishes

<u>Section</u>	<u>Title</u>
09 2116	Gypsum Board Assemblies
09 2216	Non-Structural Metal Framing
09 7200	Wall Covering
09 7723	Wall Panels
09 9000	Painting And Coatings

Division 10 - Specialties

<u>Section</u>	<u>Title</u>
10 1116	Visual Display Boards
10 1400	Signage
10 2113	Reinforced Composite Toilet Compartments
10 2233	Accordion Folding Partitions
10 2800	Toilet Accessories
10 4400	Fire Extinguishers And Cabinets

Division 11 - Equipment

<u>Section</u>	<u>Title</u>
11 5200	Audio-Visual Equipment

Division 12 - Furnishings

<u>Section</u>	<u>Title</u>
12 2100	Window Shade Systems
12 3100	Laboratory Casework
12 3559	Display Casework

Division 13 - Special Construction

<u>Section</u>	<u>Title</u>
13 3419	Metal Building Systems

Division 14 - 20 (Not Used)**Division 21 - Fire Suppression**

<u>Section</u>	<u>Title</u>
21 0000	Wet-Pipe Sprinkler Systems

Division 22 - Plumbing

<u>Section</u>	<u>Title</u>
22 0000	General Requirements - Plumbing
22 0529	Hangers And Supports

<u>Section</u>	<u>Title</u>
22 0700	Plumbing Insulation
22 1116	Domestic Water Systems
22 1119	Plumbing Specialties
22 1313	Condensate Drainage System
22 1316	Drain, Waste, And Vent Systems
22 3313	Instantaneous Domestic Water Heater
22 3333	Light Commercial Electric Water Heaters
22 4000	Plumbing Fixtures

Division 23 - Heating Ventilating and Air Conditioning (HVAC)

<u>Section</u>	<u>Title</u>
23 0300	General Requirements - HVAC
23 0529	Hangers and Supports
23 0593	Testing, Adjusting, and Balancing
23 0700	Thermal Insulation for Mechanical Systems
23 2300	Refrigerant Piping
23 3113	Metal Ducts
23 3713	Diffusers, Registers and Grilles
23 8000	Decentralized HVAC Equipment

Division 24 - 25 (Not Used)

Division 26 - Electrical

<u>Section</u>	<u>Title</u>
26 0500	Common Work Results For Electrical
26 0519	Low-Voltage Electrical Power Conductors And Cables
26 0526	Grounding and Bonding For Electrical Systems
26 0533	Raceways and Boxes
26 0553	Identification For Electrical Systems
26 2413	Switchboards
26 2416	600 - Volt Rated Panelboards & Circuit Breakers
26 2726	Wiring Devices
26 5000	Lighting

Division 27 - Communications

<u>Section</u>	<u>Title</u>
27 1000	Telecommunications Infrastructure

Division 28 - 30 (Not Used)

Division 31 - Earthwork

<u>Section</u>	<u>Title</u>
31 0000	Earthwork
31 1000	Site Clearing

<u>Section</u>	<u>Title</u>
31 2300	Excavation And Fill

Division 32 - Exterior Improvements

<u>Section</u>	<u>Title</u>
32 1100	Base Courses
32 1200	Flexible Paving

Division 33 - Utilities

<u>Section</u>	<u>Title</u>
33 4000	Storm Drainage Utilities
33 4600	Subdrainage
33 7173	Electrical Utility Services

Division 34 - 48 (Not Used)

(Volume 3 of 3)

DRAWINGS

(See Drawing List on Drawing No. G-1)

END OF DOCUMENT

DIVISION 3
CONCRETE

**SECTION 03 0000
CONCRETE**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Materials for portland cement concrete.
- B. Aggregate and aggregate grading for portland cement concrete.
- C. Water for portland cement concrete.
- D. Admixtures for portland cement concrete.
- E. Proportioning for portland cement concrete.
- F. Mixing and transporting portland cement concrete.
- G. Formwork for cast in place portland cement concrete.
- H. Embedded materials for portland cement concrete.
- I. Steel reinforcement for portland cement concrete.
- J. Placing and finishing portland cement concrete.
- K. Curing portland cement concrete.
- L. Protecting portland cement concrete.

1.02 RELATED SECTIONS

- A. Section 31 0000, Earthwork.

1.03 RELATED DOCUMENTS

- A. ASTM:
 - 1. A 82, Cold Drawn Steel Wire for Concrete Reinforcement.
 - 2. A 185, Steel Welded Wire Fabric, Plain for Concrete Reinforcement.
 - 3. A 615, Deformed and Plain Billet Steel Bars, for Concrete Reinforcement.
 - 4. C 94, Specification for Ready-mixed Concrete.
 - 5. C 114, Method for Chemical Analysis of Hydraulic Cement.
 - 6. C 150, Portland Cement.
 - 7. C 618, Fly Ash and Raw or Calcined Natural Pozzolan for use as Natural Admixture in Portland Cement.
 - 8. C 1751, Preformed Expansion Joint Fillers for Concrete. Paving and Structural Construction (Non-extruded and Resilient Bituminous Types).

- B. Caltrans Standard Specifications:
 - 1. Section 51: Concrete Structures.
 - 2. Section 70: Miscellaneous Drainage Facilities
 - 3. Section 72: Slope Protection
 - 4. Section 73: Concrete Curbs and Sidewalks.
 - 5. Section 90: Portland Cement Concrete.

1.04 DEFINITIONS

- A. ASTM: American Society for Testing Materials

1.05 SUBMITTALS

- A. Concrete Mix Design: Have all concrete mixes designed by a testing laboratory and approved by Owner. Conform all mixes to the applicable building code requirement, regardless of other minimum requirements listed herein or on the drawings. Submit mix designs for review before use. Show proportions and specific gravities of cement, fine and coarse aggregate, and water and gradation of combined aggregates.

1.06 QUALITY ASSURANCE

- A. Concrete shall be subject to quality assurance in accordance with Section 90 of Caltrans Standard Specifications.
- B. Certifications:
 - 1. Provide Owner at the time of delivery with certificates of compliance signed by both Contractor and Supplier containing the following statements:
 - a. Materials contained comply with the requirements of the Contract Documents in all respects.
 - b. Proportions and mixing comply with the design mix approved by Owner. Design mix shall have been field tested in accordance with the herein requirements of the Caltrans Standard Specifications and produces the required compressive strength under like conditions.
 - c. Statement of type and amount of any admixtures.
 - 2. Provide Owner, at time of delivery, with certified delivery ticket stating volume of concrete delivered and time of mixing, or time of load-out in case of transit mixers.
- C. Conform to the applicable provisions of Section 51, 73 and 90 of the Caltrans Standard Specification and these Technical Specifications.
 - 1. Conform construction of portland cement concrete surface improvements (including curbs, gutters, medians, valley gutters, walks) to the requirements of Section 73 of the Caltrans Standard Specifications unless otherwise required in these Technical Specifications or shown on the Plans.
 - 2. Construct "V" ditches in accordance with Section 72-4 of the Caltrans Standard Specifications; except that finishing shall be in accordance with Caltrans Standard Specification Section 73 instead of 53, or as otherwise required in these Technical Specifications or shown on the Plans.
 - 3. Conform other construction of portland cement concrete items to the requirements of Section 51 of the Caltrans Standard Specifications unless otherwise required in these Technical Specifications or shown on the Plans.

1.07 DESIGNATION

- A. General: Whenever the 28-day compressive strength is designated herein or on the Plans is 3,600psi or greater, the concrete shall be considered to be designated by compressive strength. The 28-day compressive strength shown herein or on the plans which are less than a 3,600psi are shown for design information only and are not considered a requirement for acceptance of the concrete. Whenever the concrete is designated by class or as minor concrete herein or on the Plans, the concrete shall contain the cement per cubic yard shown in Section 90-1.01 of the Caltrans Standard Specifications.
- B. Unless specified otherwise herein or on the Plans, portland cement concrete for this Project shall be Class 2, not less than 590 pounds of portland cement/cubic yard of concrete, as specified in Section 90-1.01 of the Caltrans Standard Specifications.

PART 2 PRODUCTS**2.01 PORTLAND CEMENT**

- A. General: Type II (modified) cement conforming to section 90-2.01 of the Caltrans Standard Specifications.

2.02 AGGREGATE AND AGGREGATE GRADING

- A. General: Conform to the requirements of Section 90-2.02, 2.02A and 2.02B of the Caltrans Standard Specifications.
- B. Aggregate Size and Gradation: Conform to the requirements of Section 90-3 of the Caltrans Standard Specifications for 1-inch maximum combined aggregate.

2.03 WATER

- A. General: Conform to the requirements of section 90-2.03 of the Caltrans Standard Specifications. For mixing and curing portland cement concrete and for washing aggregates.

2.04 EXPANSION JOINT MATERIAL

- A. Material for expansion joints in portland cement concrete improvements shall be premolded expansion joint fillers conforming to the requirements of ASTM Designation D 1751. Expansion joint material shall be shaped to fit the cross section of the concrete prior to being placed. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site. Unless noted otherwise herein or on the Plans expansion joint thickness shall be as follows:
 1. Curbs, Curb Ramps, Island Paving, Sidewalks, Driveways and Gutter Depressions: ¼-inch.
 2. Concrete Slope Protection, Gutter Lining, Ditch Lining and Channel Lining: ½-inch.
 3. Structures: As indicated.

2.05 REINFORCEMENT AND DOWELS

- A. Bar reinforcement for concrete improvements shall be deformed steel bars of the size or sizes called for on the plans conforming to the requirements of ASTM Designation A 615 for Grade 60 bars. Size and shape for bar reinforcement shall conform to the details shown or called for on the Plans. Substitution of wire mesh reinforcement for reinforcing bars will not be allowed.

- B. Slip dowels, where noted or called for on the plans or detail drawings shall be smooth billet-steel bars as designated and conforming to the requirements of ASTM Designation A 615 for Grade 60 bars. Ends of bars inserted in new work shall be covered with a cardboard tube sealed with cork; no grease or oil shall be used.
- C. Mesh for reinforcement for concrete improvements shall be cold drawn steel wire mesh of the size and spacing called for on the plans conforming to the requirements of ASTM Designation A 82 for the material and ASTM Designation A 185 for the mesh. Size and extent of mesh reinforcement shall conform to the details shown or called for on the plans.
- D. Tie wire for reinforcement shall be eighteen (18) gauge or heavier, black, annealed conforming to the requirements of ASTM Designation A 82.
- E. Suppliers certificates showing conformance with this specification shall be delivered with each shipment of materials delivered to the job site.

2.06 COLOR AND PATTERN FOR DECORATIVE SURFACES

- A. Colors for decorative surfacing shall be CHROMIX admixtures as manufactured by the L. M. Scofield Company, Schedule A-312.05 or Approved Equal. The specific color shall be as designated or called for on the Plans.
- B. Patterns for decorative surfacing shall be standard "Bomanite" patterns as copyrighted by the Bomanite Corporation of Palo Alto, California or Equal. The specific pattern shall be as designated or called for on the Plans.

2.07 ACCESSORY MATERIALS

- A. Conform water stops and other items required to be embedded in portland cement concrete structures to the applicable requirements of Section 51 of the Caltrans Standard Specifications unless otherwise specifically noted or called for on the Plans or detail drawings.
- B. Curing Compounds:
 - 1. Regular Portland Cement Concrete: "Non-Pigmented Curing Compound - Chlorinated Rubber Base-Clear" conforming to the requirements contained in Section 90-7.01B, of the Caltrans Standard Specifications.
 - 2. Color Conditioned Decorative Portland Cement Concrete: LITHOCHROME colorwax as manufactured by the L. M. Scofield Company or Approved Equal.

2.08 FORMS

- A. Conform to the requirements of Section 51-1.05 of the Caltrans Standard Specifications.

2.09 PRECAST CONCRETE STRUCTURES

- A. Conform to the following Sections of Caltrans Standard Specifications:
 - 1. 70- 4 Precast Concrete Pipe Drainage Facilities
 - 2. 70- 5 drainage Appurtenances

PART 3 EXECUTION**3.01 STRUCTURAL EXCAVATION**

- A. Structural excavation may be either by hand, or by machine and shall be neat to the line and dimension shown or called for on the plans. Excavation shall be sufficient width to provide adequate space for working therein, and comply with CAL-OSHA requirements.
- B. Where an excavation has been constructed below the design grade, refill the excavation to the bottom of the excavation grade with approved material and compact in place to 95% of the maximum dry density.
- C. Remove surplus excavation material remaining upon completion of the work from the job site, or condition it to optimum moisture content and compact it as fill or backfill on the site, if the material is approved by Owner.

3.02 BRACING AND SHORING

- A. Conform to California and Federal OSHA requirements.
- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove bracing and shoring upon completion of the work.
- C. Be solely responsible for all bracing and shoring and, if requested by Owner, submit details and calculations to Owner. Owner may forward the submittal to the California Division of Industrial Safety for their review. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by Owner.
- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

3.03 PLACING CONCRETE FORMS

- A. Form concrete improvements with a smooth and true upper edge. Side of the form with a smooth finish shall be placed next to concrete. Construct forms rigid enough to withstand the pressure of the fresh concrete to be placed without any distortion.
- B. Thoroughly clean all forms prior to placement and coat forms with an approved form oil in sufficient quantity to prevent adherence of concrete prior to placing concrete.
- C. Carefully set forms to the alignment and grade established and conform to the required dimensions. Rigidly hold forms in place by stakes set at satisfactory intervals. Provide sufficient clamps, spreaders and braces to ensure the rigidity of the forms.
- D. Provide forms for back and face of curbs, lip of gutters and edge of walks, valley gutters or other surface slabs that are equal to the full depth of the concrete as shown, noted or called for on the Plans. On curves and curb returns provide composite forms made from benders or thin planks of sufficient ply to ensure rigidity of the form.

3.04 PLACING STEEL REINFORCEMENT

- A. Bars shall be free of mortar, oil, dirt, excessive mill scale and scabby rust and other coatings of any character that would destroy or reduce the bond. All bending shall be done cold, to the shapes shown on the plans. The length of lapped splices shall be as follows:
 - 1. Reinforcing bars No. 8, or smaller, shall be lapped at least 45 bar diameters of the smaller bar joined, and reinforced bars Nos. 9, 10, and 11 shall be lapped at least 60 bar diameters of the smaller bars joined, except when otherwise shown on the plans.
 - 2. Splice locations shall be made as indicated on the plans.
- B. Accurately place reinforcement as shown on the plans and hold firmly and securely in position by wiring at intersections and splices, and by providing precast mortar blocks or ferrous metal chairs, spacers, metal hangers, supporting wires, and other approved devices of sufficient strength to resist crushing under applied loads. Provide supports and ties of such strength and density to permit walking on reinforcing without undue displacement.
- C. Place reinforcing to provide the following minimum concrete cover:
 - 1. Surfaces exposed to water: 4-inches.
 - 2. Surfaces poured against earth: 3-inches.
 - 3. Formed surfaces exposed to earth or weather: 2-inches.
 - 4. Slabs, walls, not exposed to weather or earth: 1-inch.
- D. Minimum spacing, center of parallel bars shall be two and one half (2-1/2) times the diameter of the larger sized bar. Accurately tie reinforcing securely in place prior to pouring concrete. Placing of dowels or other reinforcing in the wet concrete is not permitted.

3.05 MIXING AND TRANSPORTING PORTLAND CEMENT CONCRETE

- A. Transit mix concrete in accordance with the requirements of ASTM Designation C 94. Transit mix for not less than ten (10) minutes total, not less than three (3) minutes of which shall be on the site just prior to pouring. Mix continuous with no interruptions from the time the truck is filled until the time it is emptied. Place concrete within one hour of the time water is first added unless authorized otherwise by Owner.
- B. Do not hand mix concrete for use in concrete structures

3.06 PLACING PORTLAND CEMENT CONCRETE

- A. Thoroughly wet subgrade when concrete is placed directly on soil. Remove all standing water prior to placing concrete.
- B. Do not place concrete until the subgrade and the forms have been approved.
- C. Convey concrete from mixer to final location as rapidly as possible by methods that prevent separation of the ingredients. Deposit concrete as nearly as possible in final position to avoid re-handling.
- D. Place and solidify concrete in forms without segregation by means of mechanical vibration or by other means as approved by Owner. Continue vibration until the material is sufficiently consolidated and absent of all voids without causing segregation of material. The use of vibrators for extensive shifting of fresh concrete will not be permitted.

- E. Concrete in certain locations may be pumped into place upon prior approval by Owner. When this procedure requires redesign of the mix, such redesign shall be submitted for approval in the same manner as herein specified for approval of design mixes.

3.07 PLACING ACCESSORY MATERIALS

- A. Place water stops and other items required to be embedded in portland cement concrete structures at locations shown or required in accordance with Section 51 of the Caltrans Standard Specifications unless otherwise specifically noted or called for on the Plans.
- B. Curing Compounds:
 - 1. Regular Portland Cement Concrete: Apply "Non-Pigmented Curing Compound - chlorinated Rubber Base-Clear" in accordance with Section 90-7.01B, 7.01D and 7.03 of the Caltrans Standard Specifications.
 - 2. Color Conditioned Decorative Portland Cement Concrete: Apply LITHOCHROME colorwax or Approved Equal in accordance with the manufacturer's instructions.

3.08 EXPANSION JOINTS

- A. Construct expansion joints incorporating premolded joint fillers at twenty (20) foot intervals in all concrete curbs, gutters, sidewalks, median/island paving, valley gutters, driveway approaches and at the ends of all returns. At each expansion joint install one-half inch by twelve inch (1/2" x 12") smooth slip dowels in the positions shown or noted on the detail drawings.
- B. Orient slip dowels at right angles to the expansion joint and hold firmly in place during the construction process by means of appropriate chairs.

3.09 WEAKENED PLANE JOINTS

- A. Construct weakened plane joints in concrete curbs, gutters, sidewalks, median/island paving and valley gutters between expansion joints at ten (10) foot intervals throughout, or as otherwise indicated. Depth of joint score depth to be one-fourth (25%) the thickness of the concrete.
 - 1. Grooved Joints: Form weakened plane joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8-inch. Repeat grooving of weakened plane joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.

3.10 FORM REMOVAL

- A. Remove forms without damage to the concrete. Remove all shores and braces below the ground surface, before backfilling.
- B. Do not backfill against concrete until the concrete has developed sufficient strength to prevent damage.
- C. Leave forms for cast-in-place walls in place at least 72 hours after pouring.
- D. Leave edge forms in place at least 24 hours after pouring.

3.11 CONSTRUCTION

- A. Form, place and finish concrete curbs, walkways, island paving, valley gutters and driveway approaches in conformance with the applicable requirements of Section 73-1.04, 73-1.05, 72-1.05A and 73-1.06 of the Caltrans Standard Specifications as modified herein.
- B. Provide a medium broom finish to all horizontal surfaces unless otherwise shown.
- C. Construct new concrete curb, curb and gutter and valley gutters against existing asphalt concrete by removing a minimum of 12-inches of the asphalt concrete to allow placement of curb or gutter forms. Patch pavement with a 6-inch deep lift of asphalt concrete after gutter form is removed.
- D. Where monolithic curb, gutter and sidewalk is specified, separate concrete pours will not be allowed.

3.12 CONNECTING TO EXISTING CONCRETE IMPROVEMENTS

- A. New curb, gutter, or sidewalk is to connect to existing improvements to remain by saw cutting to existing sound concrete at the nearest score line, expansion joint or control joint. Drill and insert ½-inch diameter by 12-inch long dowels at 24-inches on center into existing improvements. Install pre-molded expansion joint filler at the matching joint.
- B. A cold joint to the existing curb is not acceptable.

3.13 DECORATIVE AND NON-DECORATIVE SURFACING CONSTRUCTION

- A. Decorative surfacing concrete walks, concrete median islands or other installations shall be formed and placed as a concrete slab conforming to the details shown or noted on the Plans.
- B. Add lampblack or Approved Equal to the non-decorative surface concrete at the central mixing plant.

3.14 FIELD QUALITY CONTROL

- A. Finish subgrade for concrete improvements shall be subject to approval prior to placement of forms.
- B. No concrete shall be placed prior to approval of forms.
- C. Concrete improvements constructed shall not contain "bird baths" or pond water and shall be smooth and ridge free.
- D. Conform the finish grade at top of curb, flow line of gutter, and the finish cross section of concrete improvements to the design grades and cross sections.
- E. Variation of concrete improvements from design grade and cross section as shown or called for on the Plans shall not exceed the tolerances established in Sections 73-1.05 and/or 73-1.06 of the Caltrans Standard Specifications.

3.15 RESTORATION OF EXISTING IMPROVEMENTS

- A. Replace in kind all pavement or other improvements removed or damaged due to the installation of concrete improvements.

- B. Remove, landscaping or plantings damaged or disturbed due to the installation of concrete improvements. Replace in kind.

END OF SECTION

SECTION 03 1000
CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL**1.01 SUMMARY**

- A. Section Includes:
 - 1. Forms, shores, bracing, removal and other operations as necessary for all cast-in-place concrete and masonry placed.
 - 2. Setting and securing anchor bolts and other metal items embedded in concrete into formwork, using materials and layouts furnished and delivered to jobsite as specified under other sections.
- B. Related Sections:
 - 1. Pertinent Sections of other Divisions specifying site concrete: Formwork for site concrete.
 - 2. Section 03 2000 - Concrete Reinforcing.
 - 3. Section 03 3000 - Cast-in-Place Concrete.
 - 4. Pertinent Sections of other Divisions specifying work to be embedded in concrete.
 - 5. Pertinent Sections of other Divisions specifying work penetrating concrete foundations and formwork.

1.02 REFERENCES

- A. ACI 347 "Recommended Practice for Concrete Formwork."
- B. American Plywood Association (APA).
- C. West Coast Lumberman's Association (WCLA).
- D. ACI SP-66 - ACI Detailing Manual; American Concrete Institute International
- E. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
- F. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement, 2005.
- G. AWS/ANSI/D1.4/D1.4M - American Welding Society (Structural Welding Code-Reinforcing Steel).
- H. California Building Code; California Code and Regulations, (CBC), Chapter 19
- I. CRSI (DA4) - Manual of Standard Practice; Concrete Reinforcing Steel Institute.

1.03 DESIGN REQUIREMENTS

- A. Design, engineer and construct formwork, shoring and bracing to conform to design and code requirements, resist imposed loads; resultant concrete to conform to required shape, line and dimension.

1.04 QUALITY ASSURANCE

- A. General: All form materials shall be new at start of work. Produce high quality concrete construction. Minimize defects due to joints, deflection of forms, roughness of forms, nonconforming materials, concrete or workmanship.

- B. Reuse of Forms: Plywood forms may be reused, if thoroughly cleaned of all dirt, mortar, and foreign materials, and undamaged at edges and contact face. Reuse shall be subject to permission from the Owner without exception, and issued in writing. Reuse of any panel which will produce a blemish on exposed concrete, will not be permitted.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Form Materials:
 - 1. Non-Exposed Surface Formwork Facing: Forms for concrete which is not exposed to view, may be of plywood as specified for exposed surfaces, or square edge 1" x nominal Douglas Fir, Construction Grade, S4S.
 - 2. Exposed Surface Formwork Facing:
 - a. Forms for all exterior and interior concrete flat surfaces unless otherwise specified as board formed shall be new Douglas Fir Plywood (APA) ply, 5/8-inch, B-B Plyform, Class 1, Exterior Type, oiled and edged and edge-sealed conforming to U.S. Product Standard PS 1-07 in large sheet sizes to achieve joint patterns shown.
 - b. All exposed concrete edges shall be chamfered 3/4" minimum or as noted on the drawings.
 - 3. Exposed Surface Formwork - Special Pattern Form Liner:
 - a. Forms for all exterior and interior concrete flat surfaces indicated shall be as designated by Owner.
- B. Earth Forms: Allowed, subject to soil standing in excavations without ravel or caving.
- C. Form Release Agent: Spray-on compound, not affecting color, bond or subsequent treatment of concrete surfaces. Maximum Volatile Organic Compound (VOC) content is 250 grams per liter.
- D. Accessories: Types recommended by manufacturers or referenced standards to suit conditions indicated;
 - 1. Anchors, spacers, void in-fill materials: sized to resist imposed loads.
 - 2. Form Ties: Prefabricated rod, flat band, or wire snap ties with 1" break-back or threaded internal disconnecting type with external holding devices of adequate bearing area. Ties shall permit tightening and spreading of forms and leave no metal closer than 1" to surface.
- E. Corner Chamfers and Rustications: Filleted, wood strip or foam type; sizes and shapes as detailed, or 3/4 x 3/4 inch size minimum if not detailed; maximum possible lengths.
- F. Nails, Spikes, Lag Bolts, Through Bolts, Anchorages: Sized as required, of sufficient strength and character to maintain formwork in place while placing concrete.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Inspect the substrate and the conditions under which concrete formwork is to be performed. Correct conditions detrimental to timely and proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected. Commencement of work indicates acceptance of substrates and conditions.
- B. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.02 EARTH FORMS

- A. If natural soil or compacted fill can be accurately cut and maintained, foundations and grade beams may be poured against earth without forming when requested by Contractor and approved by Owner. Provide positive protection of trench top corners.
- B. Maintain earth forms free of water and foreign materials.

3.03 ERECTION FORMWORK

- A. General: Construct formwork in accordance with calculations, and recommendations of Section 401 of ACI 347. Construct forms to the sizes, shapes, lines and dimensions shown, and as required to obtain accurate alignment, location, grades, level and plumb work in finished structure. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes.

3.04 FORM RELEASE AGENT

- A. Apply form release agent on formwork in accordance with manufacturer's recommendations.
- B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.
- C. Do not allow excess form coating material to accumulate in the forms or to come into contact with reinforcement or surfaces which will be bonded to fresh concrete.
- D. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork will be rejected.
- E. Leave no residue or stain on the face of the concrete, nor affect bonding of subsequent finishes or work specified in other sections.

3.05 INSERTS, EMBEDDED PARTS, AND OPENINGS

- A. Provide formed openings where required for items to be embedded in passing through concrete work.
 - 1. Provide openings in concrete formwork to accommodate work of other sections including those under separate contracts (if any). Size and location of openings, recesses and chases shall be in accordance with the section requiring such items. Accurately place and securely support items to be built into forms.
- B. Construction Joints: Construct and locate generally as indicated on Drawings and only at locations approved by Owner, so as not to impair the strength of the structure. Form keys in all cold joints shown or required.
- C. Locate and set in place items that will be cast directly into concrete.
- D. Rough Hardware and Miscellaneous Metal: Set inserts, sleeves, bolts, anchor, angles, and other items to be embedded in concrete. Set embedded bolts and sleeves for equipment to template and approved shop drawings prepared by trades supplying equipment.
- E. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.
- F. Wood Inserts and Nailers: Provide approved preservative-treated lumber. Set all required nailing blocks, grounds, and other inserts as required to produce results shown. Wood plugs shall not be used.
- G. Install accessories in accordance with manufacturer's instructions, so they are straight, level, and plumb. Ensure items are not disturbed during concrete placement.

- H. Piping: Do not embed piping in structural concrete unless locations specifically approved by Owner.
- I. Conduit: Place conduit below slabs-on-grade and only as specifically detailed on structural drawings. Minimum clear distance between conduits shall be 3 diameters. Location shall be subject to Owner's written approval and shall not impair the strength of the structure.
- J. Provide temporary ports or openings in formwork where required to facilitate cleaning and inspection. Locate openings at bottom of forms to allow flushing water to drain.
 - 1. Provide openings for the introduction of vibrators at intervals necessary for proper placement.
 - 2. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.
- K. Install Form Liner inserts in accordance with manufacturer's recommendations, to produce patterns and textures indicated.
- L. Install waterstops in accordance with manufacturer's recommendations to provide continuous waterproof barrier.

3.06 FORM CLEANING

- A. Clean forms as erection proceeds, remove foreign matter within forms.
- B. Clean formed cavities of debris prior to placing concrete.
 - 1. Remove all dirt, chips, sawdust, rubbish, water and foreign materials detrimental to concrete.
 - 2. Flush with water or use compressed air to remove remaining foreign matter. Ensure that water and debris drain to exterior through clean-out ports.

3.07 FOOTINGS

- A. Verify elevations and provide final excavation required for footings prior to placing of concrete.

3.08 EQUIPMENT BASES

- A. Form concrete bases for all mechanical and electrical equipment in accordance with approved shop details furnished by other sections.
- B. Sizes and locations as indicated and as required to produce results shown.
- C. Provide coved base for all equipment bases placed on concrete slabs.

3.09 FORMWORK TOLERANCES

- A. Construct formwork to maintain tolerances required by ACI 301.

3.10 FIELD QUALITY CONTROL

- A. Inspect erected formwork, shoring, and bracing to ensure that work is in accordance with formwork design, and to verify that supports, fastenings, wedges, ties, and items are secure.
- B. Do not reuse wood formwork more than 2 times for concrete surfaces to be exposed to view. Do not patch formwork.
- C. Clean and repair surfaces to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.
- D. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets.

3.11 FORM REMOVAL

- A. Do not loosen or remove forms before minimum curing period has elapsed without employment of appropriate alternate curing methods, approved by the Owner in writing.
- B. Remove forms without damage to the concrete using means to ensure complete safety of the structure and without damage to exposed beams, columns, wall edges, chamfers and inserts. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.
- C. Do not remove forms until the concrete has hardened sufficiently to permit safe removal and the concrete has attained sufficient strength to safely support imposed loads. The minimum elapsed time for removal of forms after concrete has been placed shall be as follows:
 - 1. Columns and Walls: 7 days, provided members are not subjected to overhead loads.
 - 2. Retaining Walls: 21 days minimum.
 - 3. Footings: 7 days minimum. If backfilled immediately, side forms may be removed 24 hours after concrete is placed.
 - 4. Beams, elevated slab, and similar overhead conditions: 28 days unless adequate shoring is provided.
- D. Durations listed above are minimums and are subject to extension at the sole judgment of the Owner.
- E. Reshoring: Reshore members where and if required by Owner.
- F. Elevated slabs with Camber: Submit measured elevations of completed work at the same locations as provided for formwork, within 7 days of removing forms.
- G. Do not subject concrete to superimposed loads (structure or construction) until it has attained full specified design strength, nor for a period of at least 14 days after placing.
- H. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

3.12 CLEANING

- A. Remove excess material and debris associated with this work from the job site.

END OF SECTION

SECTION 03 2000
CONCRETE REINFORCING

PART 1 GENERAL**1.01 SUMMARY**

- A. Section Includes:
 - 1. Reinforcing steel work for all concrete and masonry work as indicated on the drawings and specified herein.
 - 2. Coordinate this work with the other work affected by these operations, such as forms, electrical work, mechanical work, structural steel, masonry and concrete.
- B. Related Sections:
 - 1. Pertinent sections of Division 02 (32) specifying site concrete paving requiring reinforcement.
 - 2. Pertinent Sections of other Divisions specifying reinforcement, including, concrete, masonry, and rough carpentry.
 - 3. Pertinent sections of other Divisions specifying work to be embedded in concrete.
 - 4. Pertinent sections of other Divisions specifying work penetrating concrete work.

1.02 REFERENCE STANDARDS

- A. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International.
- B. ACI 315 - Manual of Standard Practice for Detailing Reinforced Concrete.
- C. ACI 318 - Building Code Requirements For Reinforced Concrete and Commentary; American Concrete Institute International.
- D. ACI SP-66 - ACI Detailing Manual; American Concrete Institute International.
- E. ASTM A185 - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete, 2005.
- F. ASTM A 615- Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
- G. AWS/ANSI/D1.4/D1.4M - American Welding Society, Structural welding code- for reinforcing steel.
- H. California Building Code, Chapter 19.
- I. CRSI (DA4) - Manual of Standard Practice; Concrete Reinforcing Steel Institute.

1.03 SUBMITTALS

- A. Shop Drawings: Show complete fabrication and placing details of all reinforcing steel. Comply with requirements of ACI SP-66. Include:
 - 1. Bar sizes and schedules;
 - 2. Shapes of bent bars, layout and spacing of bars, location of splices.
 - 3. Stirrup spacing, arrangements and assemblies.
 - 4. References to Contract Documents detail numbers and designations.
 - 5. Wall elevations corresponding to elevations shown in Contract Documents.
- B. Product Data: Submit manufacturer's product data, specifications, location and installation instructions for proprietary materials and reinforcement accessories

- C. Certificates: Submit all certifications of physical and chemical properties of steel for each heat number as manufactured, including location of material in structure as specified below in Article titled QUALITY ASSURANCE. All materials supplied shall be tagged with heat numbers matching submitted Mill Test Report analyses.
- D. Certification and Identification of Materials and Uses
 - 1. Provide manufacturer's Mill Test Reports for all materials. Include chemical and physical properties of the material for each heat number manufactured. Tag all fabricated materials with heat number.
 - 2. Provide letter certifying all materials supplied are from heat numbers covered by supplied mill certificates. Include in letter the physical location of each grade of reinforcing and/or heat number in the project (i.e. foundations, walls, etc.).

1.04 QUALITY ASSURANCE

- A. Perform work of this Section in accordance with CRSI (DA4), CRSI (P1), ACI 301, and ACI 318.
- B. Testing and Inspection: Tests and Inspections required by Independent Testing Agency are specified below in Articles SOURCE QUALITY CONTROL and FIELD QUALITY CONTROL.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver reinforcement to project site in bundles marked with durable tags indicating heat number, mill, bar size and length, proposed location in the structure and other information corresponding with markings shown on placement diagrams.
- B. Handle and store materials above ground to prevent damage, contamination or accumulation of dirt or rust.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Reinforcing Steel: Deformed billet steel bars, ASTM A706 Grade 60 or ASTM A615 Grade 60.
 - 1. Exception: Bars #3 and smaller shall be Grade 40 minimum, unless otherwise noted on the drawings.
 - 2. All reinforcement to be unfinished.
 - 3. ASTM A615 reinforcement at special structural concrete walls, concrete coupling beams, and special concrete moment frames shall have maximum yield stress of 78,000 psi and the tensile strength shall be greater than 125% of the actual yield strength. Test ASTM A615 reinforcement for conformance to these criteria prior to fabrication and/or installation.
- B. Tie Wire: No. 14 AWG or heavier, black annealed.
- C. Reinforcing Supports: Plastic or galvanized steel chairs, bolsters, bar supports, or spacers sized and shaped for adequate support of reinforcement and construction loads imposed during concrete placement, meeting ACI and CRSI standards.
 - 1. For use over formwork: Galvanized wire bar type supports complying with CRSI recommendations. Provide plastic tips where exposed to view or weather after removal of formwork. Do not use wood, brick, or other unacceptable materials.
 - 2. For slabs on grade: Supports with sand plates or horizontal runners where base material will not support chair legs.
- D. Concrete blocks: Slab-on-grade conditions only, as required to support reinforcing bars in position.

- E. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice, unless specifically shown otherwise. Details not specifically shown or indicated shall conform to ACI 315 and specified codes and standards.
 - 1. Accurately shop-fabricate to shapes, bends, sizes, gauges and lengths indicated or otherwise required.
 - 2. Bend bars once only. Discard bars improperly bent due to fabricating or other errors and provide new material; do not re-bend or straighten unless specifically indicated. Rebending of reinforcement in the field is not allowed.
 - 3. Do not bend reinforcement in a manner that will injure or weaken the material or the embedding concrete.
 - 4. Do not heat reinforcement for bending. Heat-bent materials will be rejected.
- F. Unacceptable materials: Reinforcement with any of the following defects will not be permitted in the work.
 - 1. Bar lengths, depths and bends exceeding specified fabrication tolerances.
 - 2. Bends or kinks not indicated on Drawings or final shop drawings.
 - 3. Bars with reduced cross-section due to rusting or other cause.
- G. Tag reinforcement with durable identification to facilitate sorting and placing.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Inspect the conditions under which concrete reinforcement is to be placed. Do not proceed with the work until unsatisfactory conditions have been corrected.
- B. Coordinate with work of other sections to avoid conflicts or interference. Bring conflicts between reinforcement and other elements to Owner's attention. Resolve conflicts before concrete is placed.
- C. Notify Owner for review of steel placement observation not less than 48 hours before placing concrete.

3.02 PLACEMENT

- A. General: Comply with the specified codes and standards, and Concrete Reinforcing Steel Institute recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.
- B. Clean bars free of substances which are detrimental to bonding. Maintain reinforcement clean until embedded in concrete.
- C. Place reinforcement to obtain the minimum coverages for concrete protection. Do not deviate from required position. Maintain required distance, spacing and clearance between bars, forms and ground.
- D. Location and Support: Provide metal chairs, runners, bolsters, spacers and hangers, as required.
- E. Provide additional steel reinforcement as necessary or as directed, to act as spreaders or separators to maintain proper positioning.
- F. Tying and Attachment: Securely tie at all intersections and supports with wire. Prevent dislocation or movement during placement of concrete. Direct twisted ends of wire ties away from exposed concrete surfaces.
- G. Separate reinforcing from pipes or conduits with approved non-metallic separators. Do not use wood or steel form stakes or reinforcement used as stakes as support for reinforcement.
- H. Accommodate placement of formed openings required by other sections.

- I. Obstructions:
 - 1. Where obstructions, block-outs or penetrations (conduits, raceways, ductwork) prevent continuous placement of reinforcement as indicated, provide additional reinforcing as detailed and as directed by the Owner to supplement the indicated reinforcement around the obstruction.
 - 2. Place additional trim bars, ties, stirrups, or other elements as detailed and as directed at all opening, sleeves, pipes or other penetrations through structural elements.
- J. Provide minimum 1-1/2 inch clearance between sets of splices. Stagger splices in horizontal bars so that adjacent splices will be 4 feet apart.
- K. Splices of reinforcement shall not be made at points of maximum stress. Provide splice lengths as noted on the structural drawings, with sufficient lap to transfer the stress between bars by bond and shear.
- L. Spacing:
 - 1. Space bars minimum distance specified and all lapped bars 2 bar diameters (minimum) clear of the next bar.
 - 2. Stagger splices of adjacent bars where possible and where required to maintain bar clearance.
 - 3. Beam or slab top bars shall be spliced mid-span of column support and bottom bars spliced at column supports.
 - 4. Request Owner review prior to placement for all splices not shown on the drawings.

3.03 Reinforcing Spacing and Coverage

- A. Spacing: Do not space bars closer than four (4) diameters of the largest of two adjacent bars, except at bar laps, which shall be placed such that a minimum of 2 bar diameters is clear between bars.
 - 1. Where reinforcing in members is placed in two layers, the distance between layers shall not be less than four bar diameters of the largest bar and the bars in the upper layers shall be placed directly above those in the bottom layer, unless otherwise detailed or dimensioned.
- B. Coverage of bars (including stirrups and columns ties) shall be as follows, unless otherwise shown:
 - 1. Footings and Mat Foundation: 3 inches to any soil face, 2 inches to top.
 - 2. Slabs (on grade): 2 inches to grade face, 1-1/2 inches to top face.
 - 3. Slabs (elevated): 1-1/2 inches top and bottom.
 - 4. Beam & Column: 1-1/2" inches to form.
 - 5. Walls: 1-1/2" clear to form and 2 inches clear to form at soil face.

3.04 DOWELS, SPLICES, OFFSETS AND BENDS

- A. Provide standard reinforcement splices at splices, corners, and intersections by lapping ends, placing bars in contact, and tightly tying with wire at each end. Comply with details shown on structural drawings and requirements of ACI 318.
- B. Provide minimum 1-1/2 inch clearance between sets of splices. Stagger splices in horizontal bars so that adjacent splices will be 4 feet apart.
- C. Laps of welded wire fabric shall be at least two times the spacing of the members in the direction lapped but not less than twelve inches.
- D. Splices of reinforcement shall not be made at points of maximum stress. Provide splice lengths as noted on the structural drawings, with sufficient lap to transfer the stress between bars by bond and shear.

E. Spacing:

1. Space bars minimum distance specified and all lapped bars 2 bar diameters (minimum) clear of the next bar.
2. Stagger splices of adjacent bars where possible and where required to maintain bar clearance.
3. Beam or slab top bars shall be spliced mid-span of column support and bottom bars spliced at column supports.
4. Request Owner review prior to placement for all splices not shown on the drawings.

3.05 WELDING

- A. No reinforcing shall be welded unless specifically indicated or without prior approval of the Owner.

3.06 CLEANING

- A. Remove excess material and debris associated with this work from the job site.

END OF SECTION

SECTION 03 3010
CAST-IN-PLACE CONCRETE

PART 1 GENERAL**1.01 SUMMARY**

- A. Section Includes:
1. Foundations, slabs-on-grade, and retaining walls.
 2. Installation of all bolts, inserts, sleeves, connections, etc. in the concrete.
 3. Joint devices associated with concrete work.
 4. Concrete curing.
 5. Coordination with other sections:
 - a. Make all preparations and do all work necessary to receive or adjoin other work. Install all bolts and anchors, including those furnished by other sections, into formwork and provide all required blocking.
 - b. Install all accessories embedded in the concrete and provide all holes, blockouts and similar provisions necessary for the work of other sections. Provide all patching or cutting made necessary by failure or delay in complying with this requirement at the Contractor's expense.
 - c. Coordinate with other sections for the accurate location of embedded accessories.
- B. Related Sections:
1. Pertinent Sections of other Divisions specifying site concrete: Formwork for site concrete.
 2. Section 03 1000 - Concrete Forming and Accessories.
 3. Section 03 2000 - Concrete Reinforcing.
 4. Pertinent Sections of Division 03 specifying concrete construction.
 5. Pertinent Sections of other Divisions specifying work to be embedded in concrete.
 6. Pertinent Sections of other Divisions specifying work penetrating concrete foundations and formwork.
 7. Pertinent sections of other Divisions specifying floor finishes and sealants applied to concrete substrates.

1.02 REFERENCES

- A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; ACI 211.2-Standard practice for selecting proportions for lightweight concrete; American Concrete Institute International.
- B. ACI 301 - Specifications for Structural Concrete; American Concrete Institute International.
- C. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International.
- D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International.
- E. ACI 305R - Hot Weather Concreting; American Concrete Institute International.
- F. ACI 306R - Cold Weather Concreting; American Concrete Institute International.
- G. ACI 308 - Standard Practice for Curing Concrete; American Concrete Institute International.
- H. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary; American Concrete Institute International.
- I. California Building Code, CBC, California Code of Regulations, Chapter 19, Concrete.

1.03 SUBMITTALS

- A. Product Data: Submit manufacturers' data on manufactured products and other concrete related materials such as bond breakers, cure/sealer, admixtures, etc. Demonstrate compliance with specified characteristics.
- B. Mix Designs: Submit Mix Designs for each structural concrete type required for work per requirements of articles CONCRETE MIXES and QUALITY ASSURANCE. Non-Structural mixes need not be submitted for review by Owner.
- C. Shop Drawings: Proposed location of construction and cold joints. Proposed location of all slab construction joints, dowel joints and blockouts.
- D. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction for concrete accessories.
- E. Batch Plant Certificates: Include with delivery of each load of concrete. Provide Certificates to the Owner as separate submittals. Concrete delivered to the site without such certificate shall be rejected and returned to the plant. Each certificate shall include all information specified in Article SOURCE QUALITY CONTROL below.
- F. Project Record Documents: Accurately record actual locations of embedded utilities and components that will be concealed from view upon completion of concrete work.
- G. Certification of Mix Design: Preparer to certify in writing that mix design meets:
 - 1. Requirements of the specifications for concrete durability and quality;
 - 2. Requirements of the California Building Code and ACI 318, Sections 5.2 to 5.5 including break histories, trial batching test results, and/or a mix designed by a California Registered Civil Engineer per ACI 318 Section 5.4 and bearing the Engineer's seal & signature.
- H. Indicate proposed location(s) of construction/cold/expansion joints on shop drawing submittals for review prior to placing concrete.

1.04 QUALITY ASSURANCE

- A. Perform work of this section in accordance with ACI 301 and ACI 318.
- B. Concrete construction verification and inspection to conform to CBC 1704.4.
- C. Common Sourcing: Provide each of the following materials from a single source for entire project.
 - 1. Cement.
 - 2. Fly ash.
 - 3. Aggregate.
- D. Follow recommendations of ACI 305R when concreting during hot weather.
- E. Follow recommendations of ACI 306R when concreting during cold weather.
- F. Services by the Independent Testing Agency (includes "Special" Inspections) as specified in this Section and as follows:
 - 1. Review mix designs and certifications. Provide letter authorized by Civil Engineer licensed in California recommending acceptance or rejection based upon conformance to specifications, and suitability of mix design for proposed use. Submit to Owner for review and final distribution.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Materials specified by brand name shall be delivered in unbroken packages bearing manufacturer's label and shall be brand specified or an approved equal.

- B. Delivery, Handling and Storage of other materials shall conform to the applicable sections of the various reference standards listed in this Section.
- C. Protect materials from weather or other damage. Sort to prevent inclusion of foreign materials.

PART 2 PRODUCTS

2.01 FORMWORK

- A. Comply with requirements of Section 03 1000.

2.02 REINFORCEMENT

- A. Comply with requirements of Section 03 2000.

2.03 MATERIALS

- A. General Requirements: All materials shall be new and best of their class or kind. All materials found defective, unsuitable, or not as specified, will be condemned and promptly removed from the premises.
- B. Cementitious Materials:
 - 1. Portland Cement: ASTM C150, Type II, low alkali conforming to CBC 1903A.2.
 - 2. Fly Ash (Pozzolan): ASTM C618, Class F.
- C. Concrete Aggregates:
 - 1. Coarse and Fine Aggregates: ASTM C33; Stone aggregate and sand. Specific source aggregate and/or sand or shrinkage characteristics as required for class of concrete specified.
 - 2. Lightweight aggregate: ASTM C330 and C332.
 - 3. Source shall remain constant throughout the duration of the job. The exact portions of the fine aggregates and coarse aggregates to be used in the mix shall be determined by the mix design.
- D. Water: Potable, clean, from domestic source.
- E. Admixtures: All admixtures shall be used in strict accordance with the manufacturer's recommendations. Admixtures containing calcium chlorides or other accelerators shall not be used without the approval of the Owner and the Owner's Testing Laboratory.

2.04 ACCESSORIES

- A. Bonding Agent: ASTM C 881, Type II Grade 2 Class B or C. Do not allow epoxy to set before placing fresh concrete.
 - 1. "Concresive Liquid LPL" by BASF;
 - 2. "Rezi-Weld 1000" by W.R. Meadows, or Approved Equal.
- B. Epoxy Bonding System: ASTM C 881, type as required by project conditions.
 - 1. "SET-XP Epoxy-Tie" by Simpson.
 - 2. "Hilti HIT-RE-500 SD" by Hilti, or Approved Equal.
- C. Chemical Hardener: Fluosilicate solution designed for densification of cured concrete slabs. "LAPIDOLITH" by BASF, "LIQUI-HARD" W.R. Meadows Co, or Approved Equal.
- D. Moisture-Retaining Cover: ASTM C 171, type 1, one of the following;
 - 1. Regular Curing Paper, Type I, reinforced waterproof: Fortifiber Corporation "Orange Label Sisalkraft", "Pabcotite" paper, or Approved Equal.
 - 2. Polyethylene Film: ASTM D 2103, 4 mil thick, clear or white color.
 - 3. White-burlap-polyethylene sheet, weighing not less than 10 oz/per linear yd.

- E. Liquid Curing Compound: ASTM C 309, Type 1, Class B, clear or translucent, 25% minimum solids, water base acrylic cure/sealer which will not discolor concrete and compatible with bonding of finishes specified in related sections. W.R. Meadows Co. "Vocomp 25", "Vocomp 30" or Approved Equal. Maximum Volatile Organic Compound (VOC) content is 350 grams per liter.
- F. Under Slab Water Vapor Retarder: Vapor retarder sheet to be ASTM E 1745 Class A; 15 mil, single ply extruded polyolefin; permeance less than 0.01 U.S. Perms per ASTM E154, ASTM E96 procedure B or ASTM F1249.
 - 1. "Stego Wrap Vapor Barrier (15mil)" by Stego Industries LLC.
 - 2. "Vaporguard" by Reef Industries.
 - 3. Approved Equal.
- G. Evaporation Reducer: "Confilm", by Master Builders.

2.05 JOINT DEVICES AND MATERIALS

- A. Waterstops: Resilient type, meeting Corps of Engineers CRD-C 572. Consult manufacturer for appropriate product for specific use. Install per manufacturers recommendation. Provide W. R. Meadows "Seal Tight" PVC waterstop, Sika "Greenstreak" PVC waterstop, or Approved Equal.
- B. Expansion Joint Filler: ASTM D 1751, Nonextruding, resilient asphalt impregnated fiberboard or felt, 3/8 inch thick and 4 inches deep; tongue and groove profile.
 - 1. Products: "Servicised Products", W.R. Meadows, Inc., "National Expansion Joint Company", "Celotex Corporation", or Approved Equal.
- C. Joint Filler: ASTM D 944, Compressible asphalt mastic with felt facers, 1/4 inch thick and 4 inches deep.
- D. Sealant and Primer: As specified in Section 07-9005.
- E. Slab Joint Sealant: Compatible with floor finishes specified in related sections.

2.06 CONCRETE MIXES

- A. General Requirements for Mix Design and Submittal of Structural Class Concrete:
 - 1. Contractor shall review mix designs and proposed placing requirements prior to submittal for compatibility to ensure that the concrete as designed can be placed in accordance with the drawings and specifications.
 - 2. Changes or Revisions require re-submittal: All variations to approved mix designs, including changing type and / or quantity of admixtures shall be resubmitted to the Owner for review prior to use.
 - 3. Clearly note on mix designs with specified maximum WCR if design permits addition of water on site, or clearly identify in the mix design that no water is to be added on site.
 - 4. Deviations: Clearly indicate proposed deviations, and provide written explanation explaining how the deviating mix design(s) will provide equivalent or better concrete product(s) than those specified.
 - 5. Include adjustments to reviewed mix designs to account for weather conditions and similar factors.
- B. Proportioning - General: The following provisions apply to all Mix Designs:
 - 1. Proportion concrete mixes to produce concrete of required average strength (as defined by California Building Code Section 1905).
 - 2. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301 and this section.
 - a. For trial mixtures method, employ independent testing agency acceptable to Owner for preparing and reporting proposed mix designs.

3. Placement Options: Mix Designs may, at the Contractor's option, be designed for either pump or conventional placement with aggregate size, slumps, etc. to be maintained as specified in this section.
- C. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations and this section.
- D. Special mix design requirements for interior concrete floor slabs on grade:
1. Proportion concrete mixes per this specification, ACI 211.1, and the requirements below:
 2. Minimum strength at 28 days to be 3000 psi; minimum strength at 56 days to be 4000 psi.
 3. Fly Ash Type F, shall be substituted for cement on a 1 lb. per 1 lb. basis, with a minimum replacement of 25% and a maximum of 35%.
 4. Total cementitious materials to exceed 6.1 sacks of cementitious material per 27 cubic feet (1 cubic yard).
 5. Water Cement Ratio (WCR): Maximum on-site 0.45.
 6. Coarse aggregates to be 1 in. x #4, per ACI 211.1, with the addition of 200 lbs. of 3/8(-) aggregate which shall be added to reduce total sand.
 7. Reduce Total Sand and blend sand to minimum practical. Blend sand 100 lb. maximum.
 8. Water reducing, and high slump water reducing, admixtures are to be based on cement content only, not total cementitious materials. Dosage may be increased for workability as long as set times are not excessive for placement and finishing.
- E. Mix Design Minimum Requirements:

Concrete Class	Coarse Aggregate Size (Inches) & Fine Aggregate ³	Maximum WCR or Maximum Nominal Slump & Tolerance (Inches) ^{1,2}	Minimum 28-Day Design Strength ⁴	Minimum Cement Sacks/per yd ⁴
NON-STRUCTURAL				
1) Lean Concrete	---	---	---	3.0
STRUCTURAL				
3) Interior Slab on Grade ⁵	1" x #4	WCR = .45	---	---
4) Foundation	1" x #4	WCR = .53	4,000	5.0

1. The tolerance is the maximum deviation allowable without rejection. The mix design shall be based on the nominal value specified and is without water reducing mixtures. Slump to be measured at the end of the hose.
2. The maximum water cement ratio (WCR) is limited at time of placement as noted. No water is to be added on site such that the specified WCR or maximum slump is exceeded without approval of the testing laboratory and the Owner. Workability is to be achieved utilizing an acceptable mid range to high range water reducing admixture.
3. Gradation of aggregate is per California Building Code (CBC), Chapter 19 Section 1903 and ASTM C33.
4. Minimum cement content as defined by California Building Code (CBC) Section 1905. See 56 day design strength and cementitious material requirement at slabs.
5. Interior Slabs on grade to be proportioned in accordance with detailed requirements in Article 2.6 titled CONCRETE MIXES.

2.07 MIXING CONCRETE

- A. Batch final proportions in accordance with approved mix designs. All adjustments to approved proportions, for whatever reason, shall be reviewed by the Owner prior to use.
- B. Batch and mix concrete in accordance with ASTM C-94, at an established plant
- C. Provide batch and transit equipment adequate for the work. Operate as necessary to provide concrete complying with specified requirements.
- D. Place mixed concrete in forms within 1-1/2 hours from the time of introduction of cement and water into mixer or 300 revolutions of the drum whichever comes first. Use of, re-mixing and/or tempering mixed concrete older than 1 hour will not be permitted.
- E. Do not add water at the site to concrete mixes with a maximum specified WCR unless the water content at batch time provides for a WCR less than specified and this provision, including the quantity of water which may be added at the site, is specifically noted on the Mix Design and Certification by the mix preparer. See ASTM C94 for additional requirements.

2.08 SOURCE QUALITY CONTROL

- A. Batch Plant Certificates: Contractor shall obtain the weighmaster's Batch Plant Certificate at arrival of truck at the site and verify mix design quantities and condition upon delivery to the site.
 - 1. Certificates to include: Date, time, ingredient quantities, water added at plant and on job, total mixer revolutions at time of placement, and time of departure.
 - 2. Concrete with specified water cement ratio: Add no water on site unless mix design and batch records each show additional water may be added. See ASTM C94 for additional requirements.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify lines, levels, and dimensions before proceeding with work of this section.
- B. Verify work of other sections is complete and tested as required before proceeding.

3.02 PREPARATION

- A. Observation, Inspection and Testing:
 - 1. Notify Owner not less than 48 hours (2 working days) before each concrete placement, for observation and review of reinforcing, forms, and other work prior to placement of concrete.
- B. Placement Records: Contractor shall maintain records of time, temperature and date of concrete placement including mix design and location in the structure. Retain records until completion of the contract. Make available for review by Owner.
- C. Coordinate placement of joint devices with erection of concrete formwork and placement of form accessories.
- D. Verify location, position and inclusion of all embedded and concealed items.
- E. Verify that installation of vapor retarder under interior slabs on grade as specified in related section, is complete.
- F. Cleaning and Preparation:
 - 1. Remove loose dirt, mud, standing water, and foreign matter from excavations and cavities.
 - 2. Close cleanout and inspection ports securely.
 - 3. Thoroughly clean reinforcement and other embedded items free from loose rust and foreign matter. Maintain reinforcing securely in place. Do not place concrete on hot reinforcing.

4. Dampen form materials and substrates on which concrete is to be placed at least 1 hour in advance of placing concrete; repeat wetting as necessary to keep surfaces damp. Do not saturate. Do not place concrete on saturated material.
 - a. Thoroughly wet wood forms (except coated plywood), bottom and sides of trenches, adjacent concrete or masonry and reinforcement.
 - b. Concrete slabs on base rock, dampen rock.
 - c. Concrete slabs on vapor retarder, do not wet vapor retarder.
5. Prepare previously placed concrete by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

3.03 PIPES AND CONDUITS IN CONCRETE

- A. Slabs-On-Grade:
 1. No pipe or conduit exceeding 1 inch outside diameter shall be embedded within the specified slab thickness except as specifically detailed.
 2. Do not stack or abut pipes, maintain 3 inches minimum clearance.
- B. Sleeving and Wrapping:
 1. Foundations: Sleeve or wrap all individual pipe penetrations, minimum 1-1/2 inches clear to reinforcing all around.
 - a. Sleeves: PVC. Provide 1 inch minimum clear all around O.D. pipe to I.D. sleeve, unless noted otherwise at ends, fill void space with mastic or plastic bituminous cement.
 - b. Wrapped Vertical Pipes: Provide 1/8 inch nominal sheet foam with three wraps minimum, Unless Noted Otherwise.
 - c. Wrapped Horizontal Pipes: Provide 1/8 inch nominal sheet foam with eight wraps minimum, Unless Noted Otherwise.
 - d. Underground Fire Lines 4" and Larger:
 - 1) Sleeves: Provide 2 inch minimum clear all around O.D. pipe to I.D. sleeve.
 - 2) Wrapped: Provide 1/8 inch nominal sheet foam with sixteen wraps minimum.
 2. Slabs or Curbs: Wrap pipes as described above.
- C. Space groups of pipes/conduits at least 3 sleeve diameters apart, do not interrupt specified concrete and reinforcement.
 1. Provide block-outs as detailed when grouping of pipes/conduits in foundation or other structural member prevents spacing as described. Notify Owner for review of any conditions not conforming to details.
 2. Center pipe/conduit penetrations in the depth and/or thickness of foundations.
 3. Maximum size of pipe/conduit penetrations shall not exceed the least dimension of concrete divided by 3.

3.04 CONCRETE PLACEMENT

- A. Transporting:
 1. Provide clean, well-maintained equipment of sufficient quantity and capacity to execute the work and produce concrete of quality specified.
 2. Handle and transport concrete from mixer to final deposit location as rapidly as practicable. Prevent separation or loss of ingredients.
- B. Perform concrete placement by methods which will not puncture, damage or disturb vapor retarder membrane. Repair all damage to vapor retarder membrane before covering.
- C. Placement - General: Placement, once started, shall be carried on as a continuous operation until section of approved size and shape is completed. Provide construction joints as detailed on the drawings. Owner's written approval required for all deviations.

D. Consolidation:

1. Consolidate all concrete thoroughly during placement with high-speed mechanical vibrators and other suitable tools. Perform manual spading and tamping to work around reinforcement, embedded fixtures, and into corners of formwork as required to obtain thorough compaction.
2. Consolidate each layer of concrete as placed.

3.05 CONCRETE JOINTS

A. Structural Joints (Construction/Cold Joints):

1. Locate joints only where shown, or as approved.
2. Clean and roughen all surfaces of previously placed concrete at construction joints by washing and sandblasting to expose aggregate to 1/4 inch amplitude.
3. Slabs-On-Grade: Maximum Length of continuous placement shall not exceed 60 feet without special review by the Owner. Alternate or stagger placement sections.
4. Foundations: Maximum Length of continuous placement shall not exceed 200 foot increments. Provide "keyed" shut-off locations made up with form boards. Extend reinforcing one lap length or more through shut-off.

B. Expansion/Construction Joints (Dowel Joints and Control Joints):

1. Interior and Exterior Floor Slabs-on-Grade: Provide dowel joints or control joints at a maximum dimension (in feet) of three times the slab thickness (in inches) in each direction unless noted otherwise. Install joints to match slab level and in straight lines. Locate joints at all reentrant corners including blockouts, and maintain maximum slab ratio of 2 to 1 length to width between slab joints.

C. Joint Types:

1. Dowel Joint: A keyed joint with smooth dowels passing through to allow unrestricted movement due to contraction and expansion. Joints are as shown on the drawings.
2. Control Joint(s): Shrinkage crack control joints may be of the following types when shown on the drawings. Install joints in a straight line between end points with edges finished appropriate to type. Fill joints with sealant as shown on the drawings or as required by related sections.
 - a. Two (2) inch deep x 1/4 inch wide troweled joint.
 - b. Keyed joint: Only at locations where concealed by other finishes.
 - c. Masonite Strip, 1/8 inch x 2 inch: Only at locations where concealed by other finishes.
 - d. Saw Cut, 1/8 inch x 2 inch deep: Must be performed within eight hours of completion of finishing. Do not make saw cuts if aggregate separates from cement paste during cutting operation. Prevent marring of surface finish. Fill with flexible sealant. As specified in section 07-9005

3.06 VAPOR RETARDER

- A. Vapor Retarder Installation: Install as specified in Article 2.4, ASTM E 1643 and per manufacturer's recommendations including taping and lapping of seams, sealing of penetrations, and repair of damage.
 1. Do not extend vapor retarder below footings.

3.07 FLATWORK

A. General Requirements for All Concrete Formed & Finished Flat:

1. Edge Forms and Screeds: Set accurately to produce indicated design elevations and contours in the finished surface, edge forms sufficiently strong to support screed type proposed.
2. Jointing: Located and detailed as indicated.
3. Consolidation: Concrete in slabs shall be thoroughly consolidated.

3.08 CONCRETE FINISHES

A. Flatwork Finishing:

1. Perform with experienced operators.
2. Finish surfaces monolithically. Establish uniform slopes or level grades as indicated. Maintain full design thickness.
3. In areas with floor drains, maintain design floor elevation at walls; slope surfaces uniformly to drains as indicated on drawings.
4. Flatwork Finish Types:
 - a. Steel Trowel Finish: Surfaces to receive carpeting, resilient flooring, seamless flooring, thin set terrazzo, thin set tile or similar finishes specified in related sections. Trowel twice, minimum.
 - b. Broom Texture Finish: Exterior surfaces as indicated or for which no other finish is indicated. Finish as for steel trowel finish, except immediately following first troweling, (depending on conditions of concrete and nature of finish required) provide uniform surfaces texture using a medium or coarse fiber broom.

3.09 TOLERANCES

- A. Minimum Flatwork Tolerances: Measure flatness of slabs within 48 hours after slab installation in accordance with ACI 302.1R and ASTM E1155 and to achieve the following FF and FL tolerances:
 1. Exterior surfaces: 1/8 inch minimum per foot where sloped to drain. Level otherwise. FF 20 and FL15.
 2. Interior surfaces not otherwise shown or required: Level throughout. FF25 and FL20
 3. Interior surfaces required to be sloped for drainage: 1/8 inch in 10 ft.
 4. Finish concrete to achieve the following tolerances:
 - a. Under Glazed Tile on Setting Bed: FF 30 and FL 20.
 - b. Under Resilient Finishes: FF 35 and FL 25.
 - c. Flooring manufacturer and pertinent section of Division 9.

3.10 CONCRETE CURING

- A. Curing - General: Cure in accordance with ACI 308. Maintain concrete water content for proper hydration and minimize temperature variations. Begin curing immediately following finishing.
- B. Protection During Curing: Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury. The Contractor is responsible for the protection of the finished slab from damage.
- C. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete for not less than 7 days.
- D. Surfaces Not in Contact with Forms:
 1. Start initial curing as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
 2. Begin final curing after initial curing but before surface is dry.
 - a. Moisture-retaining cover: Seal in place with waterproof tape or adhesive.
 - b. Curing compound: Apply in two coats at right angles, using application rate recommended by manufacturer.
- E. Flatwork on Grade: Cure by one of the following methods:
 1. Water Cure (Ponding): Maintain 100 percent coverage of water over floor slab areas, continuously for minimum seven (7) calendar days.
 2. Spraying: Spray water over floor slab areas and maintain wet for 7 days.
 3. Moisture-Retaining Film or Paper: Lap strips not less than 6 inches and seal with waterproof tape or adhesive; extend beyond slab or paving perimeters minimum 6 inches and secure at edges; maintain in place for minimum seven (7) days.

4. Absorptive Moisture-Retaining Covering: Saturate burlap-polyethylene and place burlap-side down over floor slab areas, lapping ends and sides and extend beyond slab or paving perimeters 6 inches minimum; maintain in place for minimum seven (7) days.
5. Liquid Membrane-forming Curing Compound: Provide only when subsequent concrete treatments or finish flooring specified in related sections will not be affected by cure/sealer. Apply curing compound in accordance with manufacturer's instructions at the maximum recommended application rate in two coats, with second coat applied at right angles to first.

F. Foundations: Apply curing compound immediately after floating.

3.11 CONCRETE HARDENER

- A. Apply hardener to all floor slabs not receiving other finishes after 30 days minimum curing. Clean slabs of non-compatible cure/sealers or other foreign material(s) and apply in strict accordance with the manufacturer's directions.

3.12 GROUTING AND DRY PACK

- A. Set steel plates on concrete or masonry with high strength grout bed, completely fill all voids; thoroughly compact in place.
- B. Bolts or inserts dry packed or grouted in place shall cure for minimum seven (7) days before tensioning.

3.13 DEFECTIVE CONCRETE

- A. Defective Concrete: Concrete not conforming to required compressive strength, lines, details, dimensions, tolerances, finishes or specified requirements; as determined by the Owner.
- B. Repair or replacement of defective concrete will be determined by the Owner who may order additional testing and inspection at its option. The cost of additional testing shall be borne by Contractor when defective concrete is identified.
- C. Repair minor defective surface defects by use of drypack and surface grinding. Specific written approval of Owner is required. Submit proposed patching mixture and methods for approval prior to commencing work.

3.14 CLEANING

- A. Maintain site free of debris and rubbish. Remove all materials and apparatus from the premises and streets at completion of work. Remove all drippings, leave the entire work clean and free of debris.
- B. Slabs to Receive Floor Finishes Specified in other sections: Remove non-compatible cure/sealers or other foreign material(s) which may affect bonding of subsequent finishes. Leave in condition to receive work of related sections.

3.15 PROTECTION

- A. Protect completed work from damage until project is complete and accepted by Owner.

END OF SECTION

SECTION 03 3519
CONCRETE COLOR ADDITIVE

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Requirements For Color Additive Used In:
 - 1. Cast-in-place concrete specified in Section 03 3010
- B. Requirements For Colored Stains Used On:
 - 1. Cast-in-place concrete specified in Section 03 3010.

1.02 RELATED SECTIONS

- A. Section 07 9005 - Joint Sealers: Colored sealants for joints.

1.03 REFERENCES

- A. ASTM C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
- B. ASTM C 979 - Standard Specification for Pigments for Integrally Colored Concrete.

1.04 SUBMITTALS

- A. Product Data: Manufacturer's specifications and instructions for pigments and curing compounds.
- B. Samples for Pigment Color Selection: Pigment manufacturer's color chart or sample chip set; indicate pigment number and required dosage rate. Submit standard, and premium color lines.
- C. Samples for Verification of Pigment Color: Sample chips of specified colors indicating pigment numbers and required dosage rates. Submittals are for general verification of color and may vary somewhat from concrete finished in field according to specifications.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Pigments: Comply with manufacturer's instructions. Deliver pigments to site or batch plant in original, unopened packaging. Store in dry conditions.

1.06 PROJECT CONDITIONS

- A. Plant-Mixed Concrete: Schedule delivery of concrete to provide consistent mix times from batching until discharge.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Acceptable Manufacturers - Concrete Color Additives:
 - 1. Davis Colors; 3700 E. Olympic Boulevard, Los Angeles, CA 90023. T: (800) 356-4848 or (323) 269-7311. F: (323) 269-1053, www.daviscolors.com
 - 2. L. M. Scofield Co., 6533 Bandini Blvd., Los Angeles, CA 90040, T: (323) 720-3000, F:(323) 720-3030, www.scofield.com
- B. Or Approved Equal

2.02 COLORS

- A. Concrete Floors - Section 03010:
 - 1. Cement: Type specified in Section 03 3010.
 - 2. Color Stain: Custom Color to match Owner's selection

- a. Allow for number of different pigment colors indicated.
3. Color Additive: Color to be selected by Owner
 - a. Allow for number of different pigment colors indicated.

2.03 MATERIALS

- A. Colored Concrete Additive: Pure, concentrated mineral pigments especially processed for mixing into concrete and complying with ASTM C 979.
 1. Base dosage rates on weight of portland cement, fly ash, silica fume, lime and other cementitious materials but not aggregate or sand.
- B. Admixtures: Do not use calcium chloride admixtures.
- C. Concrete Color Stain: Water based Acrylic Sealer and Cure, "Consov Acid Stain" by Conrad Sovig Inc. San Francisco, CA, (415) 863-3809. Or Approved Equal.
 1. Water based acid solution of metallic salts, available in 6 basic colors.
- D. Curing Compound for Colored Concrete: type as recommended by pigment manufacturer; complying with ASTM C 309.
- E. Sealant for Color Stain: Water based Acrylic Sealer and Cure, "KonSeal Clear" by Conrad Sovig.
 1. Acrylic Emulsion Polymer, non-yellowing, minimum 25% solids by weight, clear transparent sheen when cured.

2.04 MIXES

- A. Concrete Mix: Mix pigments in accordance with manufacturer's instructions, until pigments are uniformly dispersed throughout mixture and disintegrating bags, if used, have disintegrated.

PART 3 EXECUTION

3.01 FORMED SURFACES

- A. Stripping: Leave forms in place as long as practical. Remove forms when concrete has reached a consistent age to maintain uniformity of curing conditions throughout Project.

3.02 FLOORS AND PAVING

- A. Broomed Finish (exterior flat work): Do not dampen brooms.
- B. Trowel Finish: Do not over-trowel or start troweling late.

3.03 PATCHING CONCRETE

- A. Fill holes and defects in concrete surface within 48 hours of form removal.
- B. Make patches with a stiff mortar made with materials from the same sources as the concrete. Adjust mortar mix proportions so dry patch matches dry adjacent concrete. Add white cement to mortar mix if necessary to lighten it.

3.04 CURING CONCRETE

- A. Maintain concrete between 65 and 85 F degrees during curing.
- B. Cure concrete using curing compound; apply curing compound in accordance with manufacturer's instructions.

3.05 TOLERANCES

- A. Minor variations in appearance of colored concrete/mortar, which are similar to natural variations in color and appearance of unpigmented concrete/mortar, are acceptable.

END OF SECTION

DIVISION 5
METALS

SECTION 05 5000
METAL FABRICATIONS

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. All miscellaneous metal work not classified as structural steel.
- B. Iron and steel work for wood framing, including bracing.
- C. Inserts and anchorages: Furnish only, inserts and anchoring devices for installation of miscellaneous metal work. Provide setting drawings, templates, instructions and directions for installation of anchorage devices. Coordinate delivery with other work.
- D. Miscellaneous nonferrous metal items not specifically specified under other Sections of Specifications.
- E. Fabrication and installation of metal work, including shop and field welding, drilling, cutting, connecting and shop painting.
- F. Miscellaneous shapes, plates, angles, clip angles, supports, bolts, and specialty iron and steel items indicated and as necessary to complete the work, including, but not limited to, the following:
 - 1. Metal handrails, railings, guardrails.
 - 2. Pipe sleeves.
 - 3. Fences, gates and enclosures.
 - 4. Miscellaneous sunshades, brackets, canopies.
 - 5. Decorative grilles, trusses, and architectural features.
 - 6. Pipe bollards.

1.02 RELATED REQUIREMENTS

- A. Section 03 3000 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Division 06 Sections: Installation of anchorage and support items. Framing connectors for wood framing.
- C. Section 07 6200 - Sheet Metal Flashing and Trim
- D. Section 08 1100 - Steel Doors and Frames
- E. Section 08 3323 - Overhead Rolling Doors
- F. Section 08 7100 - Door Hardware
- G. Section 09 9000 - Paints and Coatings: Paint finish systems and required level of finish for substrates.
- H. Section 10 2233 - Accordion Folding Partitions
- I. Other sections requiring metal fabrications or referencing this section for fabrication and installation.
- J. Pertinent Division 22, 23 and 26 sections: Sleeves and inserts for mechanical piping and ducts, and electrical conduit, bracing and support of mechanical and electrical equipment:

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.

- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- D. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- E. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
- F. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
- G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- H. AHDGA - American Hot Dip Galvanizing Association.
- I. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society.
- J. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society.
- K. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings.
- L. SSPC (PM2) - Painting Manual, Vol. 2, Systems and Specifications; Steel Structures Painting Council.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.
 - 1. Include details of cuts, connections, camber, holes, and other pertinent data.
 - 2. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths, sizes and types.
- B. Product Data:
 - 1. Catalog cuts for all manufactured items demonstrating compliance with specified requirements.
 - 2. Structural steel primer paint.
- C. Welding procedures: For welding structural steel as required in accordance with AWS D1.1, submit prequalified joints.
- D. Certification: Copy of approved fabricator's license.
- E. Manufacturer's data: Submit certified copies of the following prior to any fabrication. Include laboratory test reports and other data as required to show compliance with these specifications, including specified standards.
 - 1. Structural steel, including certified copies of mill reports covering the chemical and physical properties.
 - 2. Unfinished bolts and nuts.

1.05 QUALITY ASSURANCE

- A. Design criteria: Design, fabricate and erect miscellaneous metal items complete, in accord with AISC's Design, Fabrication and Erection of Structural Steel for Buildings.
- B. Welders:
 - 1. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

2. Provide certification that welders to be employed in the work have satisfactorily passed AWS qualification tests within the previous 12 months, and are qualified in the State of California.
- C. Welding Inspection: All structural welding shall be specially inspected according to CBC 1704A except as otherwise provided below.
 1. Special inspection shall not be required if welding is done in an approved fabricator's shop licensed in accordance with CBC 1704A.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General: Furnish new tested stock complying with reference specifications.
- B. Steel Sections: ASTM A36/A36M.
- C. Steel Tubing: Hot formed, welded or seamless, ASTM A 501, or cold-formed, ASTM A500, Grade B cold-formed.
- D. Plates: ASTM A283.
- E. Pipe: ASTM A53/A53M, Grade B Schedule 40, black and hot-dip galvanized finish, as indicated.
- F. Bars and bar-size shapes: ASTM A 663, Grade 65, or ASTM A 36.
- G. Sheets: ASTM A 446 with zinc-coating in accord with ASTM A 525, G-90.
- H. Hot-rolled carbon steel bars and bar-size shapes: ASTM A 575, Grade as selected by fabricator.
- I. Steel plate, checkered pattern: Steel with checkered (diamond) pattern, galvanized, ASTM A 525, coating designation G90.
- J. Carbon steel sheets and strips:
 1. Hot-rolled: ASTM A 568 and ASTM A 569, pickled and oiled.
 2. Cold-rolled: ASTM A 366.
 3. Galvanized sheets: ASTM A 525, or A 526 with G-90 zinc coating
- K. Sunscreen Grating: Pultruded Fiberglass, "Series T-3300 2 inch" available from Duradek - Fiberglass Walkway and Platform Systems, Division of AFC, Inc. Chatfield, Minnesota, 1-800-654-2498, www.strongwell.com. Alternate Supplier; McNichols Co., Hayward CA. Or Approved Equal
 1. Flange Shape: "I";
 2. Width of Top Flange: 1 inch;
 3. Width of Open Space: 0.5 inch;
 4. Percent Open Area: 33%;
 5. Approx. Weight: 4 lbs./sq.ft.;
 6. Finish: Fire retardant isophthalic polyester resin with antimony trioxide added, meeting Class 1 flame spread rating of ASTM E-84 and self extinguishing requirements of ASTM D-635 with UV Coating, with anti-skid texture. Colors selected by Owner from manufacturer's standards.
 7. Anchorage: Saddle clips, stainless steel, with stainless steel bolts.
- L. Masonry anchorage devices: Expansion shields, FS FF-S-325.
- M. Toggle bolts: Tumble-wing type, FS FF-B-588, type, class and style as required.
- N. Fasteners: Select fasteners for type, grade and class required for the installation of miscellaneous metal items, compatible for material in contact. Provide hot-dipped galvanized at exterior exposures or when in contact with pressure-treated wood materials..
- O. Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, galvanized to ASTM A153/A153M where connecting galvanized components.

1. Standard bolts and nuts: Regular square or hexagon head type, ASTM A 307, Grade A.
 2. Lag bolts: Square head type, galvanized.
 3. Machine screws: Cadmium-plated steel, ASTM F 468 and FS FF-S-92.
 4. Plain washers: ANSI B18.22.1 and FS FF-W-92.
 5. Anchors: Manufactured by Ramset Fastening System Division, Olin Corp., Rawlplug Co., Diamond Division, General Cable, Hilti or ITT Phillips Drill Division. Provide type best suited for intended application and indicate on shop drawings.
 6. Lock washers: FS FF-W-84, helical spring type carbon steel.
 7. Anchor Bolts: ASTM A307.
- P. Brackets, flanges and anchors: Cast or formed metal of the same type material and finish as supported rails, unless otherwise indicated.
- Q. Concrete inserts: Threaded or wedge type, galvanized ferrous castings, either malleable iron ASTM A 47 or cast steel ASTM A 27. Provide bolts, washers and shims as required, hot-dip galvanized, ASTM A 153.
- R. Welding Materials: AWS D1.1; type required for materials being welded. Comply with AWS D1.1, D1.3 and CBC Title 24 Part 2.
- S. Non-shrink Grout for Guardrail post inserts: Masterflow 928 Grout by Master Builders. Or Approved Equal
- T. Zinc-rich paint (cold galvanizing): ZRC-221 by ZRC WorldWide. Or Approved Equal
- U. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction, compatible with intermediate and finish coatings specified in other Sections. Or Approved Equal
- V. Touch-Up Primer for Galvanized Surfaces: ZRC Zero-VOC by ZRC Worldwide, compatible with intermediate and finish coatings specified in other Sections. Or Approved Equal.

2.02 FABRICATION

- A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of the work. Allow for trimming and fitting where field conditions preclude accurate measurements or where final dimensions cannot be established prior to fabrication.
- B. Fit and shop assemble items in largest practical sections, for delivery to site.
1. Minimize field splicing and site assembly. Disassemble only to the extent necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.
 2. Complete assembly, including welding, before start of finishing operations. Provide finish surfaces of members exposed in the final structure free of markings, burrs, and other defects.
 3. Use materials and items necessary to complete the work, using the best materials and methods ordinarily used for this type of work whether explicitly specified, indicated and detailed or not.
- C. Fabricate items with joints tightly fitted and secured.
- D. Machine-roll components or elements required to be curved or radiused. Do not field bend or "walk-down". Provide curves true to indicated dimensions, minimizing joints; segmented fabrication not allowed unless specifically noted.
- E. Continuously seal joined members by continuous welds.
1. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

2. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
 3. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.
- F. Use only materials smooth and free of blemishes including pitting, seam marks, roller marks, trade names and roughness.
- G. Fabricate steel members in accordance with drawings and as recommended by A.I.S.C. Verify all dimensions with field conditions prior to fabrication.
1. Clean, prepare and shop-prime steel members. Do not prime surfaces to be field welded or in direct contact with concrete.
 2. Galvanizing: ASTM A153, ASTM A123; all steel exposed to weather.
 3. Cutting and drilling: Provide holes for fabrication and for attachment of work specified elsewhere. Countersink holes for bolts and screws.
- H. Welding: Comply with the AWS Structural Welding Code, and with the following:
1. Welds shall be free from excessive oxides, nonmetallic inclusions, and gas pockets.
 2. Welds shall be uniform in section, smooth in weld metal, feather edged, without overlaps.
 3. Surfaces to be welded shall be free from loose scale, rust, paint, or other foreign matter.
 4. Tack welds located in way of design welds shall be melted out when encountered in final welding, or shall be thoroughly fused in with final weld.
 5. Use proper care and procedures to minimize locked-in stress and distortion.
 6. Welder qualification requirements, welding procedure and welding electrodes shall conform to CBC 2204 and AWS D1.1, D1.3; CBC IR-17-3.

2.03 METAL FENCES, HANDRAILS, and RAILINGS

- A. Steel pipe or tube fences,, handrails, and railings: Fabricate to dimensions and details shown, with welded joints ground smooth and flush. Hot-dipped galvanized at exterior locations.
1. Fabricate and install to comply with requirements of ASTM E985 for structural performance based on testing performed in accordance with ASTM E894 and E935.
 2. Structural Performance: Handrails and top rails shall withstand the following structural loads:
 - a. Concentrated Load: 200 lbs., applied non-concurrently, in any direction.
 - b. Uniform Load:50 lb/ft. applied simultaneously in both vertical and horizontal direction.
 - c. Concentrated loads and uniform loads need not be assumed to act concurrently.
 3. Picket and grille spacing, fences: Fabricate fence pickets and grillework so that all openings in the finished fence are less than 3.5 inches or greater than 9 inches, including the opening between the bottom rail and the finish grade.
 4. Shop fabricate to greatest extent possible.
 5. Interconnect railing members by butt-welding or by welding with internal connectors, unless otherwise indicated.
 6. At tee and cross intersections, notch ends of intersection members to fit contour of pipe and weld all around.
 7. Form changes in direction of railing members by radius bends, maintaining cylindrical cross-section of pipe throughout bend without buckling, twisting, cracking or otherwise deforming exposed surface of pipe.
 8. Provide galvanized inserts for concrete paving for attachment of rails, where occurs.

2.04 GATES

- A. Fabrication: Fabricate perimeter frames of gates from steel tubing as specified for fences. Finish to match fence panels. Assemble gate frames by welding at corners.
1. Gate frames: Infill with panels or pickets to match adjacent fence.

- B. Swinging Gate Hardware: Provide all hardware necessary for a complete, operational gate assembly, sizes and types recommended by manufacturer to suit conditions indicated, galvanized and shop finished to match adjacent gate components.
1. Hinges: Brass washer leaf hinges: 7 inch ball bearing hinges for medium and heavy gates. Provide two hinges for each leaf up to 6 foot nominal height, and one additional hinge for each additional 24 inches in height, or fraction thereof.
 2. Balance of hardware specified in Section 08 7100 - Door Hardware.

2.05 FABRICATED ITEMS

- A. Green Screen: ECO-MESH as manufactured by McNichols
1. 9 gage woven wire mesh screen, 1 1/2"x 1-1/2", with .105 bridge wire for stabilization
 2. Screen framed on four sides with 16 gauge 2" galvanized metal channel
 3. Powder coated finish

2.06 FINISHES - STEEL

- A. Hot-dip galvanize steel items fully or partially exposed to exterior conditions or to wet environments such as custodial or toilet rooms. Prime paint steel items in all other locations.
1. Exceptions: Galvanize items to be embedded in concrete or masonry.
 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2 SSPC SP-3, "Power Tool Cleaning", minimum. Remove oil, grease and similar contaminants in accordance with SSPC SP-1 "Solvent Cleaning".
1. Review coating systems specified in other Sections. Provide level of substrate surface finish required or recommended by coating manufacturer for each specified system.
- C. Prime Painting: One coat, primer in accordance with the coating manufacturer's printed instructions. Select products compatible with coating systems specified in other Sections.
- D. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

2.07 FABRICATION TOLERANCES

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field conditions are acceptable and are ready to receive work. Correct conditions detrimental to the proper and timely performance of this work before proceeding with installation. Commencement of work indicates acceptance of substrates.

3.02 PREPARATION

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

3.03 INSTALLATION

- A. Install items plumb and level, measured from established lines and levels, accurately fitted, free from distortion or defects.
- B. Provide temporary bracing or anchors in formwork for items which are to be built into concrete or similar construction.
- C. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal items to in-place construction; including threaded fasteners for concrete inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.
- E. Cutting and fitting:
 - 1. Perform cutting, drilling and fitting required for installation of miscellaneous metal items. Fit exposed connections accurately together to form tight hairline joints.
 - 2. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations.
 - 3. Do not weld, cut or abrade the surfaces of exterior units which have been hot dip galvanized after fabrication, and are intended for bolted or screwed field connections.
- F. Perform field welding in accordance with AWS D1.1/D1.1M.
- G. Obtain approval from Owner prior to site cutting or making adjustments not scheduled.
- H. Immediately after erection, clean and prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete with the same materials used for shop finishing.
- I. Steel Pipe or Tube Fences and Railings: Plumb posts in each direction.
 - 1. Anchor posts in concrete by means of galvanized steel pipe sleeves, not less than 6" long, with an outside diameter not less than 1/2" greater than the outside diameter of the inserted pipe post. Provide steel plate closure secured to bottom of sleeve of width and length not less than 1" greater than outside diameter of sleeve. After posts have been inserted into sleeves, fill annular space between post and sleeve solid with non-shrink, non-ferrous grout.
 - 2. Anchor rail ends into masonry with steel round flanges welded to rail ends and anchored into wall construction with lead expansion shields and bolts.
 - 3. Secure handrails to walls using wall brackets, and wall return fittings at handrail ends. Provide brackets with not less than 3" projection from finish wall surface to center of pipe handrail, and with wall plate portion of bracket drilled to receive one 3/8" bolt. Locate brackets at not more than 5 ft. o.c. Provide flush-type wall return fittings with same projection as that specified for wall brackets. Secure brackets and return fittings as follows:
 - a. Wood framing: Use lag screws.
 - b. Steel Framing: Stainless steel threaded self- tapping screws.
 - c. Masonry or Concrete: Stainless steel threaded tap-in anchor bolts.
- J. Gates: Install gates plumb, level, and secure for full opening without interference. Anchor ground-set items in concrete. Adjust hardware for smooth operation and lubricate where necessary.
- K. Sunscreen Grating Installation:
 - 1. Install components in accordance with manufacturer's instructions "Field Fabrication Guide" and applicable portions of referenced standards for metal gratings.
 - 2. Place sunscreen frames and brackets in correct position, plumb and level. Anchor securely to substrates with suitable fasteners.

3. Mechanically cut fiberglass finish surfaces. Do not flame cut. Field treat cut ends with manufacturer's recommended resin sealer.
4. Anchor by bolting through saddle clips.
5. Secure to prevent movement.

3.04 TOLERANCES

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

3.05 PROTECTION

- A. Repair and replacement: In the event of damage, immediately make repairs and replacements necessary to satisfaction of Owner without change in contract sum or time.

3.06 CLEAN-UP

- A. When work of this section has been completed, and at such other times as may be directed, remove all trash, debris, surplus materials, tools and equipment from site.

END OF SECTION

**SECTION 05 5500
STAIR NOSINGS**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Single component stair nosings.

1.02 RELATED SECTIONS

- A. Section 03 3000 - Concrete.

1.03 REFERENCES

- A. ATBCB ADAAG - Americans with Disabilities Act Accessibility Guidelines; U.S. Architectural and Transportation Barriers Compliance Board.
- B. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- C. ASTM B 221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric).

1.04 PERFORMANCE REQUIREMENTS

- A. Comply with ADAAG requirements for non-slip stair surfaces.
- B. Provide stair nosings that are anchored permanently to stair structure.

1.05 SUBMITTALS

- A. Product Data: Manufacturer's specifications and technical data, including installation instructions, and catalog cuts and templates.
- B. Shop Drawings: Show complete fabrication details for all stair nosings, including required anchorage to surrounding construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Balco, Inc; P.O. Box 17249, Wichita, KS 67217-0249. ASD. Tel: (800) 767-0082 or (316) 945-9328. Fax: (316) 945-0789; Email: info@balcousa.com. www.balcousa.com.

2.02 MATERIALS

- A. Aluminum: ASTM B 221 (ASTM B 221M), alloy 6063-T5 for extrusions, mill finish, with clear acrylic lacquer coating on surfaces to be embedded in concrete.
- B. Abrasive Surfaces: Two-part epoxy combined with aluminum oxide grit.
 - 1. Color: C-10 Black (Standard).
- C. Fasteners and Anchors: Manufacturer's standard connection devices, as appropriate to substrate.

2.03 MANUFACTURED STAIR NOSINGS

- A. Single Component Nosings: Aluminum nosings with embedded abrasive treads. Balco Model R-300.
 - 1. Type: Anchored to substrate.
 - 2. Abrasive Treads: Solid.
 - 3. Width: 1 in.

2.04 FABRICATION

- A. Fabricate stair nosings in greatest widths possible, to minimize joints. Where joints are necessary, arrange symmetrically and outside of major traffic patterns.
- B. Package components with all necessary anchors for proper installation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine conditions under which work is to be performed and notify Owner of unsatisfactory conditions in writing. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to the installer.

3.02 INSTALLATION

- A. Install stair nosing components in accordance with governing regulations, industry standards applicable to the work, and the manufacturer's written installation instructions.
- B. Anchor stair nosings securely to substrate using fasteners and accessories as furnished or recommended by manufacturer, aligning components to be level, plumb, square, and flush with adjacent surfaces as required.

3.03 ADJUSTING AND PROTECTION

- A. Inspect stair nosings for proper size and fit. Adjust, repair or replace components not conforming to requirements. Repair or replacement of an individual unit shall be as approved by the Owner.
- B. Protect installation from damage by work of other Sections.

END OF SECTION

DIVISION 6
WOOD, PLASTICS, AND COMPOSITES

SECTION 06 2000
FINISH CARPENTRY

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Finish carpentry items.
- B. Interior and exterior wood trim;
- C. Wood casings and moldings.
- D. Hardware and attachment accessories.

1.02 RELATED SECTIONS

- A. Section 06 4100 - Architectural Wood Casework: Shop fabricated custom cabinet work.
- B. Section 08 1416 - Flush Wood Doors.
- C. Section 09 7200 - Wall Covering: Shimming behind wood trim adjacent to tackwall.
- D. Section 09 9000 - Paints and Coatings: Painting and finishing of finish carpentry items, back-priming of finish carpentry.

1.03 REFERENCE STANDARDS

- A. ASTM Standards: A153, A165, D 226
- B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards.
- D. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.9).
- E. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce).
- F. West Coast Lumber Inspection Bureau (WCLIB): "Standard Grading and Dressing Rules No. 16".
- G. Architectural Woodwork Standards (AWS), published jointly by the Woodwork Institute, Architectural Woodwork Institute, and the Architectural Woodwork Manufacturer's Association of Canada.
- H. USGBC LEED-NC - LEED Green Building Rating System for New Construction and Major Renovations; U.S. Green Building Council; 2009.

1.04 SUBMITTALS

- A. Mill grade certificate, if material cannot be marked on a concealed surface.
- B. Samples of materials for making stain and transparent finish samples.
 - 1. Following review, provide samples to other Sections for application of finishes.
- C. Samples: Submit two samples of finish plywood, 8x10 inch in size illustrating wood grain and specified finish.
- D. Samples: Submit two samples of each wood trim profile, 12 inch long.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with Woodwork Institute Manual of Millwork, Custom grade.
- B. Factory-mark each piece of lumber and plywood with type, grade, mill and grading agency identification; except omit marking from surfaces to receive transparent finish.
- C. All sealants and adhesives used within the interior of the building shall meet the low VOC requirements of USGBC LEED-NC v2009 IEQ Credit 4.4

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Wood: Store indoors, in well ventilated area at maximum relative humidity of 60 percent and in accordance with WIC technical bulletin 419-R.
- B. Protect work from moisture damage.

PART 2 PRODUCTS**2.01 FINISH CARPENTRY ITEMS**

- A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI/AWMAC/WI Architectural Woodwork Standards for Premium Grade.

2.02 MATERIAL

- A. Wood and Plywood: Selected for exposed surfaces to meet requirements for WI "Custom Grade" work, unless otherwise indicated.
- B. Types:
 - 1. Exterior wood: Dry; with moisture content up to 15 percent, unless otherwise indicated.
 - a. Exterior Trim and Fascias, opaque finish: Redwood Inspection Service Paragraph 107 - "Grade B". RIS Paragraph 109 "Select" for material thinner than 2 inch, and Paragraph 117 "Select" for 2 inch and thicker; S4S; smooth surfaced.
 - 2. Interior wood: Dry; with moisture content between 6 and 12 percent, unless otherwise indicated. Finger joints not permitted. WI manual, Section 3 and Section 4; "Custom Grade"
 - a. Hardwoods: Transparent finish, plain sawn "Select White" maple.

2.03 FASTENINGS

- A. Rough Hardware and fasteners: Provide nails, screws, anchor bolts, machine bolts, expansion sleeves, lag screws, powder driven fasteners, joist hangers, straps, and other framing anchors of the size and type required to securely attach finish carpentry to substrates.
 - 1. Nails:
 - 2. Interior Work: Steel, typical unless otherwise indicated.
 - 3. Screws, Bolts, Washers:
 - a. Exterior Work: Hot-dip galvanized steel, ASTM A153.
 - b. Interior Work: Cadmium plated steel, ASTM A165.
 - 4. Framing Devices:
 - a. Exterior Work: Hot-dip galvanized steel, ASTM A153.
 - b. Interior Work: Plated, ASTM A165; or painted steel.
- B. Concealed Joint Fasteners: Threaded steel.

2.04 ACCESSORIES

- A. Adhesive and Tape
 - 1. 1. Wood Adhesive: Essex Chemical "Webtex 588", Inmont "Presstite 220", 3M "Scotch-Grip 4314".

- B. Building Paper: #15 imperforate asphalt saturated organic felt, ASTM D226, Type I.
- C. Lumber for Shimming, Blocking, and furring: Softwood lumber of conforming species.
- D. Aluminum Edge Trim: Extruded flat shape; smooth surface finish; self locking serrated tongue; of width to match component thickness; clear anodized finish. Sizes and profiles as indicated and as recommended by manufacturer to suit application. Fry Products. Or Approved Equal
- E. Wood Filler: Solvent base, VOC Compliant, tinted to match surface finish color. Duratite "Wood Dough", Boyle-Midway "Plastic Wood" or Approved Equal.

2.05 FABRICATION

- A. Shop assemble work for delivery to site, permitting passage through building openings.
- B. Mill and fabricate units and pieces as long as practical.
- C. Finish and assemble at shop to greatest extent possible.
- D. Architectural Woodwork Standards (AWS) manual Sections 6, 7 and 8, "Custom Grade"
 - 1. Opaque finish, unless otherwise indicated.
- E. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify location of blocking, adequacy of backing and support framing.
- B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 PREPARATION

- A. Separate units and condition wood materials for a minimum of 72 hours. Allow wood to achieve prevailing humidity conditions in installation areas prior to installing.
- B. Backprime lumber, including side and ends, before installation for:
 - 1. Exposed exterior surfaces;
 - 2. Where surface is exposed to interior moisture and high relative humidities.

3.03 INSTALLATION

- A. Install work in accordance with AWI/AWMAC/WI Architectural Woodwork Standards requirements for grade indicated.
- B. Trim and bases: Install with minimum number of joints possible. Use full-length pieces from maximum lengths of lumber available.
 - 1. Stagger joints in adjacent and related members.
 - 2. Cope at returns and miter at corners. Produce tight fitting joints with full surface contact throughout length of joint.
 - 3. Joints: End-to-end
 - a. Wood: Scarf.
 - 4. Locate wood bases above subfloor by the thickness of finish flooring.
- C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim to conceal larger gaps.
- D. Building paper: Install under exterior wood; without holes or tears.

- E. Lap flashings to weather to the exterior.
 - 1. Lap horizontal edges 3-inches minimum and vertical edges 6-inches minimum
 - 2. Lap sheet metal flashings; double layer at corners by extending 6-inches around corner from each side.
- F. Anchorage: Drill pilot holes for nails where necessary to preclude splitting or chipping of material.
 - 1. Anchor finish carpentry work to anchorage devices or blocking built-in or directly attached to substrates. Secure to grounds, stripping and blocking with countersunk, concealed fasteners.
- G. Blind nail where possible and use fine finishing nails for exposed nailings, countersunk and filled flush with finished surface.
- H. At exterior locations drive nails flush.

3.04 PREPARATION FOR SITE FINISHING

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth. Prepare in accordance with level of finish specified in Section 09 9000.
- B. Site Finishing: See Section 09 9000.
- C. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

3.05 TOLERANCES

- A. Tolerances
 - 1. Install the work plumb, level, true and straight with no distortions. Conceal shims.
 - a. 1/16-inch maximum offset in flush adjoining surfaces.
 - b. 1/8-inch maximum offset in revealed adjoining surfaces.
 - 2. Scribe and cut work to fit adjoining work, and refinish cut surfaces or repair damaged finish at cuts.
- B. Maximum Variation from True Position: 1/16 inch.

3.06 ADJUSTMENT AND FINISHING

- A. Ease salient corners and edges and sand all exposed surfaces of smooth finish wood.
- B. Repair damaged and defective finish carpentry work wherever possible to eliminate functional and visual defects. Chipped or split materials is considered a defect.
- C. Replace where repair is not possible.
- D. Adjust joinery for uniform appearance.

END OF SECTION

SECTION 06 4100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Wood Casework
- B. Laminated Plastic Casework
- C. Cabinet Hardware
- D. Preparation for installing utilities.

1.02 RELATED SECTIONS

- A. section 06 2000 - Finish Carpentry
- B. Division 09: pertinent sections concerning finishes adjacent to cabinets.
- C. Pertinent sections specifying plumbing and/or mechanical equipment interfacing cabinets.
- D. Pertinent sections specifying lighting and/or electrical equipment interfacing cabinets.

1.03 REFERENCE STANDARDS

- A. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 2010 (ANSI/BHMA A156.9).
- B. GSA CID A-A-1936 - Adhesive, Contact, Neoprene Rubber; Federal Specifications and Standards.
- C. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association.
- D. NHLA G-101 - Rules for the Measurement & Inspection of Hardwood & Cypress; National Hardwood Lumber Association.
- E. PS 20 - American Softwood Lumber Standard; National Institute of Standards and Technology (Department of Commerce).
- F. Architectural Woodwork Standards (AWS), published jointly by the Woodwork Institute, Architectural Woodwork Institute, and the Architectural Woodwork Manufacturer's Association of Canada.
- G. USGBC LEED-NC - LEED Green Building Rating System for New Construction and Major Renovations; U.S. Green Building Council; 2009.

1.04 SYSTEM DESCRIPTION

- A. Design Requirements: Comply with applicable requirements of "Architectural Woodwork Standards" published jointly by Woodwork Institute, Architectural Woodwork Institute, and the Architectural Woodwork Manufacturer's Association of Canada unless otherwise indicated.
- B. All sealants and adhesives used within the interior of the building shall meet the low VOC requirements of USGBC LEED-NC v2009 IEQ Credit 4.4

1.05 SUBMITTALS

- A. Shop Drawings: Indicate materials, component profiles and elevations, assembly methods, joint details, fastening methods, accessory listings, hardware location and schedule of finishes.
 - 1. Submit shop drawings conforming to the requirements of the Architectural Woodwork Standards.

2. Furnish with a WI Certified Compliance Label on the first page of the shop drawings indicating that drawings fully meet the requirements of the AWS Millwork Grade specified.
- B. Product Data: Provide data for hardware accessories.
- C. Samples:
1. Full range of plastic laminates and edge tapes available from the specified group, of the specified manufacturer.
 2. Plastic (PVC) Edge Trim: Provide minimum of seventy-five color selections including patterns and woodgrains.
- D. Closeout: WI certificates of compliance as required in 1.06 below.

1.06 QUALITY ASSURANCE

- A. Single Source Responsibility: A single manufacturer shall provide and install the work described in this Section.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Protect units from moisture damage.
- B. Do not deliver woodwork, until the area of operation is enclosed, painting, wet work, grinding, overhead work and similar operations which could damage, soil or deteriorate woodwork are complete and the area is broom clean.
- C. If woodwork is stored in other than installation areas, store only in areas meeting requirements specified for installation areas.
- D. Do not install woodwork until required temperature and relative humidity are stable and will be maintained in installation areas.

1.08 FIELD CONDITIONS

- A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces in the range recommended by the Architectural Woodwork Standards for the location of the project.

PART 2 PRODUCTS

2.01 CABINETS

- A. Quality Grade: Unless otherwise indicated provide products of quality specified by AWI//AWMAC/WI Architectural Woodwork Standards for Custom Grade.

2.02 WOOD-BASED COMPONENTS

- A. Wood fabricated from old growth timber is not permitted.

2.03 LUMBER MATERIALS

- A. Wood Moisture Content: Comply with requirements of referenced quality standard for moisture content of lumber at time of fabrication and for relative humidity conditions in the installation areas.

2.04 PANEL MATERIALS

- A. Medium Density Fiberboard (MDF) meeting the requirements of the AWS and:
1. No added urea formaldehyde.
 2. Recycled content of 60 percent minimum post-industrial recycled wood fiber.
 3. Forest Stewardship Council (FSC) Certified.

- B. Plywood:
 - 1. Sink Tops: Hardwood plywood with non-telegraphing faces manufactured with type 2 glue.
 - 2. Drawer Boxes: Half inch thick seven or nine ply hardwood plywood with no internal voids.

2.05 LAMINATE MATERIALS

- A. Manufacturers:
 - 1. Formica Corporation: www.formica.com.
 - 2. Wilsonart International, Inc: www.wilsonart.com.
 - 3. Panolam Industries International, Inc: www.nevamar.com. Wilsonart International, Inc: www.wilsonart.com.
- B. High pressure decorative laminate complying with NEMA LD 3 and as follows:
 - 1. General application at exposed faces and other locations per referenced standards: Type HGS (0.048" nominal thickness).
 - 2. Colors, Patterns, and Finishes: As selected by Owner for manufacturer's full range of standard and premium colors and patterns, and as follows:
 - a. Allow for different patterns/colors of base cabinet, upper cabinet and countertops in each building.
 - b. Allow for different color scheme combination for each building.

2.06 COUNTERTOPS

- A. Plastic Laminate Countertops: High pressure decorative laminate sheet bonded to substrate.
 - 1. Laminate Sheet, Unless Otherwise Indicated: NEMA LD 3 Grade HGS, 0.048 inch nominal thickness.
 - a. Surface Burning Characteristics: Flame spread 25, maximum; smoke developed 450, maximum; when tested in accordance with ASTM E84.
 - b. NSF approved for food contact.
 - c. Wear Resistance: In addition to specified grade, comply with NEMA LD 3 High Wear Grade requirements for wear resistance.
 - d. Finish: Matte or suede, gloss rating of 5 to 20.
 - e. Surface Color and Pattern: As selected by Owner from the manufacturer's full line.
 - f. Manufacturers: Selected from those listed in Section 06 4100. Provide all materials from a single manufacturer.
 - 2. Exposed Edge Treatment: Square, substrate built up to minimum 1-1/4 inch thick; covered with matching laminate.
 - 3. Back and End Splashes: Same material, same construction.

2.07 ACCESSORIES

- A. Adhesive: Type recommended by WI to suit application.
- B. Plastic (PVC) Edge Trim: Flat shaped; 3 mm thick minimum, smooth finish; of width to match component thickness; color as selected by Owner to match or contrast with laminate color.
- C. Fasteners: Size and type to suit application.
- D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.
- E. Concealed Joint Fasteners: Threaded steel.
- F. Grommets: plastic material for cut-outs, 2 inch diameter minimum, color as selected.

2.08 HARDWARE

- A. General: Meet or exceed specified requirements of WI, Supplement #1 to Section 15 and BHMA Grade 1; US 26D finish or as selected by Owner from manufacturer's standards..
- B. Shelf Support Clips: Plated steel, with support pin for drilled hole in cabinet standard and shelf, with pre-drilled hole for seismic fastener to shelf. Hettich Sekura #1 or Approve Equal. Plastic clips will be rejected.
- C. Door and Drawer Pulls: Provide at all doors and drawers, brushed stainless steel, 116 x 28 mm loop pull; Hafele, San Francisco, CA "Model 115.60.601", or Approved Equal.
- D. Cabinet Locks: Provide at all cabinets and drawers except sink cabinets. Locks to be keyed cylinder, two keys per lock, master keyed, steel with chrome finish.
- E. Catches: Magnetic.
- F. Drawer Slides:
 - 1. Type: Full extension, ball bearing.
 - 2. Static Load Capacity: Heavy Duty grade and minimum capacity ratings as follows;
 - a. File Drawers: Extra Heavy Duty grade 125 pounds.
 - b. Lateral File Drawers: Extra Heavy Duty grade 150 pounds.
 - c. Lateral File Drawers More Than 30" Wide: Extra Heavy Duty grade 200 pounds.
 - d. Drawers in excess of 36 inches wide: Extra Heavy Duty grade 150 pounds.
 - e. Pencil Drawers (less than 4 inches inside height): 50 pounds.
 - f. All other drawers: 75 pounds.
 - 3. Mounting: Side mounted.
 - 4. Stops: Positive type.
 - 5. Features: Provide self closing/stay closed type.
 - 6.
 - 7. Products:
 - a. Accuride International, Inc: www accuride.com.
 - b. Grass America Inc: www.grassusa.com.
 - c. Knappe & Vogt Manufacturing Company: www.knappeandvogt.com.
 - d. Or Approved Equal
- G. Hinges: Stainless steel, five knuckle ANSI / BHMA Grade 1, non-removable pins, attached with screws that are inaccessible when closed, capable of 270 degree swing. Finish as selected by Owner. European style concealed hinges will be rejected.
 - 1. Manufacturer: Rockford Process Control "No. 376" or equal.
- H. Latches: Finger-release type; Locate release not exceeding 40 inches above finish floor elevation, on either leaf of pair doors, to suit configurations shown.
- I. Grommets and covers: 2 inch diameter, ABS plastic; black.
- J. File frames and followers: Pendaflex type at each drawer indicated as file drawer.
- K. Other Hardware: per referenced standard.

2.09 FABRICATION

- A. Casework General
 - 1. Construction Style: Style A, Frameless.
 - 2. Door and Drawer Style: Flush Overlay.

3. Provide dados or lock joint construction as indicated in the drawings in addition to the locations permitted by the Referenced Standard.
 4. Backs shall be full 3/4 inch thick.
 5. Door and drawer fronts shall be 3/4 inch thick.
 6. Shelves over 36 inch in length, fixed or adjustable, shall be 1 inch thick.
 7. Fabricate cabinets with openings and mortises precut, to receive hardware, appliances,, plumbing, fixtures, electrical work and similar items, wherever possible.
 8. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Seal cut edges.
 9. Locate openings accurately and use templates or roughing-in diagrams to provide accurate size and shape.
 10. Smooth edges of cutoffs and, where located in countertops and similar exposures, seal edges of cutouts with a water resistant coating.
 11. Where doors are notched for hinges seal exposed edges of core with black paint.
 12. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.
 13. Fitting: When necessary to cut and fit on-site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.
- B. Plastic Covered Casework
1. Meeting the requirements of AWS "Custom" or "Premium" Grade as indicated. Refer to herein.
 2. Exposed Surfaces: High Pressure Decorative Laminate as selected by the Owner and conforming to the requirements of the AWS.
 3. Exposed Interior Surfaces: Low Pressure Melamine in a pattern or color compatible with the exposed surfaces unless otherwise noted.
 4. Exposed Interior Surfaces: High Pressure Decorative Laminate matching exposed surfaces at Library shelving.
 5. Semi-Exposed Surfaces: White melamine.
 6. Edge Band: 3mm PVC at doors, drawer fronts, false fronts, and at all other edges requiring banding.
 7. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Locate counter butt joints minimum six feet from sink cut-outs.
 8. Apply laminate backing sheet to reverse side of plastic laminate finish surfaces.
- C. Wood Veneer Casework
1. Meeting the requirements of AWS "Custom" or "Premium" Grade as indicated. Refer to herein.
 2. Exposed Surfaces: Hardwood and hardwood veneer, species as indicated, rotary cut, book matched. Refer to herein.
 3. Exposed Interior Surfaces: Hardwood and hardwood veneer of the same species, cut and match as exposed surfaces.
 4. Semi-Exposed Surfaces: Hardwood and hardwood veneer of the same species and cut as exposed surfaces.
 5. Edge Band: 3mm wood edge band at doors, drawer fronts and false fronts, all other edges per the AWS.
- D. Edge Treatments
1. Countertops: square edge.
 2. Backsplash: Square butt joint with square top.
 3. Cap exposed plastic laminate countertop finish ends and edges with material of same finish and pattern. Cap semi-exposed ends and edges with materials permitted by the Referenced Standard. Plastic Tee banding is not acceptable.

- E. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:
 - 1. Provide center matched panels at each elevation.

2.10 SOURCE QUALITY CONTROL

- A. Labels: Certification of compliance, affixed by WI Inspector at the place of fabrication prior to shipment.

2.11 FACTORY FINISHING

- A. Shop Finishing: Comply with requirements of AWS.
 - 1. Laboratory Grade Casework: AWS System 7, Catalyzed Vinyl.
 - 2. Custom Grade Casework: AWS System 5, Conversion Varnish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify location of blocking, adequacy of backing and support framing.
- B. Verify location and sizes of utility rough-in associated with work of this section.

3.02 INSTALLATION

- A. Set and secure casework in place; rigid, plumb, and level, free of distortions. Shim as required; use concealed shims.
- B. Use fixture attachments in concealed locations wherever possible for wall mounted components. Exposed fasteners at semi-exposed surfaces and exposed interior surfaces are acceptable when required to provide a seismic compliant installation.
- C. Use concealed joint fasteners to align and secure adjoining cabinet units.
- D. Carefully scribe casework abutting other work, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.
- E. Secure cabinets to floors and walls using appropriate angles and anchorages.
- F. No exposed fastening permitted except at access panels.
- G. Cabinets:
 - 1. Adjust hardware to center doors and drawers in openings and to provide smooth operation.
 - 2. Install adjustable shelves evenly spaced, with specified hardware.
- H. Countertops: Anchor securely to base units and other support systems
- I. Connection of sinks to plumbing systems as specified in pertinent related sections.

3.03 TOLERANCES.

- A. Site Tolerances: 1/8-inch in 8 feet for plumb and level; adjoining surfaces flush, without offset.

3.04 ADJUSTING

- A. Adjust installed work.
- B. Adjust moving or operating parts to function smoothly and correctly.
- C. Repair damaged and defective woodwork and eliminate defects functionally and visually. Where repair is not possible replace woodwork. Adjust joinery for uniform appearance.

3.05 FIELD QUALITY CONTROL

- A. If a product or installation is suspected of not conforming to the WI Certified Compliance program, final inspection by a WI Inspector is required.

3.06 CLEANING

- A. Clean, lubricate and adjust hardware.
- B. Touch-up shop-applied finishes to restore damaged or soiled areas.
- C. Clean casework, counters, shelves, hardware, fittings, and fixtures.

3.07 PROTECTION OF FINISHED WORK

- A. Do not permit finished casework to be exposed to continued construction activity.
- B. Do not store materials or products on countertops. Do not stand or walk on countertops or use for construction access to building elements above floor level.
- C. Protect countertops with durable panel materials secured in place using methods which will not damage surfaces or finishes. Do not remove until Owner acceptance.

3.08 SCHEDULES

- A. Room 200:
 - 1. Quality: WI Premium Grade
 - 2. Cabinets: Wood; White Maple.
 - 3. Countertops and Sinks: Epoxy resin.
- B. All Other Locations:
 - 1. Quality: WI Custom Grade.
 - 2. Cabinet Construction: Plastic laminate faced.
 - 3. Countertops: Plastic laminate.

END OF SECTION

DIVISION 7
THERMAL AND MOISTURE PROTECTION

**SECTION 07 2500
VAPOR RETARDERS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Vapor Retarders: Materials to make slabs-on-grade water vapor-resistant and air tight.

1.02 RELATED REQUIREMENTS

- A. Section 03 3010 - Cast-In-Place Concrete: Vapor retarder under concrete slabs on grade.
- B. Section 07 9005 - Joint Sealers: Sealant materials and installation techniques.

1.03 REFERENCE STANDARDS

- A. Manufacturer's recommendations and specifications.
- B. ASTM D 1709
- C. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials.
- D. ASTM E 154 (Section 7)
- E. ASTM E 1745-96 - Standard for Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
- F. ASTM F 1249-01 Standard Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor.

1.04 SUBMITTALS

- A. Product Data: Provide data on material characteristics.
- B. Manufacturer's Installation Instructions: Indicate preparation.

1.05 QUALITY ASSURANCE

- A. Demonstrate compliance with ASTM E 1745 performance class specified.
- B. Vapor Permeability (Perm): Measure in accordance with ASTM E 96 Procedure E.

PART 2 PRODUCTS**2.01 VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)**

- A. Under-Slab Vapor Retarder/Barrier Sheet: ASTM E 1745, performance classification A, B, and C; 15 mil, single ply extruded polyolefin; 0.009 perm water vapor permeance per ASTM E 154 or E 96 procedure B; 0.01 or less perm vapor performance per ASTM E 154 Section 8, 11, 12 and 13; 0.0054 WVTR water vapor permeance per ASTM F 1249; tensile strength 45 lb/in.; minimum puncture resistance 2000 grams per ASTM D 1709, Method B.
- B. Acceptable Manufacturers: As specified in Section 03 3010 - Cast-in-place Concrete
- C. Adhesives, sealants and plastic cement: Types recommended by manufacturer to suit application and for compliance with referenced standards.
- D. Sealing Tape: Two-sided tape; 4 inch wide colored seaming tape with release liner; types recommended by manufacturer to suit application.

2.02 ACCESSORIES

- A. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION**3.01 INSTALLATION**

- A. Install materials in accordance with manufacturer's instructions.
- B. Vapor Retarder under slabs: Install in accordance with referenced standards and the following,
 - 1. Install continuous air-tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.
 - 2. Lap seams 6 inches minimum and seal with continuous tape or adhesive.
 - 3. Turn onto foundation walls, lap face of wall at least 6 inches.
 - 4. Protect vapor retarder membrane from damage during installation of concrete, reinforcement, utilities, and other work above the membrane.
 - 5. No penetrations through membrane other than specified utilities or building elements.
 - 6. Seal membrane to pipes and permanent penetrations with tape.
 - 7. Prior to covering membrane, check all seams and penetrations for interruptions. Check entire surface for snags, holes or penetrations and repair.
- C. Edge dampproofing: install HLM 5000 in accordance with reference standards.
- D. Mastic Coating:
 - 1. Prepare substrate in manner recommended by coating manufacturer; fill and tape joints in substrate and between dissimilar materials.
 - 2. Install by trowel or roller to minimum thickness of 1/4 inch.
 - 3. Use self-adhesive sheet flashing to seal to adjacent construction and to bridge joints.
 - 4. Seal airtight with sealant.
- E. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer when temperature is out of this range.

END OF SECTION

SECTION 07 6200
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, and other items indicated in Schedule and as follows:
 - 1. Edge strip and flashing.
 - 2. Counterflashings for roof accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 9005 - Joint Sealers.
- B. Section 13 3419 - Metal Building Systems

1.03 REFERENCE STANDARDS

- A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- B. ASTM A792 Steel Sheet, Aluminum-Zinc Alloy-Coated, by the Hot-Dip Process
- C. ASTM B32 - Standard Specification for Solder Metal.
- D. ASTM B486 Paste Solder
- E. ASTM D226 - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.
- F. ASTM D2178 - Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing.
- G. FS QQ-L-201 Specification for Lead Sheet
- H. SMACNA (ASMM) - Architectural Sheet Metal Manual; Sheet Metal and Air Conditioning Contractors' National Association.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.
 - 1. For manufactured and shop fabricated gravel stops, fascia, scuppers, and all other sheet metal fabrications.
 - 2. Indicate type, gauge and finish of metal.
- B. Product data: Provide manufacturer's specification data sheets for each product:
 - 1. Metal material characteristics and installation recommendations.
 - 2. Submit color chart prior to material ordering and/or fabrication
- C. Certification:
 - 1. Submit certification that metal and fastening system furnished is Tested and Approved by Factory Mutual for 1-90 Wind Up-Lift Requirements.
- D. Provide approval letters from metal manufacturer for use of their metal within this particular roofing system type.
- E. Proof of fabricator and installer qualifications.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with SMACNA Architectural Sheet Metal Manual requirements, except as otherwise indicated.
 - 1. Factory Mutual Approval Standard 4435.
- B. Warranty: The Contractor shall provide the Owner with a notarized written warranty assuring that all sheet metal work including caulking and fasteners to be water-tight and secure for a period of five years from the date of final acceptance of the building. Warranty shall include all materials and workmanship required to repair any leaks that develop, and make good any damage to other work or equipment caused by such leaks or the repairs thereof.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in manufacturer's original, unopened containers or packages with labels intact and legible.
- B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.
- C. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS**2.01 SHEET MATERIALS**

- A. Galvanized Steel: ASTM A 653/A 653M, with G90/Z275 zinc coating; minimum 0.02 inch thick base metal, minimum thickness 24 gauge and greater as required by referenced standards for specific applications indicated.
- B. Pre-Finished Galvanized Steel: Material supplied by Preformed Metal Roof Panel Manufacturer, matching roof panels and as follows, ASTM A 792, with G90/Z275 zinc coating; shop pre-coated with polyvinylidene fluoride coating of selected color. Provide for gutters and miscellaneous exposed flashings and closures at metal roof areas. Minimum thickness 24 gauge and greater as required by referenced standards for specific applications indicated.

2.02 ACCESSORIES

- A. Reinforcement Metals:
 - 1. For other metal work: Steel, hot dip galvanized per ASTM A123.
- B. Fasteners:
 - 1. Corrosion resistant screw fastener as recommended by metal manufacturer. Finish exposed fasteners same as flashing metal.
 - 2. Fastening shall conform to Factory Mutual 1-90 requirements or as stated on section details, whichever is more stringent.
 - 3. Screws, bolts, washers, drive-ins.
 - a. For galvanized steel work: Galvanized steel or cadmium plated steel.
 - b. For stainless steel work or dissimilar metals: Stainless steel.
- C. Underlayment: ASTM D226, organic roofing felt, Type I ("No. 15").
- D. Primer: Zinc chromate type.
- E. Protective Backing Paint: Bituminous type, emulsified asphalt, ASTM D1187.
- F. Flexible Flashing: 25 mil (0.64 mm), cold applied, self-adhering membrane consisting of a 3 mil (0.07 mm) high density, cross-laminated polyethylene film coated on one side with a 22 mil (0.56 mm) layer of rubberized asphalt adhesive; W. R. Grace "Vycor Plus". Or Approved Equal.

- G. Sealer Tape: Polyisobutylene sealer tape specifically manufactured for setting flanges on bituminous roofing, Morrison and Company CL-50, or Gibson-Homans #7810, or equal. Or Approved Equal.
- H. Sealant: Type recommended by flashing manufacturer or as specified in Section 07 9005.
- I. Flux: FS O-F-506.
- J. Solder: ASTM B 32; Alloy Grade 50A.

2.03 FABRICATION - GENERAL

- A. Fabricate in accordance with referenced standards. Form sections true to shape, accurate in size, square, and free from distortion or defects. Form pieces as recommended by SMACNA standard for conditions required.
 - 1. Provide reinforcements and supports as required for secure anchorage.
 - 2. Make joints rigid. Seams mechanically strong and soldered or sealed to make watertight
 - 3. Fabricate corners in one piece with legs extending 30-inches each way to field joint. Lap, rivet, and solder or seal corner seams watertight.
 - 4. Turn up "end dam" flanges at ends of opening sill flashing pieces, lap with wall flashing and membranes to shed water.
 - 5. Fabricate cleats of same material as sheet, minimum 3/4 inches wide, interlockable with sheet.
 - 6. Hem exposed edges on underside 1/2 inch; miter and seam corners.
 - 7. Solvent clean all sheet metal. Coat surfaces to be in contact with roofing or otherwise concealed with specified asphaltic paint; 0.015-inch minimum uniform thickness.
- B. Form pieces in longest possible lengths.
- C. Hem exposed edges on underside 1/2 inch; miter and seam corners.
- D. Form material with flat lock seams, except where otherwise indicated. At moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.
- E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

2.04 ROOF-RELATED SHEET METAL AND FLASHINGS

- A. Roof-Related Sheet Metal and Flashings: As indicated, as specified in related sections, as required by roofing material manufacturers and referenced standards. Coordinate work of this section with related sections. Provide complete systems without conflict or omission.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.
- B. Verify roofing termination and base flashings are in place, sealed, and secure.
- C. Beginning of installation means acceptance of existing conditions.
- D. Field measure site conditions prior to fabricating work.

3.02 PREPARATION

- A. Install starter and edge strips, and cleats before starting installation.
- B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.03 INSTALLATION

- A. Install work watertight, without waves, warps, buckles, fastening stress, or distortion, allowing for expansion and contraction. Conform to referenced standards. Make metal joints watertight.
- B. Fastening of metal to walls and wood blocking shall comply with SMACNA Architectural Sheet Metal Manual, Factory Mutual 1-90 wind uplift specifications and/or manufacturer's recommendations whichever is of the highest standard.
- C. All accessories or other items essential to the completeness of sheet metal installation and water tight envelope of the building, whether specifically indicated or not, shall be provided.
- D. Flashing: Joints at 10-foot maximum spacing and at 2-1/2-feet from corners. Butt joints with 3/16-inch space centered over matching 8-inch long backing plate with sealer tape in laps.
- E. Flanged flashings and roof accessories: Set on continuous sealer tape. Nail flanges through sealer tape and at 3-inch maximum spacing.
- F. Isolate metal from dissimilar metal with 2 coats of specified asphaltic paint, sealer tape or other approved coating, specifically made to stop electrolytic action.. Use only stainless steel fasteners to connect isolated dissimilar metals.
- G. Joints, fastenings, reinforcements and supports: Sized and located as required to preclude distortion or displacement due to thermal expansion and contraction. Conceal fastenings wherever possible.
- H. Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.
- I. Flexible Flashing Installation:
 - 1. Prime substrates as recommended by flexible flashing manufacturer, allow to dry.
 - 2. Install flexible flashings in maximum feasible lengths to minimize lap joints.
 - 3. Peel release paper from roll to expose rubberized asphalt and position flashing to center over joint location before applying. Move along opening or joint, being careful to put flashing as evenly as possible over the opening. Avoid fishmouths.
 - 4. Press flashing firmly into place with heavy hand pressure. Ensure continuous and intimate contact with substrate.
 - 5. If wrinkles develop, carefully cut out affected area and replace as outlined above.
- J. Apply plastic cement compound between metal flashings and felt flashings.
- K. Fit flashings tight in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.
- L. Seal prefinished metal joints watertight.
- M. Solder other metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

3.04 FIELD QUALITY CONTROL

- A. Tolerances
 - 1. Exposed surfaces: Free of dents, scratches, abrasions, or other visible defects; clean, ready for painting.
 - 2. Set flashings and sheet metal to straight, true lines with exposed faces aligned in plane as indicated.

3.05 SHOP FABRICATED SHEET METAL

- A. Installer shall be responsible for determining if the sheet metal systems are in general conformance with roof manufacturer's recommendations.

- B. Metal work shall be shop fabricated to configurations and forms in accordance with recognized sheet metal practices.
- C. Hem exposed edges.
- D. Angle bottom edges of exposed vertical surfaces to form drip.
- E. All corners for sheet metal shall be lapped with adjoining pieces fastened and set in sealant.
- F. Joints for gravel stop fascia system, cap flashing, and surface-mount counterflashing shall be formed with a 1/4" opening between sections. The opening shall be covered by a cover plate or backed by an internal drainage plate formed to the profile of fascia piece. The cover plate shall be embedded in mastic, fastened through the opening between the sections and loose locked to the drip edges.
- G. Install sheet metal to comply with Architectural Sheet Metal manual, Sheet Metal and Air Conditioning Contractor's National Associations, Inc.

END OF SECTION

**SECTION 07 9005
JOINT SEALERS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Sealants and joint backing.
 - 1. Exterior and Interior joints where indicated, and as follows;
 - 2. To make building watertight.
 - 3. To fill an exposed joint between materials which do not fit tightly together.

1.02 RELATED REQUIREMENTS

- A. Pertinent Sections specifying sealants or referencing this Section for sealant products and execution requirements.
- B. Section 07 6200-Sheet Metal Flashing and Trim: Sealants in conjunction with sheet metal flashing

1.03 REFERENCE STANDARDS

- A. Manufacturer's recommendations and specifications.
- B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- C. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- D. ASTM D1667 - Standard Specification for Flexible Cellular Materials--Poly(Vinyl Chloride) Foam (Closed-Cell).
- E. BAAQMD 8-51 - Bay Area Air Quality Management District Regulation 8, Rule 51, Adhesive and Sealant Products; www.baaqmd.gov.
- F. SCAQMD 1168 - South Coast Air Quality Management District Rule No.1168; current edition; www.aqmd.gov.
- G. USGBC LEED-NC - LEED Green Building Rating System for New Construction and Major Renovations; U.S. Green Building Council; 2009.

1.04 SYSTEM DESCRIPTION

- A. Design Requirements
 - 1. Sealing building envelope
 - a. Seal typical building joints with non-sag type sealant.
- B. Performance Requirements
 - 1. Building envelope:
 - a. Make watertight and weathertight.
 - b. Exterior work that does not remain watertight and all work which does not retain all properties inherent in the product as stipulated by the manufacturer will be considered faulty

1.05 SUBMITTALS

- A. Product Data: Provide data indicating sealant chemical characteristics.

- B. Certification of compatibility by sealant manufacturer of accessory components.
- C. Manufacturer's Installation Instructions: Indicate limitations, special procedures, surface preparation, and perimeter conditions requiring special attention.

1.06 QUALITY ASSURANCE

- A. Manufacturer of sealant and caulking material to certify that cleaners, joint filler or bond breakers, and primers, for a particular application, are compatible with sealant.
- B. All sealants and adhesives used within the interior of the building shall meet the low VOC requirements of USGBC LEED-NC v2009 IEQ Credit 4.2

1.07 COORDINATION

- A. Coordinate the work with all sections referencing this section.

1.08 WARRANTY

- A. Warranty: Include coverage for installed sealants and accessories which fail to achieve airtight seal and watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Products of, or certified as compatible by, the approved manufacturer of the sealant or caulking material.

2.02 MANUFACTURERS

- A. Butyl Sealants:
 - 1. Bostik Inc; Product Chem-Calk 300: www.bostik-us.com.
 - 2. Pecora Corporation; Product BC 158: www.pecora.com.
 - 3. Tremco, A BFGoodrich Specialty Chemicals Company.
- B. Epoxy Joint Filler:
 - 1. W.R. Meadows, Inc; Rezi-Weld Flex: www.wrmeadows.com.

2.03 SEALANTS

- A. General: Products of, or certified as compatible by, the approved manufacturer of the sealant or caulking material.
- B. General Purpose Exterior Sealant: Polyurethane; ASTM C920, Grade NS, Class 25, Uses M, G, and A; single or multi- component.
 - 1. Color: Standard colors matching finished surfaces. Provide minimum of 40 standard selection choices
 - 2. Product: NP-2 manufactured by Sonneborne or Approved Equal.
 - 3. Product: Sikaflex 1A manufactured by Sika, or Approved Equal.
 - 4. Product: Vulkem 116 manufactured by Tremco, or Approved Equal. Primer required.
 - 5. Applications: Use for:
 - a. Joints between concrete and other materials.
 - b. Joints between metal frames and other materials.
 - c. Other exterior joints for which no other sealant is indicated.

- C. General Purpose Exterior Sealant: single or multi- component.
 - 1. Product: TremGlaze U1400 or U1600 manufactured by Tremco, or Approved Equal.
 - 2. Product: Permthane SM7108 manufactured by Schnee-Morehead, Inc., or Approved Equal.
 - 3. Product: Sonolastic 150 manufactured by Sonneborne, or Approved Equal.
 - 4. Applications: Use for:
 - a. Joints where sealant in contact with flexible flashing.
- D. Exterior Metal Lap Joint Sealant: Butyl or polyisobutylene, nondrying, nonskinning, noncuring.
 - 1. Product: 564 manufactured by Hapco, Presstite 579 or Approved Equal.
 - 2. Applications: Use for:
 - a. Concealed sealant bead in sheet metal work.
 - b. Concealed sealant bead in siding overlaps.

2.04 ACCESSORIES

- A. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- B. Joint Cleaner: Non-corrosive and non-staining type, recommended by sealant manufacturer; compatible with joint forming materials.
- C. Joint Backing: Round foam rod compatible with sealant; ASTM D 1667, closed cell PVC; oversized 30 to 50 percent larger than joint width.
- D. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrate surfaces are ready to receive work.
- B. Verify that joint backing and release tapes are compatible with sealant.

3.02 PREPARATION

- A. Remove loose materials and foreign matter that could impair adhesion of sealant.
- B. Mask adjacent surfaces where necessary to maintain neat edge.
- C. Clean and prime joints in accordance with manufacturer's instructions.
- D. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.
- E. Protect elements surrounding the work of this section from damage or disfigurement.

3.03 INSTALLATION

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.

- C. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.
- D. Install joint backing to achieve a neck dimension no greater than 1/3 of the joint width, unless otherwise recommended by manufacturer or specifically indicated.
- E. Install bond breaker where joint backing is not used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags.
- G. Apply sealant within recommended application temperature ranges. Consult manufacturer when sealant cannot be applied within these temperature ranges.
- H. Tool joints concave. Fill joint space completely from back to top, without voids; finish uniformly smooth without laps, sags, or depressions.

3.04 FINISHING

- A. Work that is exposed to view: Uniform surface with neat, straight edges and no excess material on adjacent surface.

3.05 CLEANING

- A. Clean adjacent soiled surfaces.

3.06 PROTECTION

- A. Protect sealants until cured.

END OF SECTION

DIVISION 8
OPENINGS

**SECTION 08 1100
STEEL DOORS AND FRAMES**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Steel doors and frames for both doors and windows.

1.02 RELATED SECTIONS

- A. Section 08 7100 - Door Hardware.

1.03 REFERENCES

- A. ANSI A250.8 - SDI-100 Recommended Specifications for Standard Steel Doors and Frames.
- B. ANSI A250.11 - Recommended Erection Instructions for Steel Frames; 2001 (until publication use SDI 105).
- C. ASTM A 591/A 591M - Standard Specification for Steel Sheet, Electrolytic Zinc-Coated, for Light Coating Weight (Mass) Applications.
- D. DHI A115.1G - Installation Guide for Doors and Hardware; Door and Hardware Institute.
- E. ANSI Standards: A115; A151.1
- F. Manufacturer's recommendations and specifications
- G. NAAMM "Hollow Metal Manual".
- H. SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames; Steel Door Institute.

1.04 DEFINITIONS

- A. Exterior doors: Doors exposed in whole or in part to the weather.

1.05 SYSTEM DESCRIPTION

- A. Performance Requirements
 1. Tolerances: In accordance with HMMA 860.
 2. Doors shall operate freely nor rattle when closed.

1.06 SUBMITTALS

- A. Product Data: Provide manufacturer's standard details and catalog data demonstrating compliance with referenced standards; installation instructions.
- B. Certificates: Provide manufacturer's certification of the following:
 1. Products comply with referenced standards.
 2. Each and every frame and hollow metal window, sidelite provided are UL listed and labeled for the fire rating indicated at the sizes shown.

C. Shop Drawings:

1. Shop drawings showing all openings in the door schedule and/ or drawings; provide details of door design, door construction and methods of assembling sections, hardware locations, anchorage and fastening methods, door frame types, and finish requirements.

E. Door, frame, and hardware schedule in accordance with SDI 111.

1.07 QUALITY ASSURANCE

A. Certifications:

1. Furnish each shipment with affixed label or other identification indicating name of manufacturer and compliance with specified standard.

B. Fire-rated Assemblies: Manufactured in accordance with Underwriters Laboratories Inc. or other approved independent testing laboratory and bearing their metal label affixed to both door and frame. Labels shall list fire rating and "UL 10B and 10C POSITIVE PRESSURE" label. Door labels shall also include smoke and draft "S" designation.

1. Manufacture in accordance with positive pressure test, UL-10C.
2. Comply with ITS/Warnock Hersey International "Category A Doors". Where intumescent edge seals are required on wood or composite doors installed in steel frames, seal shall be built-in edge type. Edge seals are not allowed on frame. Only smoke and draft seals complying with the "S" rating are allowed to be installed on the frame.
3. Coordinate with specification Section 08 7100 Door Hardware as required for compliance with UL 10C test, positive pressure fire-rated components and fire door assemblies.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Upon delivery, inspect all materials for damage; notify shipper and supplier if damage is found.
- B. Protect products from moisture, construction traffic, and damage.
- C. Take precautions and provide stiffeners or spacers necessary to preclude distortion in shipping and storage.
- D. Store vertically under cover. Do not use non-vented plastic or canvas shelters. Should wrappers become wet, remove immediately.
- E. Place units on 4 inch high wood sills or in a manner that will prevent rust or damage. Provide 1/4 inch space between doors to promote air circulation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers:

1. Door Components, Inc.,
2. Security Metal Products Corp.,
3. Ceco Door Products,
4. Curries Company,
5. Steelcraft.

2.02 MATERIALS

- A. Steel Sheet for Doors and Frames:
 - 1. Free of scale, pitting or surface defects.
 - 2. Cold rolled steel: ASTM A 1008/A 1008M, Designation CS.
 - 3. Hot rolled steel: Pickled and oiled, ASTM A 1011/A 1011M, Designation CS Type B.
 - 4. Galvanized steel: Hot-dipped, ASTM A 653/A 653M, with G60/Z180 or A40/ZF120 coating, minimum.
- B. Steel Sheet for Anchors and Accessories: Electrolytically deposited zinc coated steel; ASTM A 591/A 591M, coating 40Z (12G), minimum.

2.03 DOORS AND FRAMES

- A. Comply with ANSI A250.8.
- B. Fire Rated Openings: Tested and listed to ratings indicated on the drawings in accordance with ANSI/UL10B and ANSI/UL10C Positive Pressure Fire Tests of Door Assemblies, UL9, ASTM E 152 and ASTM E 163, NPFA 252 and NFPA 257 and CSFM 43-7: UL or WH(ITS) labeled without any visible seals when door is open.
 - 1. Affix permanent labels attesting to fire resistance.
- C. General Requirements:
 - 1. 1-3/4-inches thick, exhibiting no warp or buckle.
 - 2. Corner bends true and straight and of minimum radius for the gauge of metal used.
 - 3. Faces: Fully welded, seamless, flush.
 - 4. Edges: Full height and width of door.
 - a. Bevel lock edge 1/8 in 2.
 - b. Top and bottom edges: Fabricate from material 2 gages thicker than specified for faces.
 - 1) Closed with a continuous recessed steel channel; extending full width of door and spot weld to both faces.
 - 5. Core: Comply with ANSI A151.1.
 - 6. Hardware reinforcement: Cut-out, reinforce, punch and tap for mortise hardware. Reinforce for surface hardware. Reinforce in accordance with ANSI A115 and SDI-107 except as specified for material gauge.
 - a. Hinges: No. 7 gauge
 - b. Lock fronts: No. 12 gauge
 - c. Mortise lock sides and other surface mounted hardware: No. 14 gauge.
- D. Exterior Doors:
 - 1. Faces: 14 gauge galvanized steel.
 - 2. Edges
 - a. Continuous welded vertical edges; ground, filled and dressed smooth and invisible.
 - b. Fabricate with an additional 16 gauge steel, flush closing channel at top and bottom edge. Continuous weld, grind, fill and finish smooth top channel. Weld bottom channel at corners and centers. Provide openings in bottom closure to permit escape of entrapped moisture.
 - 3. Core: Steel stiffened, insulated, fire-resistive types recommended by manufacturer in accordance with listed construction and as follows;

- a. Continuous vertical steel sections spanning full space between faces. Minimum 18 gauge and spaced a minimum of 6-inches.
 - b. Reinforce edges with continuous 10 gauge steel channel.
 - c. Attach to face sheets by spot welding.
 - d. Fill cavities with glass batt insulation.
- E. Exterior Frames:
- 1. No. 12 gauge steel.
 - 2. Fabricate all components, including and hardware reinforcing, with galvanized steel.
 - 3. Joints, including returns, faces and integral stops: welded full length.
- F. Interior Frames
- 1. No. 14 gauge steel.
 - 2. Joints, including returns, faces and integral stops: welded full length.
- G. Hardware reinforcement for frames.
- 1. Cut-out, reinforce, punch and tap for mortise hardware. Where frames are grouted fabricate mortises in frames with mortar-tight back cover. Punch frames and provide silencers except where scheduled to have door seals.
 - 2. Reinforce for surface hardware. Reinforce in accordance with ANSI A115 and SDI-107 except as specified for material gauge.
 - a. Hinge: No. 7 gauge; 1-1/4-inch by 10-inch, minimum.
 - b. Strikes: No. 16 gauge formed combination reinforcement and dust cover.
 - c. Flush bolts, closers, and other surface mounted hardware: No. 12 gauge.
- H. Frames: Provide welded unit type frames.
- I. Galvanizing: Provide units of galvanized steel at exterior openings and toilets.
- J. Frame Anchors: Furnish type of anchorage accepted by the Steel Door Institute. For wall conditions that do not permit installation of floor anchors furnish 1 additional wall anchor.
- 1. Floor anchors: Furnish 1 per jamb. Minimum 16 gauge galvanized steel. Type with 2 bolts to structure.
 - 2. Jamb anchors:
 - a. Stud Partitions: Furnish 4 per jamb. Minimum 18 gauge and welded inside each jamb.
- K. Glazed Lights: Provide glazing stops and beads, minimum 18 gage.
- 1. Weld glazing stops to door on security side.
 - 2. Removable interior beads secured to opening with cadmium or zinc-coated counter sunk screws.
- L. Glazing: Single; Types specified in Section 08 8000; Conditions as indicated.

2.04 FINISHES

- A. Finishing: Provide factory-finished units; clean and prime paint.
- 1. Exposed surfaces: Filled and sanded smooth.
 - 2. Repair damaged galvanizing with zinc-rich coating before priming.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that project conditions are suitable before beginning installation of frames.
- B. Correct unsatisfactory condition before proceeding with installation.

3.02 INSTALLATION

- A. Install frames plumb, level, rigid, and in true alignment as recommended in ANSI A250.11 and DHI A115.1G.
- B. Install doors plumb and in true alignment and fasten to achieve the maximum operational effectiveness and appearance of the unit. Maintain clearances specified in ANSI A250.8 and NFPA 80 whichever is more restrictive.
 - 1. Fill all spaces between frame anchors and structure with approved shim material.
- C. Where surface mounting is indicated, countersink anchors and plug with metallic filler. Finish smooth and flush with frame surface.
- D. Install hardware in accordance with hardware manufacturer's recommendations and templates. Consult DHI A115.1G and ANSI A250.6 as necessary.

3.03 ADJUST AND CLEAN

- A. Adjust doors for proper operation, free from binding or other defects.
- B. Clean and restore soiled surfaces. Remove scraps and debris, and leave site and a clean condition.
- C. Protect completed work from damage. Replace damaged work.

END OF SECTION

**SECTION 08 1416
FLUSH WOOD DOORS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Flush wood doors; flush and flush glazed configuration; non-rated.

1.02 RELATED REQUIREMENTS

- A. Section 06 2000 - Finish Carpentry.
- B. Section 08 1100 - Steel Doors and Frames.
- C. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

- A. ANSI Standards: A208.1; particleboard.
- B. Manufacturer's specifications and recommendations.
- C. National Wood Window and Door Association (NWWDA) standard: I.S. 1-87.
- D. UL (BMD) - Building Materials Directory; Underwriters Laboratories Inc..
- E. AWI/AWMAC/WI - Architectural Woodwork Standards (AWS).

1.04 SUBMITTALS

- A. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- B. Shop Drawings: Illustrate door opening criteria, elevations, sizes, types, swings, undercuts required, special beveling, special blocking for hardware, factory machining criteria, factory finishing criteria, identify cutouts for glazing and inserts.
- C. Samples: Submit samples of door veneer, 8x 10 inch in size illustrating wood grain, stain color, and sheen.
- D. Manufacturer's Installation Instructions: Indicate special installation instructions.

1.05 QUALITY ASSURANCE

- A. Perform work in accordance with AWI/AWMAC/WI - Architectural Woodwork Standards (AWS); Section 9, Custom Grade.
- B. Finish doors in accordance with AWI/AWMAC/WI - Architectural Woodwork Standards (AWS); Section 5.
- C. Certifications: Furnish each shipment with affixed label or other identification indicating name of manufacturer and compliance with specified standard.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging. Inspect for damage.

- C. Protect doors with resilient packaging. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.07 PROJECT CONDITIONS

- A. Coordinate the work with door opening construction, door frame and door hardware installation.

1.08 WARRANTY

- A. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- B. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wood Veneer Faced Doors:
 - 1. Eggers Industries: www.eggersindustries.com.
 - 2. Marshfield Door Systems, Inc: www.marshfielddoors.com.
 - 3. VT Industries, Architectural Wood Doors: www.vtindustries.com
 - 4. Oregon Door, www.oregondoor.com

2.02 DOORS

- A. All Doors: See drawings for locations and additional requirements.
 - 1. AWI/AWMAC/WI - Architectural Woodwork Standards (AWS); Section, Custom Grade.
 - 2. Wood Veneer Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
 - 1. Provide solid core doors at all locations.
 - 2. Fire Rated doors: Tested to ratings indicated on the drawings in accordance with ANSI/UL10C Positive Pressure Fire Tests of Door Assemblies: UL or WH(ITS) labeled without any visible seals when door is open.
 - 3. Wood veneer facing with factory transparent finish where indicated on drawings.
 - 4. Hardboard facing for field opaque finish where indicated on drawings.

2.03 DOOR AND PANEL CORES

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated above.

2.04 DOOR FACINGS

- A. Wood Veneer Facing for Transparent Finish: Select White Maple, Grade "A", plain sliced, book veneer match, running assembly match.
 - 1. Vertical Edges: Same species as face veneer.
 - 2. Pairs: Pair match each pair; set match pairs within 10 feet of each other when doors are closed.
- B. Veneer Facing for Opaque Finish: Medium density overlaid plywood.

- C. Facing Adhesive: Type I - waterproof all locations.

2.05 ACCESSORIES

- A. Glazing Stops: Rolled steel channel shape, mitered corners; prepared for countersink style tamper proof screws.

2.06 DOOR CONSTRUCTION

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
 - 1. Bevel lock edge 1/8 in 2.
 - 2. Cores
 - a. Glue all edges of adjacent components. Glue entire core assemble to edges.
 - b. Block for hardware at doors having mineral or particleboard cores. Provide solid blocking for through-bolted hardware.
- C. Provide solid blocks at lock edge for hardware reinforcement.
 - 1. Provide solid blocking for other throughbolted hardware.
- D. Fit door edge trim to edge of stiles after applying veneer facing.
- E. Vertical Exposed Edge of Stiles - Veneer Faces: Of same species as veneer facing.
- F. Fit door edge trim to edge of stiles after applying veneer facing.
- G. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.
- H. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
 - 1. Exception: Doors to be field finished.
- I. Provide edge clearances in accordance with the quality standard specified.
- J. Provide edge clearances in accordance with AWI Quality Standards Illustrated Section 1700.

2.07 FACTORY FINISHING - WOOD VENEER DOORS

- A. Prior to factory finish, cut-out and frame for glazed panels and cut-out for hardware.
 - 1. Bevel or ease all corners at intersections of faces with edges, top, and bottom, 1/16-inch.
 - 2. Doors to receive paint finish: Clear seal all surfaces including faces, edges, top, bottom, cutouts, and rabbets.
 - 3. Prime paint steel glass stops, edges, and astragals.
- B. Factory finish doors in accordance with WI Manual of Millwork, Section 5 to the following finish designations:
 - 1. Transparent Finish: TR-5, transparent catalyzed polyurethane, Custom quality, semi-gloss sheen.
- C. Seal door top edge with color sealer to match door facing.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.02 INSTALLATION

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Conform to WI requirements for fit and clearance tolerances. Door clearance at head and jambs shall be 3/32-inch plus or minus 1/32-inch.
- D. Doors shall operate freely but not loosely and shall be free from rattling in closed position.
- E. Adjust width of non-rated doors by cutting equally on both jamb edges.
- F. Trim door height by cutting bottom edges to a maximum of 3/4 inch (19 mm).
- G. Use machine tools to cut or drill for hardware.
- H. Coordinate installation of doors with installation of frames and hardware.
- I. Coordinate installation of glazing.
- J. Install door louvers plumb and level.

3.03 TOLERANCES

- A. Conform to specified quality standard for fit and clearance tolerances.
- B. Conform to specified quality standard for telegraphing, warp, and squareness.

3.04 ADJUSTING

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure in compliance with prevailing codes.
- C. Repair damaged and defective work and eliminate functional and visual defects. Where repair is not possible replace work. Adjust for uniform appearance. No unfinished surfaces or irregularities in completed work.
- D. Protect installed work from subsequent construction operations until Owner's acceptance. Utilize durable protective wrappings using methods which will not damage surfaces or finishes. Do not remove until Owner acceptance following move-in.

END OF SECTION

SECTION 08 3100
ACCESS DOORS AND PANELS

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Access door and frame units, fire-rated and non-fire-rated, in wall and ceiling locations wherever required for access to enclosed spaces or equipment.

1.02 RELATED REQUIREMENTS

- A. Section 09 9000 - Painting and Coating: Field paint finish.
- B. Division 23 - Mechanical: Mechanical and plumbing components requiring access.
- C. Division 26 - Electrical: Electrical components requiring access.

1.03 REFERENCE STANDARDS

- A. ITS (DIR) - Directory of Listed Products; Intertek Testing Services NA, Inc..
- B. Manufacturer's recommendations and specifications.
- C. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc..

1.04 DESIGN REQUIREMENTS

- A. Design Requirements: Provide door seals for access doors located in sound isolating walls or ceilings.
- B. Performance Requirements: Provide door covered access into all attic spaces and at all portions of the work to which access is necessary for periodic inspection, adjustments, or maintenance, and which is enclosed behind finish materials, including, but not limited to, valves, water hammer arrestors, mechanical units, electrical panels and outlets, equipment and systems.

1.05 SUBMITTALS

- A. Schedule: Tabular listing of access doors and panels, indicating location, size, materials, fire rating, device or purpose for access.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of all access door units.
- D. Manufacturer's Installation Instructions: Indicate installation requirements for fire rated units.

1.06 REGULATORY REQUIREMENTS

- A. Conform to Title 24, Part 2, California Building Code for fire rated access doors.
 - 1. Provide access doors of fire rating equivalent to the fire rated assembly in which they are to be installed.

- B. Provide products listed and labeled by UL or ITS (Warnock Hersey) as suitable for the purpose specified and indicated.

1.07 PROJECT CONDITIONS

- A. Coordinate the work with other work requiring access doors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Wall and Ceiling Access Doors:
 - 1. Acudor Products Inc.; Product ED-2002: www.acudor.com.
 - 2. Karp Associates, Inc; Product DSC-214M: www.karpinc.com.
 - 3. Milcor by Commercial Products Group of Hart & Cooley, Inc: www.milcorinc.com.
 - 4. J. L. Industries, www.jlindustries.com.

2.02 ACCESS DOORS AND PANELS

- A. All Units: Factory fabricated, fully assembled units with corner joints welded, filled, and ground flush; square and without rack or warp; coordinate requirements with assemblies units are to be installed in.

2.03 ACCESS DOOR UNITS - WALLS AND CEILINGS

- A. Door sizes: Unless otherwise specifically noted on drawings; smallest standard size which will permit ready access and removal of working parts requiring maintenance.
- B. Door and Frame Units: Formed steel and stainless steel where noted.
 - 1. Door panels: 0.070 inch single thickness steel sheet.
 - 2. Size(s): As indicated.
 - 3. Hardware:
 - a. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
 - b. Hinge: 175 degree stainless steel piano hinge with pin.
 - c. Latch/Lock: Cylinder lock operated cam latch, two keys for each unit.

2.04 FABRICATION

- A. Weld, fill, and grind joints to ensure flush and square unit.

2.05 FINISHES

- A. General: Provide doors and/or panels of the following finishes as scheduled.
 - 1. Galvanized, hot dipped finish.
 - 2. Prime coat with alkyd primer.
 - 3. Stainless Steel Finish: No. 4 finish.

2.06 SOURCE QUALITY CONTROL

- A. Certifications: Furnish each fire rated door with affixed label of Underwriters Laboratories (UL), Warnock Hersey International (WHI), or other approved independent testing laboratory and inspection service, certifying scheduled fire rating.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Investigate conditions requiring access, select panels of suitable type and configuration for conditions indicated.
- B. For conditions requiring access and for which panels or doors are not otherwise shown, recommend panel or door type and size for Owner's review.
- C. Verify that rough openings are correctly sized and located.

3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings. Secure rigidly in place.
- C. Position units to provide convenient access to the concealed work requiring access. Avoid conflict with other building elements.

3.03 SCHEDULE

- A. Exterior Doors and Panels: Galvanized for site finishing specified in 09 9000.
- B. Interior Doors and Panels in Restrooms wherever located: Stainless steel construction, No. 4 finish.
- C. Interior Doors and Panels in all other locations: Primed for site finishing specified in 09 9000.

END OF SECTION

**SECTION 08 3323
OVERHEAD COILING DOORS**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Overhead coiling doors, operating hardware, exterior, manual operation.

1.02 RELATED REQUIREMENTS

- A. Section 08 7100 - Door Hardware: Cylinder cores and keys.
- B. Section 09 9000 - Painting and Coating: Field paint finish.
- C. Section 07 9005 - Joint Sealers

1.03 REFERENCE STANDARDS

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

1.04 SUBMITTALS

- A. Product Data: Provide general construction, component connections and details, electrical equipment.
- B. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.
- C. Manufacturer's Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.
- D. Maintenance Data: Indicate lubrication requirements and frequency and periodic adjustments required.
- E. Manufacturer's standard color selection

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Overhead Coiling Doors:
 - 1. The Cookson Company: www.cooksondoor.com.
 - 2. Overhead Door Corporation; 600 Series: www.overheaddoor.com

2.02 COILING DOORS

- A. Exterior Coiling Doors: Steel slat curtain.
 - 1. Capable of withstanding positive and negative wind loads of 20 psf, without undue deflection or damage to components.
 - 2. Flat slat construction
 - 3. Nominal Slat Size: 2 inches wide x required length.

4. Finish: Powder coated, color to be selected by Owner.
5. Guides: Angles; galvanized steel.
6. Hood Enclosure: Manufacturer's standard; primed steel.
7. Manual hand chain lift operation.
8. Mounting: As indicated.
9. Exterior lock and latch handle.

2.03 MATERIALS

- A. Curtain Construction: Interlocking slats.
 1. Slat Ends: Alternate slats fitted with end locks to act as wearing surface in guides and to prevent lateral movement.
 2. Curtain Bottom: Fitted with angles to provide reinforcement and positive contact in closed position.
 3. Weatherstripping: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
- B. Steel Slats: Minimum 26 gage ASTM A653/A653M galvanized steel sheet.
 1. Galvanizing: Minimum G90/Z275 coating.
- C. Guide Construction: Continuous, of profile to retain door in place with snap-on trim, mounting brackets of same metal.
- D. Steel Guides: ASTM A36/A36M steel angles, size as indicated, hot-dip galvanized per ASTM A 123/A 123M.
- E. Hood Enclosure: Internally reinforced to maintain rigidity and shape.
 1. Prime paint.
- F. Hardware:
 1. Lock Cylinders: Specified in Section 08 7100.
- G. Roller Shaft Counterbalance: Steel pipe and helical steel spring system, capable of producing torque sufficient to ensure smooth operation of curtain from any position and capable of holding position at mid-travel; with adjustable spring tension; requiring 25 lb nominal force to operate.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that opening sizes, tolerances and conditions are acceptable.

3.02 INSTALLATION

- A. Install units in accordance with manufacturer's instructions.
- B. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.
- C. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.
- D. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

- E. Coordinate installation of sealants and backing materials at frame perimeter as specified in Section 07 9005.

3.03 TOLERANCES

- A. Maintain dimensional tolerances and alignment with adjacent work.
- B. Maximum Variation From Plumb: 1/16 inch.
- C. Maximum Variation From Level: 1/16 inch.
- D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 ft straight edge.

3.04 ADJUSTING

- A. Adjust operating assemblies for smooth and noiseless operation.

3.05 CLEANING

- A. Clean installed components.
- B. Remove labels and visible markings.

END OF SECTION

SECTION 08 4313
ALUMINUM ENTRANCES AND STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aluminum-framed storefront, with vision glass.
- B. Aluminum doors and frames.
- C. Weatherstripping.
- D. Perimeter sealant.

1.02 RELATED REQUIREMENTS

- A. Section 07 9005 - Joint Sealers: Perimeter sealant and back-up materials.
- B. Section 08 5113 - Aluminum Windows.
- C. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.
- D. Section 08 8000 - Glazing: Glass and glazing accessories.

1.03 REFERENCE STANDARDS

- A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; American Architectural Manufacturers Association.
- B. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; American Architectural Manufacturers Association; 2009 (part of AAMA 501).
- C. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; American Architectural Manufacturers Association.
- D. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
- E. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- F. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; American Society of Civil Engineers.
- G. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- I. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- J. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- K. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

- L. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- M. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
- N. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- O. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings.
- P. SSPC-Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II; Society for Protective Coatings.

1.04 PERFORMANCE REQUIREMENTS

- A. System to accommodate, without damage to components or deterioration of seals, movement within system, movement between system and peripheral construction, dynamic loading and release of loads, deflection of structural support framing.
- B. Design and size components to withstand the following load requirements, as measured in accordance with ASTM E 330:
 - 1. Wind loads: Comply with requirements of CBC, Title 24, Part 2, code and design criteria on structural drawings.
 - 2. Member Deflection: Limit member deflection to 1/200 in any direction, with full recovery of glazing materials.
- C. Movement: Accommodate movement between storefront and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
- D. Limit air leakage through assembly to conform with C.C.R. Title 24, Part 6, Energy Conservation Requirements.
- E. Thermally Broken: All components, including doors, to be thermally broken with continuous resilient elastomeric extrusions.
- F. Water Leakage: None, when measured in accordance with ASTM E 331 with a test pressure difference of 2.86 lbf/sq ft.
- G. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
- H. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glass and inner sheet of infill panel and heel bead of glazing compound.
- I. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.

1.05 SUBMITTALS

- A. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, internal drainage details and perimeter conditions.
- B. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related Work, expansion and contraction joint location and details, and field welding required.
- C. Design Data: Provide framing member structural and physical characteristics, dimensional limitations.
- D. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.
- E. Samples: Submit two samples 12x12 inches in size illustrating finished aluminum surface, glass, glazing materials.
- F. Manufacturer's Certificate: Certify that the products supplied meet or exceed the specified requirements.
- G. Report of field testing for water leakage.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle products of this section in accordance with AAMA CW-10.
- B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.08 WARRANTY

- A. Provide ten year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Basis of design: Oldcastle Building Envelope; Product Series 3000 Thermal Multiplane: www.oldcastlebe.com.
- B. Aluminum storefront shall be by same manufacturer as aluminum windows. Section 08 5113 - Aluminum Windows.
- C. Aluminum-Framed Storefront and Doors:
 - 1. Oldcastle Building Envelope
 - 2. Kawneer North America; Product Trifab VG 451T: www.kawneer.com.
 - 3. United States Aluminum Corp.; Product IT451: www.usalum.com.

2.02 STOREFRONT

- A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
 - 1. Glazing Position: Centered (front to back).
 - 2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.
 - 3. Water infiltration: No uncontrolled leakage when tested in accordance with ASTM E331 at test pressure of 10 psf as defined in AAMA 501.
 - 4. Air Infiltration Test Pressure Differential: 1.57 psf.
 - 5. Finish: High performance organic coating.
 - 6. Finish Color: As selected from manufacturer's standards.

2.03 COMPONENTS

- A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
 - 1. Glazing stops: Manufacturer's standard.
 - 2. Cross-Section: As indicated on drawings.
- B. Doors: Glazed aluminum. Manufacturer's standard "wide-stile" type.
 - 1. Thickness: 2 inches.
 - 2. Bottom Rail: 12 inches wide.
 - 3. Glazing Stops: Square.
 - 4. Finish: Same as storefront.
- C. Operable Sash: As specified in Section 08 5113 - Aluminum Windows

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M). 6063 alloy, T5 temper.
- B. Sheet Aluminum: ASTM B209 (ASTM B209M).
- C. Fasteners: Stainless steel.
- D. Exposed Flashings: 0.040 inch thick aluminum sheet; finish to match framing members.
 - 1. Break shapes as indicated, as recommended by manufacturer, and as required to fully enclosed and seal system.
- E. Concealed Flashings: 0.018 inch thick stainless steel.
- F. Perimeter Sealant: Polyurethane, as specified in Section 07900.
- G. Glass: As specified in Section 08 8000.
 - 1. Glass in Exterior Framing: Type tinted.
 - 2. Glass in Interior Framing: Type clear.
- H. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.
- I. Glazing Accessories: As specified in Section 08 8000.
- J. Shop and Touch-Up Primer for Steel Components: SSPC-Paint 25, zinc oxide, alkyd, linseed oil primer.

- K. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.
- L. Protective Backing Paint: Bituminous type, emulsified asphalt, ASTM D1187.
- M. Flexible Flashing: 25 mil (0.64 mm), cold applied, self-adhering membrane consisting of a 3 mil (0.07 mm) high density, cross-laminated polyethylene film coated on one side with a 22 mil (0.56 mm) layer of rubberized asphalt adhesive. Rolls interwound with a disposable silicone coated release sheet. Product: W. R. Grace "Vycor Plus", or Approved Equal.

2.05 FINISHES

- A. High Performance Organic Finish: AAMA 605.2; multiple coats, thermally cured fluoropolymer system; color as scheduled.
- B. Touch-Up Materials: As recommended by coating manufacturer for field application.

2.06 HARDWARE

- A. Other Door Hardware: Storefront manufacturer's standard type to suit application.
 - 1. For each door, include butt hinges, pivots, push handle, pull handle, exit device, narrow stile handle latch, and closer.
- B. See Section 087100 - Door Hardware for other hardware products not mentioned. Coordinate with Hardware supplier for installation.

2.07 FABRICATION

- A. Fabricate components with minimum clearances and shim spacing around perimeter of assembly, yet enabling installation and dynamic movement of perimeter seal.
- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices. Fabricate anchors.
- D. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
- E. Arrange fasteners and attachments to conceal from view.
- F. Reinforce components internally for door hardware.
- G. Reinforce framing members for imposed loads.
- H. Finishing: Apply factory finish to all surfaces that will be exposed in completed assemblies.
 - 1. Touch-up surfaces cut during fabrication so that no natural aluminum is visible in completed assemblies, including joint edges.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify dimensions, tolerances, and method of attachment with other work.
- B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.02 INSTALLATION

- A. Install wall system in accordance with manufacturer's instructions.
- B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.
- C. Provide alignment attachments and shims to permanently fasten system to building structure.
- D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.
- E. Provide thermal isolation where components penetrate or disrupt building insulation.
- F. Install sill and perimeter flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.
- G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.
- H. Coordinate attachment and seal of perimeter air and vapor barrier materials.
- I. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- J. Install operating sash.
- K. Set thresholds in bed of mastic and secure.
- L. Install hardware using templates provided.
 - 1. See Section 08 7100 for hardware installation requirements.
- M. Install glass and infill panels in accordance with Section 08 8000, using glazing method required to achieve performance criteria.
- N. Install perimeter sealant in accordance with Section 07 9005.
- O. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

- A. Maximum Variation from Plumb: 0.06 inches every 3 ft non-cumulative or 1/16 inches per 10 ft, whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.04 FIELD QUALITY CONTROL

- A. Test installed storefront for water leakage in accordance with AAMA 501.2.

3.05 ADJUSTING

- A. Adjust operating hardware and sash for smooth operation.

3.06 CLEANING

- A. Remove protective material from pre-finished aluminum surfaces.
- B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths. Take care to remove dirt from corners. Wipe surfaces clean.
- C. Remove excess sealant by method acceptable to sealant manufacturer.

END OF SECTION

SECTION 08 5113
ALUMINUM WINDOWS

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Extruded aluminum windows with fixed sash and operating sash.
- B. Factory glazing.
- C. Operating hardware.
- D. Insect screens.

1.02 RELATED REQUIREMENTS

- A. Section 07 9005 - Joint Sealers: Perimeter sealant and back-up materials.
- B. Section 08 4313 - Aluminum Storefronts: Operable sash within framing system.
- C. Section 08 8000 - Glazing.
- D. 13 3419 - Metal Building Systems

1.03 REFERENCE STANDARDS

- A. AA DAF-45 - Designation System for Aluminum Finishes Ninth Edition.
- B. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; American Architectural Manufacturers Association.
- C. AAMA 101 - Specifications for Windows, Doors and Unit Skylights
- D. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels.
- E. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels.
- F. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; American Architectural Manufacturers Association.
- G. ASCE 7 - Minimum Design Loads for Buildings and Other Structures; American Society of Civil Engineers.
- H. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- I. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- J. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- K. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

- L. ASTM E330 - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.
- M. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
- N. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference
- O. ASTM F588 - Standard Test Methods for Measuring the Forced Entry Resistance of Window Assemblies, Excluding Glazing Impact.
- P. California Association of Window Manufacturer's (CAWM) - Standard Practice for installation of Windows with Integral Mounting Flange in Wood Frame Construction, 1995.
- Q. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings.
- R. SSPC-Paint 25 - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Hand Cleaned Steel, Type I and Type II; Society for Protective Coatings.
- S. SSPC-Paint 25BCS - Zinc Oxide, Alkyd, Linseed Oil Primer for Use Over Blast Cleaned Steel; Society for Protective Coatings.

1.04 PERFORMANCE REQUIREMENTS

- A. Design and size windows to withstand the following load requirements, as measured in accordance with ASTM E 330:
 - 1. Wind loads: Comply with requirements of Title 24, California Building code.
 - 2. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
- B. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
- C. Air Infiltration: Limit air infiltration through assembly to 0.3 cu ft/min/sq ft of wall area, measured at a reference differential pressure across assembly of 1.57 psf as measured in accordance with ASTM E 283.
- D. Water Leakage: None, when measured in accordance with ASTM E 331 with a test pressure difference of 2.86 lbf/sq ft.
- E. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly.
- F. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, or migrating moisture occurring within system.
- G. Forced Entry Resistance: Conform to ASTM F 588 requirements for performance level 10.

1.05 SUBMITTALS

- A. Product Data: Provide component dimensions, information on glass and glazing, internal drainage details, descriptions of hardware and accessories, and information on exterior finishes.
- B. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, method for achieving air and vapor barrier seal to adjacent construction, anchorage locations, anchorage size and penetration, and installation requirements.
- C. Samples: Submit 12 x 12 inch in size illustrating typical corner construction, accessories, and finishes.
- D. Certificates: Certify that windows meet or exceed specified requirements.
- E. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of AAMA CW-10.
- B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40 degrees F.
- B. Maintain this minimum temperature during and 24 hours after installation of sealants.

1.08 WARRANTY

- A. Provide ten year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.
- B. Provide ten year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Basis of Design: Oldcastle Building Envelope; Product Signature Series 16E.
- B. Aluminum windows shall be by same manufacturer as storefront system, Section 08 4313 - Aluminum Entrances and Storefronts
- C. Aluminum Windows:
 - 1. Oldcastle Building Envelope; 816 Kieman Ave, Modesto, Ca. 95356, 800-266-8686; Product Signature Series 16E.
 - 2. US Aluminum/C.R. Laurence Co. Inc.; 33200 Dowe Ave. Union city, Ca. 94587-2013, 800-421-6144; Product Series 7500T
 - 3. Kawneer North America, www.kawneer.com

2.02 WINDOWS

- A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
 - 1. Frame Depth: As shown in drawings.
 - 2. Air Infiltration: Limit air infiltration through assembly to .10 cu ft/min/sq ft of wall area, measured at a specified differential pressure across assembly in accordance with ASTM E283.
 - 3. Water Infiltration Test Pressure Differential: None at 12 pounds per square foot.
- B. Types: As indicated
 - 1. Construction: Thermally broken.
 - 2. Glazing: Double; tinted; type specified in Section 08 8000 - Glazing.
 - 3. Exterior Finish: high performance organic coating.
- C. Outswinging Awning Type:
 - 1. Construction: Thermally broken.
 - 2. Provide screens.
- D. Inswinging Hopper Type:
 - 1. Construction: Thermally broken.
 - 2. Provide screens.

2.03 COMPONENTS

- A. Insect Screen Frame: Rolled aluminum frame of rectangular sections; sections 7/16-inch by 3/4-inch with .020-inch wall thickness; fit with adjustable hardware; nominal size similar to operable glazed unit.
- B. Insect Screens: FS RR-W-365, woven aluminum mesh; 18/16 mesh size, charcoal flat enamel finish, at locations indicated.
- C. Operable Sash Weatherstripping: neoprene/EPDM alloy or Santoprene; permanently resilient, profiled to achieve effective weather seal.
- D. Fasteners: Stainless steel, No. 6 or larger for attachments of nailfins to framing.
- E. Glazing Materials: As specified in Section 08 8000.
- F. Sealant and Backing Materials: As specified in Section 07 9005.

2.04 MATERIALS

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T5 temper.
- B. Flexible Flashing: 25 mil (0.64 mm), cold applied, self-adhering membrane consisting of a 3 mil (0.07 mm) high density, cross-laminated polyethylene film coated on one side with a 22 mil (0.56 mm) layer of rubberized asphalt adhesive. Rolls interwound with a disposable silicone coated release sheet. Product: W. R. Grace "Vycor Plus", or Approved Equal.
- C. Sealer between aluminum members: Manufacturer's standard, color to match aluminum finish.

- D. Concealed Steel Items: Profiled to suit mullion sections; galvanized in accordance with ASTM A123/A123M.

2.05 HARDWARE

- A. Locks, operators, sash arms, rollers: Manufacturer's standard for operating types indicated.
- B. Sash lock: Lever handle with cam lock Provide pole handle of 6 feet.
- C. Operator: Lever action handle fitted to projecting sash arms with limit stops.
- D. Pulls: Manufacturer's standard type.
- E. Limit Stops: Resilient rubber.

2.06 FABRICATION

- A. Fabricate components with smallest possible clearances and shim spacing around perimeter of assembly that will enable window installation and dynamic movement of perimeter seal.
- B. Accurately fit and secure joints and corners. Make joints flush, hairline, and weatherproof.
- C. Prepare components to receive anchor devices.
- D. Arrange fasteners and attachments to ensure concealment from view.
- E. Prepare components with internal reinforcement for operating hardware.
- F. Provide steel internal reinforcement in mullions as required to meet loading requirements.
- G. Provide internal drainage of glazing spaces to exterior through weep holes.
- H. Assemble insect screen frames with mitered and reinforced corners. Secure wire mesh tautly in frame. Fit frame with four, spring loaded steel pin retainers.
- I. Double weatherstrip operable units.
- J. Factory glaze window units.

2.07 FINISHES

- A. Comply with AA DAF-45 for aluminum finishes required.
- B. High Performance Organic Finish: AAMA 2604; multiple coats, thermally cured fluoropolymer system; color as scheduled.
- C. Operator and Exposed Hardware: Enameled to color as selected from manufacturer's standards.
- D. Apply 1 coat of bituminous coating to concealed aluminum and steel surfaces in contact with dissimilar materials.
- E. Shop and Touch-Up Primer for Steel Components: SSPC-Paint 25, zinc oxide, alkyd, linseed oil primer.
- F. Touch-Up Primer for Galvanized Steel Surfaces: SSPC-Paint 20, zinc rich.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that wall openings and adjoining air and vapor seal materials are ready to receive aluminum windows.

3.02 INSTALLATION

- A. Install windows in accordance with manufacturer's instructions and the referenced standards.
 - 1. Screw framing members in place using backing, anchor plugs, or straps as required to make secure when subjected to imposed loads. Where moldings are jointed, accurately cut and fit to provide a tightly closed joint.
 - 2. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
 - 3. Install so that weather-stripping makes continuous positive contact when window is in closed position.
- B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.
- C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.
- D. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
- E. Coordinate attachment and seal of perimeter air barrier and vapor retarder materials.
- F. Install operating hardware not pre-installed by manufacturer.
- G. Align and adjust vents for optimum weathering contact to the frame and ease of operation.
- H. Install glass in accordance with requirements specified in Section 08 8000.
- I. Maintain attachment and seal of perimeter air barrier and vapor retarder materials.
- J. Install perimeter sealant in accordance with requirements specified in Section 07 9005.
 - 1. Seal joints between window assembly and other building components. No unfinished aluminum visible.
 - 2. Install with bead of sealant under head fin, 6-inch strips of flashing felt under jamb and sill fins, and 6-inch strip of felt over head fin.

3.03 TOLERANCES

- A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft non-cumulative or 1/8 inches per 10 ft, whichever is less.

3.04 FIELD QUALITY CONTROL

- A. Test installed windows for compliance with performance requirements for water penetration, in accordance with ASTM E1105 using uniform pressure and the same pressure difference as specified for laboratory testing.

1. If any window fails, test additional windows at Contractor's expense.

B. Replace windows that have failed field testing and retest until performance is satisfactory.

3.05 CLEANING

A. Adjust hardware for smooth operation and secure weathertight closure.

B. Remove protective material from factory finished aluminum surfaces.

C. Wash surfaces by method recommended and acceptable to sealant and window manufacturer; rinse and wipe surfaces clean.

D. Remove excess sealant by moderate use of mineral spirits or other solvent acceptable to sealant and window manufacturer.

E. Touch-up factory finishes; no raw metal visible.

F. After installation check and adjust primary and secondary locks to assure proper function.

G. Protect finished work including finishes from subsequent construction.

END OF SECTION

SECTION 08 7100**DOOR HARDWARE****PART 1 GENERAL****1.01 SUMMARY**

- A. Section Includes: All door hardware required to complete the work as indicated on the drawings and as specified herein.
- B. Related Sections/Work Specified Elsewhere
 - 1. Section 08 1100 – Steel Doors and Frames
 - 2. Section 08 4313 – Aluminum Entrances and Storefronts
 - 3. Section 08 1416 – Flush Wood Doors

1.02 REFERENCES

- A. CBC - California Building Code – (Title 24, Part 2, California Code of Regulations (CCR))
- B. ADAAG – Americans with Disabilities Act Accessibility Guidelines
- C. ANSI A156.1 through A156.20 – American National Standards Institute hardware standards as applicable
- D. U.L. – Underwriters Laboratories, Inc.
- E. BHMA – Builders Hardware Manufacturers Association
- F. DHI – Door and Hardware Institute – “Keying Systems and Nomenclature” and mounting heights/locations procedures and standards

1.03 SUBMITTALS

- A. Hardware Schedule: Submit a complete Schedule of Hardware to Owner for review. Schedule criteria:
 - 1. Prepare in Door and Hardware Institute (DHI) vertical format only. Horizontal schedules will be rejected.
 - 2. Include index of doors listing door number, page and heading number for each door listed.

3. Include a legend of abbreviations, symbols, finishes and manufacturers.
 4. Schedule each hardware item with quantity, type, manufacturer's model number, size/handling as applicable, screws/fasteners, finish, manufacturer's name and any additional information required for proper installation/operation.
 5. List hardware for each door in groups, referencing the same group numbers and numerical group sequence as specified in 3.06 HARDWARE SCHEDULE.
 6. Include in each hardware group/heading, the door number/location, door and frame types, material, size, thickness, fire rating and any additional door and frame information required for proper installation/operation of hardware.
- B. Product Data: Include catalog cut sheets on each type of hardware scheduled to include pictures/drawings, specifications and/or data sheets.
- C. Templates: Provide paper templates or physical hardware for all scheduled templated hardware to the door and frame manufacturers.
- D. Keying Schedule: Within 10 days after approval of the hardware submittal, Contractor shall have a keying conference with Owner to determine the specific keying requirements of the project. Contractor shall subsequently prepare and submit a finalized Keying Schedule to Owner for approval.
- E. Installation, Operations and Maintenance: Provide Owner 1 copy of an "Owners Operation and Maintenance Manual". The manual shall include:
1. Maintenance data for each item of hardware
 2. Manufacturer's installation instructions for each hardware item
 3. Name, address and phone number of the local representative of each manufacturer
 4. Parts list for each product
 5. Copy of final hardware schedule to include all items listed in 1.03 SUBMITTALS, B.

and C.

1.04 QUALITY ASSURANCE/REGULATORY REQUIREMENTS

- A. Exit Doors: Doors shall be operable from the inside with "non-grasping" trim that does not require the use of a key or any special knowledge.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Marking and Packaging: Package each hardware item individually in manufacturer's original box/package. Mark all packages with respective door, room, hardware heading and hardware set number.

B. Delivery: Deliver all hardware to jobsite.

C. Storage: Store all hardware in a dry, secured, enclosed area that is not subject to any corrosive elements that could damage the operation or appearance of the product.

1.06 WARRANTY

A. Product Warranties:

1. Butt Hinges: Lifetime
2. Continuous Hinges: Lifetime
3. Locksets: 7 years
4. Exit Devices: 5 years
5. Surface Closers: 25 years
6. Remaining hardware shall be warranted for a minimum period of 2 years. The manufacturer's specific product warranty, if greater than 2 years, shall take precedence.

B. The manufacturer's product warranty shall commence from date of substantial completion.

1.07 MAINTENANCE

A. Tools: Provide Owner any special tools required for maintenance, removal and/or replacement of hardware.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Provide hardware from listed manufacturers, or as approved equal.

<u>HARDWARE ITEM</u>	<u>SPECIFIED MANUFACTURER</u>
Hinges - Butts	HAG Hager
Continuous Hinges	SEL Select Hinges
Locksets, Cylinders	SCH Schlage
Exit Devices, Removable Mullions	VON Von Duprin
Closers	NOR Norton
Kick Plates, Stops	ROC Rockwood
Overhead Stops/ Holders	ABH Architectural Builders Hardware
Thresholds, Sweeps, Seals	PEM Pemko
Key Cabinets	MMF MMF Industries

2.02 MATERIALS

A. Screws and Fasteners: Install all hardware only with screws and fasteners furnished with hardware.

1. Where a specific type of hardware is packaged by the manufacturer with "screws and fasteners by others", install hardware with manufacturer's recommended type(s).
2. Finish to match hardware.

B. Hinges (butts): Unless otherwise scheduled in 3.06 HARDWARE SCHEDULE, furnish 4.5 x 4.5, full mortise, template type butts with non-rising loose pins.

1. Furnish 5 x 4.5 size for doors 3'1" and wider.
2. Furnish three hinges for doors less than 7'6" tall and four hinges for doors 7'6" tall and greater.
3. Exterior doors: Furnish out-swinging door hinges in non-ferrous material with stainless steel, Non Removable Pin (NRP).
4. Interior doors: Furnish wrought steel or non-ferrous type as specified.
5. Furnish hinges of sufficient width to clear frame and trim and allow door to open 180 degrees.

C. Continuous Hinges: Furnish aluminum geared type as scheduled in 3.06 HARDWARE SCHEDULE.

D. Locks and Cylinders:

1. Provide locksets and cylinders in Primus keyway
2. Provide Schlage ND series locksets with conventional cylinders and Rhodes lever design as specified.
3. Provide interchangeable core cylinders (IC) at exit devices.
4. Provide conventional (standard) cylinders at key removable mullions.

E. Exit Devices: Provide Von Duprin as specified.

F. Closers: Provide Norton as specified.

1. Provide drop plates, back plates, brackets, mortise shoes, spacer blocks and long arms as required for proper installation and operation.
2. Closers shall comply with CBC opening force requirements.

- 1) Interior non-rated doors - 5 lbs.
- 2) Exterior doors - 5 lbs.
- 3) Fire doors to have minimum opening force allowable by the appropriate

authority

having jurisdiction, not to exceed 15 lbs.

G. Protective Plates: Unless otherwise specified in the HARDWARE SCHEDULE, kick plates shall be .050 thick, 10" high and 2" less than door width (LDW) for single doors and 1" less than door width for each leaf of a pair.

1. Plates shall have 4 beveled edges.
 2. Furnish plates of the correct size. Before ordering, it shall be the hardware supplier's responsibility to confirm that the specified plate size will fit the bottom rail of the specific door on which it is to be installed as specified in 3.02 INSTALLATION.

H. Stops and Holders: Provide as specified in 3.06 HARDWARE SCHEDULE and as follows:

1. Where conditions will not allow installation of wall or floor stops as specified in 3.02 INSTALLATION, furnish overhead stop ABH 9000 ADJ series, or Approved Equal.

I. Thresholds, Sweeps and Seals: Provide per plan details and as specified in 3.06 HARDWARE SCHEDULE.

1. Thresholds shall not exceed 1/2" in height with a slope no greater than 1:2. 90 degree changes in height shall not exceed 1/4" vertical. Furnish with proper screws and anchors for floor material.

J. Silencers: For frames without seals, provide push-in type silencers. Self-adhesive type is not allowed. Provide silencers as follows:

1. Pairs of doors: 2 each
 2. Single doors: 3 each

K. Miscellaneous Hardware: Provide remaining hardware items as specified in 3.06 HARDWARE SCHEDULE. The manufacturers' and model numbers listed establish design, function and quality requirements.

2.03 FINISHES

A. The finish of all hardware shall be as specified in 3.06 HARDWARE SCHEDULE. BHMA designation indicates base metal as well as finish.

2.04 KEYING

- A. Refer to 1.03, F. Keying Schedules for preparation requirements of specific keying schedule.
- B. Key all locksets and cylinders as follows:
 - 1. Master key/grand master key as required
 - 2. Construction master key
- C. Factory key all locks.
- D. Furnish the following keys and related items:
 - 1. 2 blanks and 2 change per keyed different lock
 - 2. 4 each keyed alike set
 - 3. 5 masters each MK set
 - 4. 2 grand masters
 - 5. 5 construction masters
 - 6. 1 bitting list
- E. Stamp all key bows with "DO NOT DUPLICATE" and with any other inscription as directed by Owner.
- F. Tag all permanent keys with door and hardware heading numbers and deliver to Owner.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Prior to installation of hardware, examine doors, frames and related items for defects or other conditions that would prevent the proper installation and operation of specified hardware. Do not proceed with hardware installation until deficiencies are corrected.

3.02 INSTALLATION

- A. Install hardware in accordance with manufacturer's instructions.
- B. Surface Closers:
 - 1. Install inside rooms, in stairwells and inside vestibules. Do not mount closers in corridors except at exterior doors that open off a corridor.
 - 2. Install with sex nuts and bolts.

3. Template for 180 degree opening.

a. Where adjacent wall, obstruction or closer stop type arm will not permit 180 degree templating, closers shall be installed to allow the maximum degree of opening allowed by the stop arm or before door contacts wall or obstruction. In no instance shall closers be templated for less than 90 degree opening.

4. Adjust closers per 2.02, F., 2. and comply with closer sweep requirements so that from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.

C. Kick Plates: Mount on push side of door unless otherwise specified. Install only with screws furnished. Align centered between door edges and with bottom edge flush with door bottom. When installed, plates are to fit flat against the face of the door without any modification to the plate. Plates of incorrect size that encroach on glass area, hang below door bottom or extend beyond door edges are not acceptable and will be replaced with the proper size.

D. Stops:

1. Floor Stops: Install stops in a position that permits maximum door swing but does not exceed 4" from wall. Furnish stops of proper height to engage doors. Position stops to contact the door at a point 6 inches from the latch edge, but in no case further than 1/3 the door width as measured from the latch edge.

2. Wall Stops: Fasten stops to solid blocking/backing. Install stops at the height that will engage operating trim/levers.

E. Thresholds: Set in full bed of butyl rubber sealant. Secure to concrete with flat head machine screws and expansion anchors.

F. Seals: As required, notch jamb seals around hardware items (closer arms, strikes, etc.).

G. Miscellaneous wall-mounted hardware shall be fastened to solid blocking/backing.

H. Unless otherwise specified, all hardware mounting heights shall be per CBC and Door and Hardware Institute (DHI) mounting location standards.

3.03 FIELD QUALITY CONTROL

A. After hardware installation has been completed Owner shall:

1. Visually inspect each hardware item to determine compliance with the approved hardware and keying schedules.

2. Check that locksets and cylinders are keyed correctly.

3. Check hardware for proper operation.

3.04 ADJUSTING AND CLEANING

A. At the end of project, clean and make final adjustments to all hardware. Where hardware is found defective, repair, replace or otherwise correct as directed.

3.05 PROTECTION

A. Provide proper care and protection for all hardware items and finishes until completion of project.

3.06 HARDWARE SCHEDULE

A. The following is a schedule of hardware to be furnished for this work. The material listed shall conform throughout with the requirements of the foregoing specifications.

HW-1

Each pair to have

2 Continuous Hinges	SL11HD	628	SEL
1 Removable Mullion	KR4954 x 154	689	VON
1 Exit Device	99NL	626	VON
1 Exit Device	99EO	626	VON
1 IC Cylinder	Type and model required@ device	626	SCH
1 Standard Cylinder	Type and model required @ mullion	626	SCH
2 Closers	PR7500	689	NOR
2 Floor Stops	463		ROC
1 Threshold	As detailed	628	PEM
2 Sweeps	3452CP		PEM
1 Set Seals	By door mfr.		

HW-2

Each door to have

1 Continuous Hinge	SL11HD	628	SEL
1 Exit Device	99NL	626	VON
1 IC Cylinder	Type and model required	626	SCH
1 Closer	PR7500	689	NOR
1 Floor Stop	464		ROC
1 Threshold	As detailed	628	PEM
1 Sweep	3452CP		PEM
1 Set Seals	319CS		PEM

HW-3

Each door to have

Hinges	AB750	652	HAG
1 Storeroom Lockset	ND96CD	626	SCH
1 Kick Plate	K1050	630	RO
1 Floor Stop and Holder	481H	626	ROC

HW-4

Each door to have

Hinges	AB750	652	HAG
1 Storeroom Lockset	ND96CD	626	SCH
1 Floor Stop and Holder	481H	626	ROC

HW-5

Each pair to have

Hinges	AB850	630	HAG
1 Storeroom Lockset	ND96CD	626	SCH
1 Threshold	As detailed	628	PEM
1 Sweep	3452CP		PEM
1 Set Seals	S88D		PEM

HW-6

Each door to have

1 Security Classroom Lockset	ND95CD	626	SCH
1 Floor Stop	481H	626	ROC
1 Threshold	151A		PEM

HW-7

Each door to have

1 Continuous Hinge	FM-300 x CHS-1	630	MAR
1 Pull Plate	107 x 70C	630	ROC
1 Classroom Deadlock	B663TD	626	SCH

1 Closer	4041	689	LCN
1 Floor Stop & Holder	464		ROC
1 Threshold	Per detail	719	PEM
1 Sweep	3452AV		PEM
1 Set Seals	S88D		PEM

END OF SECTION

SECTION 08 8000
GLAZING

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Glass: Glazing of the following principle components:
 - 1. Windows.
 - 2. Storefront.
 - 3. Interior windows.
 - 4. Door lights.
- B. Glazing compounds and accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 9005 - Joint Sealers: Sealant and back-up material.
- B. Section 08 1416 - Flush Wood Doors: Glazed lites in doors.
- C. Section 08 4313 - Aluminum Entrances and Storefronts
- D. Section 08 5113 - Aluminum Windows: Glazed windows.

1.03 REFERENCE STANDARDS

- A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials.
- B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test.
- C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers.
- D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
- E. ASTM C1036 - Standard Specification for Flat Glass.
- F. ASTM C1048 - Standard Specification for Heat-Treated Flat Glass--Kind HS, Kind FT Coated and Uncoated Glass.
- G. ASTM C1193 - Standard Guide for Use of Joint Sealants.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- I. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings.
- J. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation.
- K. California Building Code, "CBC", Title 24, Part 2.
- L. GANA (GM) - GANA Glazing Manual; Glass Association of North America.
- M. GANA (SM) - GANA Sealant Manual; Glass Association of North America.

1.04 DEFINITIONS

- A. Sealed Insulating Glass Unit Surfaces:

1. Side 1 - Exterior surface of outer pane.
2. Side 2 - Interior surface of outer pane.
3. Side 3 - Interior surface of inner pane.
4. Side 4 - Exterior surface of inner pane.

1.05 PERFORMANCE REQUIREMENTS

- A. Provide glass and glazing materials for continuity of building enclosure vapor retarder and air barrier:
 1. In conjunction with vapor retarder and joint sealer materials described in other sections.
 2. To maintain a continuous air barrier and vapor retarder throughout the glazed assembly from glass pane to heel bead of glazing sealant.
- B. Performance Requirements for Exterior Glazing (Note: Project Energy compliance documentation based on the following minimum requirements for specified products. Alternate products shall demonstrate equal or superior characteristics):
 1. Light Transmittance:
 - a. Visible Light Transmission: 60%
 - b. Ultra Violet: 14-28 percent
 2. Visible Reflectance: 10percent
 3. Solar Heat Gain Coefficient: 0.32 maximum.
 4. "U" Factor:
 - a. Winter: 0.29
- C. Thicknesses listed or scheduled are minimum.

1.06 SUBMITTALS

- A. Product Data on Glass Types: Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- B. Product Data on Glazing Compounds: Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.
- C. Samples: ___12x 12 inch in size of glass units, showing coloration.
- D. Samples: 2 inch long bead of glazing sealant, selected color.

1.07 FIELD CONDITIONS

- A. Do not install glazing when ambient temperature is less than 50 degrees F.
- B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.08 WARRANTY

- A. Sealed Insulating Glass Units: Provide a ten (10) year warranty to include coverage for seal failure, interpane dusting or misting, including replacement of failed units.

PART 2 PRODUCTS

2.01 GLASS MATERIALS

- A. Float Glass Manufacturers:
 - 1. Zeledyne: www.versaluxglass.com.
 - 2. Pilkington North America Inc: www.pilkington.com/na.
 - 3. PPG Industries, Inc: www.ppgideasapes.com.
- B. Float Glass: All glazing is to be float glass unless otherwise indicated.
 - 1. Annealed Type: ASTM C1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
 - 2. Heat-Strengthened and Fully Tempered Types: ASTM C1048.
 - 3. Tinted Types: Color and performance characteristics as indicated.
 - 4. Thicknesses: As indicated; for exterior glazing comply with specified requirements for wind load design regardless of specified thickness.
- C. Glass Properties: Conform to California Building Code (CBC) Part 2, Chapter 24 and CPSC Safety Standard 16 CFR 1201, all glazing fully tempered; each lite marked with permanent ANSI Z97-1 logo; with the following minimum requirements: glazing thicknesses as noted on the Drawings.
- D. Interior Glazing: Clear Float Glass; fully tempered.
 - 1. Comply with ASTM C 1036, Type I, transparent flat, Class 1 clear, Quality Q3 (glazing select).
 - 2. 1/4 inch minimum thick.
- E. Exterior Glazing: Tinted Glass; Float type, tempered, heat-absorbing and light reducing in green color. "Azurlia" or "Solexia", as manufactured by PPG Industries or "Evergreen", as manufactured by Pilkington/LOF, or Approved Equal.
 - 1. Comply with ASTM C 1036, Type I, transparent flat, Class 2, Quality Q3 (glazing select).

2.02 SEALED INSULATING GLASS UNITS

- A. Manufacturers:
 - 1. Any of the manufacturers specified for float glass.
- B. Sealed Insulating Glass Units: Types as indicated.
 - 1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
 - 2. Edge Spacers: Aluminum, bent and soldered corners.
 - 3. Edge Seal: Glass to elastomer with supplementary silicone sealant.
 - 4. Purge interpane space with dry hermetic air.
- C. Insulated Glass Units: Double pane with glass to elastomer edge seal.
 - 1. Outer pane of tinted glass, inner pane of clear glass Low-E.
 - 2. Durability: Certified by an independent testing agency to comply with ASTM E 2190.
 - 3. Purge interpane space with dry hermetic air.
 - 4. Total unit thickness of 1 inch minimum.
- D. Edge Seal Construction: Stainless steel, bent and spot welded corners.
- E. Edge Seal Material: selected color.

2.03 GLAZING ACCESSORIES

- A. Setting Blocks: Neoprene, 80 to 90 Shore A durometer hardness, ASTM C864 Option I. Length of 0.1 inch for each square foot of glazing or minimum 4 inch x width of glazing rabbet space minus 1/16 inch x height to suit glazing method and pane weight and area.
- B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness, ASTM C 864 Option I. Minimum 3 inch long x one half the height of the glazing stop x thickness to suit application, self adhesive on one face.
- C. Glazing Tape: Preformed butyl compound with integral resilient tube spacing device; 10 to 15 Shore A durometer hardness; coiled on release paper; size as required; black color.
- D. Glazing Channels, Beads and Stops: As provided by manufacturer of frames to be glazed.

2.04 FABRICATION

- A. Edges: Clean Cut.
- B. Fabricate glass and other glazing products in sizes required to glaze openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with recommendations of product manufacturer and referenced glazing standard as required to comply with system performance requirements.

2.05 SOURCE QUALITY CONTROL AND TESTS

- A. Provide shop inspection for all glass.
 - 1. Inspect all edges of each glass unit before shipment to the site. Ensure that edges do not contain nicks, scratches, fissures, puddling or other imperfections which are known, within the glass industry, to lessen performance.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Examine glass framing for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
 - 2. Minimum required face or edge clearances.
 - 3. Observable edge damage or face imperfections.
- B. Verify that openings for glazing are correctly sized and within tolerance.
- C. Glass Product
 - 1. Verify that each piece of glass is free of scratches or marred surfaces.
 - 2. Verify that all edges are clean cut and finished in the specified manner.
- D. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and ready to receive glazing.
- E. Do not proceed with glazing until unsatisfactory conditions have been corrected. Commencement of work indicates acceptance of substrates.

3.02 PREPARATION

- A. Clean contact surfaces with solvent and wipe dry immediately before glazing.

- B. Seal porous glazing channels or recesses with substrate compatible primer or sealer. Remove coatings that are not firmly bonded to substrates.
- C. Prime surfaces scheduled to receive sealant.
- D. Install sealants in accordance with ASTM C1193 and GANA Sealant Manual.
- E. Install sealant in accordance with manufacturer's instructions.

3.03 INSTALLATION - GENERAL

- A. Shop cut all glazing. Make concealed edges of glazing clean, straight cut and free from chips and fissures; trim wire flush.
- B. Install glazing in accordance with Flat Glass Manufacturers' Association, "Glazing Manual". Set glass crown to the outside, with equal bearing on entire width of pane. Position sheets of glass with setting blocks located at quarter points of glass with edge block no more than 6 inches from corners.
- C. Protect glass from edge damage during handling and installation. Inspect glass during installation and discard pieces with edge damage that could affect glass performance.
- D. Set units of glass in each series with uniformity of pattern, draw, bow, and similar characteristics.
- E. Stop Glazing: Set glass on glazing tape to fit openings exactly, with stretch allowance during installation. Fill all voids around perimeter and between glass and stop with glazing compound. Trim tape and compound flush with sight line.
- F. Snap-in Bead Glazing: Set glass on glazing tape in accordance with frame manufacturer's installation instructions. Trim tape flush with sight line.

3.04 INSTALLATION - EXTERIOR WET/DRY METHOD (PREFORMED TAPE AND SEALANT)

- A. Cut glazing tape to length and set against permanent stops, 3/16 inch below sight line. Seal corners by butting tape and dabbing with butyl sealant.
- B. Apply heel bead of butyl sealant along intersection of permanent stop with frame ensuring full perimeter seal between glass and frame to complete the continuity of the air and vapor seal.
- C. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
- D. Rest glazing on setting blocks and push against tape and heel bead of sealant with sufficient pressure to attain full contact at perimeter of pane or glass unit.
- E. Install removable stops, with spacer strips inserted between glazing and applied stops, 1/4 inch below sight line. Place glazing tape on glazing pane or unit with tape flush with sight line.
- F. Fill gap between glazing and stop with butyl type sealant to depth equal to bite of frame on glazing, but not more than 3/8 inch below sight line.
- G. Apply cap bead of polyurethane type sealant along void between the stop and the glazing, to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.05 INSTALLATION - INTERIOR WET/DRY METHOD (TAPE AND SEALANT)

- A. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.
- B. Place setting blocks at 1/4 points with edge block no more than 6 inches from corners.
- C. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.
- D. Install removable stops, spacer shims inserted between glazing and applied stops at 24 inch intervals, 1/4 inch below sight line.
- E. Fill gaps between pane and applied stop with butyl type sealant to depth equal to bite on glazing, to uniform and level line.
- F. Trim protruding tape edge.

3.06 FIELD QUALITY CONTROL

- A. Flood exterior glazing with water from bottom to top; repair any leaks.

3.07 MANUFACTURER'S FIELD SERVICES

- A. Provide Glass and Glazing product manufacturers to perform field surveillance of the installation of their products.
- B. Monitor and report installation procedures and unacceptable conditions.

3.08 CLEANING

- A. Remove glazing materials from finish surfaces.
- B. Remove labels after Work is complete.
- C. Clean glass and adjacent surfaces, both faces, not more than 4 days prior to date scheduled for final inspection.

END OF SECTION

DIVISION 9
FINISHES

SECTION 09 2116
GYP SUM BOARD ASSEMBLIES

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Metal stud wall framing.
- B. Gypsum wallboard.
- C. Joint treatment and accessories.
- D. Tackable mineral fiber board backing for wallcoverings.
- E. Textured finish system.

1.02 RELATED REQUIREMENTS

- A. Section 07 9005 - Joint Sealers: Acoustic sealant.
- B. Section 09 2216 - Non-Structural Metal Framing.
- C. Division 09: Pertinent sections specifying finishes installed over gypsum board substrates.
- D. Section 13 3419 - Metal Building Systems
- E. Divisions 22 and 23: Pertinent sections specifying building utility systems penetrating gypsum board.

1.03 REFERENCE STANDARDS

- A. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.
- B. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.
- C. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- D. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board.
- E. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
- F. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
- G. ASTM C1396/C1396M - Standard Specification for Gypsum Board.
- H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- I. ASTM E 119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
- J. Cisca Ceiling Systems Installation Handbook.
- K. GA-214 - Recommended Levels of Gypsum Board Finish; Gypsum Association
- L. GA-216 - Application and Finishing of Gypsum Board; Gypsum Association.

- M. GA-600 - Fire Resistance Design Manual; Gypsum Association.
- N. California Building Code, Title 24, Part 2, California Building Code, Chapter 8.
- O. UL (FRD) - Fire Resistance Directory; Underwriters Laboratories Inc..

1.04 SUBMITTALS

- A. Product Data: Provide data on metal framing, gypsum board, accessories, and tackboard.
- B. Samples: _____ Gypsum board finished with proposed texture application, 12 by 12 inches in size, illustrating finish color and texture.
- C. Two samples 8 x 10 inch in size of tack board substrate, with manufacturer's labeling attached.

1.05 QUALITY ASSURANCE

- A. Perform in accordance with ASTM C 840. Comply with requirements of GA-600 for fire-rated assemblies.

1.06 REGULATORY REQUIREMENTS

- A. Conform to applicable code for fire rated assemblies as indicated on drawings.

1.07 PROJECT CONDITIONS

- A. Suspended Ceiling Systems - General: Coordinate with other work supported by or penetrating through the ceiling, including mechanical and electrical work and partition systems.
 - 1. Mechanical work: Ductwork and piping above system shall be complete, and permanent HVAC systems operating.
 - 2. Electrical Work: Installation of conduit above suspension system shall be complete before installation of suspension system.

PART 2 PRODUCTS

2.01 GYPSUM BOARD ASSEMBLIES

- A. Provide completed assemblies complying with ASTM C840 and GA-216.

2.02 METAL FRAMING MATERIALS

- A. Manufacturers - Metal Framing, Connectors, and Accessories:
- B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
- C. Non-Loadbearing Framing System Components: ASTM C 645; galvanized sheet steel, size and gage to comply with ASTM C 754 at spacing indicated; maximum deflection L/240 at 5 psf.
 - 1. Studs: "C" shaped with flat or formed webs with knurled faces.
 - 2. Runners: U shaped, sized to match studs.
 - 3. Resilient Channels, wall and ceiling sound attenuation: U. S. Gypsum "Sheetrock" brand RC-1 Resilient Channels, roll formed 25 gage, corrosion resistant steel, attached with

screws through pre-punched holes in inner flange, gypsum board or panel screw attached to knurled outer flange, spacings as recommended by manufacturer for framing spacings indicated.

4. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
5. Additional profiles: Types indicated or as required to suit conditions, conforming to referenced standards or as recommended by metal framing manufacturer.

D. Metal Studs for Application of Gypsum Board: As specified in Section 05 5000.

2.03 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:

1. Georgia-Pacific Gypsum: www.gpgypsum.com.
2. National Gypsum Company: www.nationalgypsum.com.
3. PABCO Gypsum: www.pabco gypsum.com.
4. USG Corporation: www.usg.com.

B. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
2. Unfaced fiber-reinforced gypsum panels as defined in ASTM C1278/C1278M, suitable for paint finish, of the same core type and thickness may be substituted for paper-faced board.
3. Thickness:
 - a. Vertical Surfaces: 5/8 inch.

C. Moisture-Resistant Gypsum Backing Board: ASTM C1396/C1396M; ends square cut. Fire-rated Type X where occurring in designated rated assemblies.

1. Thickness: 1/2 inch.
2. Edges: tapered.

D. Fire Rated Gypsum Wallboard: ASTM C 1396/C1396M; Type X, UL or WH rated; sizes to minimize joints in place; ends square cut.

1. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X.
2. Application: all locations, unless otherwise indicated.
 - a. Thickness: 1/2 inch, and 5/8 inch, as indicated.

2.04 TACKBOARD

A. Acceptable manufacturers:

1. FlameSpec manufactured by Celotex Blue Ridge Fiberboard, a subsidiary of WR Meadows, having Class A surface burning characteristics and tested in conformance with ASTM E 84.
2. "Micore" Mineral Fiber Board 300 by USG, Chicago, IL, www.micore.com
3. Or Approved Equal

B. Requirements:

1. Class A surface burning characteristics and tested conformance with ASTM E 84.
2. Flame spread less than 20 and having a smoke development rating of less than 30 on the exposed face, when tested in accordance with ASTM E 84.

3. 1/2 inch thickness, primed and ironed, calendared, and with square edges.

2.05 ACCESSORIES

- A. Acoustic Sealant: As specified in Section 07 9005.
- B. Vapor Retarder (Water-Resistive Barrier): As specified in Section 07 25000.
- C. Finishing Accessories: ASTM C1047, galvanized steel or rolled zinc, unless otherwise indicated. Mechanically fastened.
 1. Types: As detailed or required for finished appearance.
 2. Special Shapes: In addition to conventional cornerbead and control joints, provide U-bead at exposed panel edges.
- D. Joint Materials: ASTM C 475 and as recommended by gypsum board manufacturer for project conditions. Water resistant where used with water resistant backer board.
 1. Tape: 2 inch wide, creased paper tape for joints and corners, USG "Perf-A-Tape", or Approved Equal.
 2. Ready-mixed vinyl-based joint compound.
- E. High Build Drywall Surfer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.
- F. Textured Finish Materials: Latex-based compound; plain.
- G. Screws for Attachment to Steel Members Less Than 0.03 inch In Thickness, to Wood Members, and to Gypsum Board: ASTM C1002; self-piercing tapping type; cadmium-plated for exterior locations.
- H. Screws: ASTM C 1002; self-drilling type. Lengths as required for minimum penetration into support members per reference standards.
 1. For Wood: "Type W".
 2. For Metal: "Type S".
 3. For joint backing: "Type G".
- I. Anchorage to Substrate: Tie wire, nails, screws, and other metal supports, of type and size to suit application; to rigidly secure materials in place.
- J. Adhesives
 1. Modified contact adhesive: As recommended by the gypsum board manufacturer and having a placement time before setting of at least 15 minutes.
 2. Joint compound adhesive: As recommended by the gypsum board manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that project conditions are appropriate for work of this section to commence.
- B. Verify that framed substrates demonstrate flatness characteristics such that work of this section will meet specified tolerances.

3.02 INSTALLATION - GENERAL

- A. Install materials in accordance with gypsum board application and finishing standards referenced.
 - 1. Single layer application: Screw attachment.
 - 2. Float interior angles, except where required to conform to fire or acoustical separation requirements.
 - 3. Do not install scored, scratched, broken, damp, or otherwise damaged boards.
 - 4. Smooth cut edges and ends to obtain neat fitting joints.

3.03 FRAMING INSTALLATION

- A. Metal Framing: Comply with ASTM C 754 and manufacturer's instructions.
- B. Fire blocking and furring for Fire Ratings: Install as required by prevailing codes to provide fire resistance ratings indicated and to GA-600 requirements.
- C. Blocking: Install blocking for support of plumbing fixtures, toilet partitions, wall cabinets, framed openings, toilet accessories, hardware, other wall mounted fixtures or equipment, and as necessary to provide solid edge blocking for fire-rated installations and support of board materials.
 - 1. Bolt or screw steel backing to metal framing substrates.

3.04 BOARD INSTALLATION

- A. Comply with ASTM C 840. Install to minimize butt end joints, especially in highly visible locations.
- B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
- C. Double-Layer Non-Rated: Use gypsum board for first layer, placed perpendicular to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Tack Board: Install as for gypsum board, perpendicular to supports, with staggered end joints over supports.
- E. Installation on Metal Framing: Use screws for attachment of all gypsum board.
- F. Moisture Protection: Treat cut edges and holes in moisture resistant gypsum board with sealant.

3.05 INSTALLATION OF TRIM AND ACCESSORIES

- A. Control Joints: Place control joints consistent with lines of building spaces and as directed.
- B. Corner Beads: Install at external corners, using longest practical lengths.
- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials and as indicated.

3.06 JOINT TREATMENT

- A. Finish gypsum board in accordance with levels defined in ASTM C 840, and required by Section 09 9000 Painting and Coating, as follows:
 - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
 - 2. Level 5: Walls to receive eggshell paint finish.
 - 3. Level 4: Walls and ceilings to receive wall coverings, unless otherwise indicated.
 - 4. Level 2: Behind cabinetry and on backing board to receive tile finish.
 - 5. Level 1: Fire rated wall areas above finished ceilings, whether or not accessible in the completed construction.
- B. Finish tack board in scheduled areas in accordance with GA-214 Level 3.
- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
 - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
- D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

3.07 TOLERANCES

- A. Maximum Variation of Finished Gypsum Board, Tack Board, or Cementitious Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 2216
NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Metal partition, ceiling, and soffit framing.
- B. Framing accessories.

1.02 RELATED REQUIREMENTS

- A. Section 07 6200 - Sheet Metal Flashing and Trim: Head and sill flashings.
- B. Section 08 3100 - Access Doors and Panels.
- C. Section 08 5113 - Aluminum windows
- D. Section 09 2116 - Gypsum Board Assemblies: Metal studs for gypsum board partition framing.

1.03 REFERENCE STANDARDS

- A. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members.
- B. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
- C. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Metal Framing, Connectors, and Accessories:
 - 1. Clarkwestern Dietrich Building Systems LLC: www.clarkdeitrich.com.
 - 2. Marino: www.marinoware.com.
 - 3. Approved Equal

2.02 FRAMING MATERIALS

- A. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.
 - 1. Studs: C shaped with flat or formed webs with knurled faces.
 - 2. Runners: U shaped, sized to match studs.
- B. Partition Head to Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.
- C. Tracks and Runners: Same material and thickness as studs, bent leg retainer notched to receive studs with provision for crimp locking to stud.

- D. Furring and Bracing Members: Of same material as studs; thickness to suit purpose; complying with applicable requirements of ASTM C754.
- E. Fasteners: ASTM C1002 self-piercing tapping screws.
- F. Sheet Metal Backing: 0.036 inch thick, galvanized.
- G. Anchorage Devices: Powder actuated.
- H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic.

2.03 FABRICATION

- A. Fabricate assemblies of framed sections to sizes and profiles required.
- B. Fit, reinforce, and brace framing members to suit design requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that rough-in utilities are in proper location.

3.02 INSTALLATION OF STUD FRAMING

- A. Extend partition framing to structure where indicated and to ceiling in other locations.
- B. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
- C. Align and secure top and bottom runners at 24 inches on center.
- D. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- E. Align stud web openings horizontally.
- F. Secure studs to tracks using crimping method. Do not weld.
- G. Fabricate corners using a minimum of three studs.
- H. Double stud at wall openings, door and window jambs, not more than 2 inches from each side of openings.
- I. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

3.03 CEILING AND SOFFIT FRAMING

- A. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.
- B. Install furring independent of walls, columns, and above-ceiling work.
- C. Securely anchor hangers to structural members or embed in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

- D. Space main carrying channels at maximum 72 inch on center, and not more than 6 inches from wall surfaces. Lap splice securely.
- E. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.
- F. Place furring channels perpendicular to carrying channels, not more than 2 inches from perimeter walls, and rigidly secure. Lap splices securely.

END OF SECTION

**SECTION 09 7200
WALL COVERING**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Wall covering for tackable and non-tackable surfaces..
- B. Shop fabrication and installation of tackable panels with wall covering.

1.02 RELATED REQUIREMENTS

- A. Section 09 2116 - Gypsum Board Assemblies: Wall substrates.
 - 1. Filling of gaps and fastener depression in gypsum board backings, and tackable substrate for wallcoverings.
- B. Section 09 7723 - Wall Panels: Shop fabrication and installation of tackable panels wrapped with wall covering.
- C. Section 09 9000 - Painting and Coating: Preparation and priming of substrate surfaces.

1.03 REFERENCE STANDARDS

- A. Manufacturer's recommendations for installation.
- B. CFFA-W-101-B: Quality Standard for Vinyl Coated Fabric
- C. WA Quality Standard for Polymer Coated Fabric Wallcovering W-101
- D. Federal Specification: CCC-W-408A, FS L-P-1040
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- F. ASTM F793 - Standard Classification of Wallcovering by Use Characteristics.

1.04 SYSTEM DESCRIPTION

- A. Performance Requirements:
 - 1. Material Fire Hazard Classification: Maximum flame spread of 25 and maximum smoke development of 50 when tested in accordance with ASTM Standard E 84.
 - 2. Extend wall coverings behind surface mounted trim plates.
 - 3. Product hairline seams at all locations which exhibit no edge ravel.
 - 4. Product installation which is uniformly flat with no ridges or folds.

1.05 SUBMITTALS

- A. Product Data: Provide data on wall covering, fillers, sealers and adhesive.
- B. Samples: Wall covering, 7 x 9 inch in size illustrating color, finish, pattern and texture.
- C. Test Reports: Indicate verification of flame and smoke ratings, when tested by UL.
- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Maintenance Data: Submit data on cleaning, touch-up, and repair of covered surfaces.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Inspect panels at arrival on site, to verify acceptability.
- B. Protect packaged adhesive from temperature cycling and cold temperatures.

PART 2 PRODUCTS**2.01 MANUFACTURER**

- A. Koroseal RJF International.
- B. Other Acceptable Manufacturers:
 - 1. Omnova Solutions Inc: Products of equivalent price grade, weight and pattern selection, www.omnova.com.
 - 2. Or Approved Equal

2.02 MATERIALS

- A. Requirements for All Wall Coverings:
 - 1. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84.
 - 2. NFPA 286 Corner Burn Test - Must meet requirement for Flame Spread, Smoke Developed and Flashover.
- B. Wall Covering: Vinyl coated fabric roll stock, conforming to the following:
 - 1. Total Weight: 21 oz/sq yd.
 - 2. Vinyl Finish Weight: 18 oz/sq yd.
 - 3. Roll Width: 54 inches, nominal.
 - 4. Fabric Weight/Type: 3 oz. PLY, Osnaburg.
 - 5. Color: Multiple colors as selected, see below.
 - 6. Pattern selected by Owner from Koroseal Standard Recycled Wallcovering Collection, or Approved Equal
 - 7. Overcoating: Stain resistant, polyvinyl fluoride over-coating, 0.0005 inch thick, manufacturer standard.
- C. All fabric shall meet CA0130 standard for indoor air quality.
- D. All fabric shall contain a minimum of 20% recycled content.
- E. Adhesive: Type recommended by wall covering manufacturer to suit application to substrate.
- F. Substrate Filler: As recommended by adhesive and wall covering manufacturers; compatible with substrate.
- G. Substrate Primer and Sealer: Alkyd enamel, type specified in Section 09 9000.
- H. Colors selected by Owner from manufacturer's full range of available colors, minimum selection of 25 colors. Color schemes will include two selections per room, of roughly equal proportions, colors and locations to be field determined by Owner.

2.03 TACKABLE PANEL FABRICATION

- A. Shop fabricate tackwall panels. Wrap tackable panels with vinyl coated fabric wall coverings covering the face and all edges and return to the back of the panel for a smooth, tailored appearance.
- B. Shop fabrication standards for finished fabric surfaces shall be as specified below for field installation, free of wrinkles, bubbles, stains, fishmouths, voids or tears.

2.04 SOURCE QUALITY CONTROL

- A. Vinyl Color Match: Each type and color produced from a single dye lot.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that substrate surfaces are prime painted and ready to receive work, and conform to requirements of the wall covering manufacturer.
- B. Measure moisture content of surfaces using an electronic moisture meter. Do not apply wall coverings if moisture content of substrate exceeds level recommended by wall covering manufacturer.
- C. Verify flatness tolerance of surfaces does not vary more than 1/8 inch in 10 feet nor vary at a rate greater than 1/16 inch/ft.
- D. Correct unsatisfactory conditions prior to commencement of work.

3.02 PREPARATION

- A. Fill cracks in substrate so that wall is flat to a tolerance of 1/8-inch in 10 feet, and 1/16 inch in 1 foot and smooth irregularities with filler; sand smooth.
- B. Wash impervious surfaces with tri-sodium phosphate, rinse and neutralize; wipe dry.
- C. Surface Appurtenances: Remove electrical plates, hardware, light fixture trim, escutcheons, and fittings prior to preparing surfaces or finishing.
- D. Surfaces: Correct defects and clean surfaces that affect work of this section. Remove existing coatings that exhibit loose surface defects.
- E. Marks: Seal with shellac those that may bleed through surface finishes.
- F. Apply one coat of primer sealer to substrate surfaces. Allow to dry. Lightly sand smooth.
- G. Vacuum clean surfaces free of loose particles.

3.03 INSTALLATION - TACKABLE PANELS

- A. Securely fasten wall panels in vertical orientation in patterns and configurations indicated with adhesives and concealed screws at top and bottom of panels. Space fasteners as specified for panel materials in Section 09 2116.
- B. Install in uniform plane matching flatness tolerance of completed substrates specified in other sections, free from twists, warps, stains, tears, dents, damaged edges or defects impairing appearance or function.

- C. Razor-cut all panel edges, do not "score-and-break"; back-wrap and adhere fabric at all cut panel edges, no exposed panel materials or substrates visible in finished work.
- D. Install vinyl-wrapped metal termination trim at edges where indicated and wherever acceptable back-wrapped edges cannot be made.

3.04 CLEANING

- A. Clean wall coverings of excess adhesive, dust, dirt, and other contaminants.
- B. Reinstall wall plates and accessories removed prior to work of this section.

3.05 PROTECTION

- A. Do not permit construction activities at or near finished wall covering areas.
- B. Replace damaged work prior to occupancy.

END OF SECTION

SECTION 09 7723
WALL PANELS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Fiberglass reinforced composite panels.
- B. Fabric-Wrapped Tackboard Paneling, factory fabricated.
- C. Trim and installation accessories.

1.02 RELATED SECTIONS

- A. Sections specifying products serving as substrates for wall panels.
- B. Section 09 2116 - Gypsum Board Assemblies: Wood-Fiber tackable panels to receive fabric wall coverings.

1.03 REFERENCES

- A. ASTM C 177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus.
- B. ASTM D 256 - Standard Test Methods for Determining the Pendulum Impact Resistance of Notched Specimens of Plastics.
- C. ASTM D 543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
- D. ASTM D 570 - Standard Test Method for Water Absorption of Plastics.
- E. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics.
- F. ASTM D 1929 - Standard Test Method for Determining Ignition Temperature of Plastics.
- G. ASTM D 2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
- H. ASTM D 3841 - Standard Specification for Glass-Fiber-Reinforced Polyester Plastic Panels.
- I. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

1.04 SUBMITTALS

- A. Product Data: Provide manufacturer's standard details and catalog data demonstrating compliance with referenced standards. Provide installation instructions.
- B. Samples:
 - 1. Submit 6 inch square samples of each surface and color required.
 - 2. Submit 6 inch long samples of each trim profile and trim color required.
- C. Test Reports: Indicate conformance to specified requirements and referenced standards.
- D. Vinyl-Wrapped Tackboard Wall Panels: Pattern and Color(s): Woven Texture, color selected from manufacturer's standard line, provide minimum of seven choices.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store products indoors and protect from moisture, construction traffic, and damage.
- B. Store panels flat on clean, dry surface. Do not stand on edge or stack on fresh concrete or other surfaces that emit moisture.
- C. Store panels for at least 24 hours at temperature and humidity conditions approximating the average environment of the finished room.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Do not install materials when projects conditions do not meet manufacturer requirements.

1.07 EXTRA MATERIALS

- A. Supply five percent of installed area of each material and color for Owner 's use in maintenance of project.

PART 2 PRODUCTS**2.01 FIBERGLASS REINFORCED COMPOSITE PANELS**

- A. General: Fiberglass reinforced composite panels.
 - 1. Composite plastic panels of random chopped fiber glass roving, modified polyester copolymer, inorganic fillers, and pigments.
 - 2. Resistant to rot, corrosion, staining, denting, peeling, and splintering.
 - 3. USDA accepted.
 - 4. Comply with ASTM D 3841, Type CC2.
- B. Sequentia Structoglas FRP Wall and Ceiling Panels; "FTSTF".
 - 1. Surface burning classification: Class C.
 - a. Flame spread (ASTM E 84): 200 or less.
 - b. Smoke developed (ASTM E 84): 450 or less.
 - 2. Flexural Modulus (ASTM D 790): 250,000 psi.
 - 3. Tensile Modulus (ASTM D 638): 500,000 psi.
 - 4. Impact Strength, IZOD (ASTM D 256): 4 ft-lb/in notched.
 - 5. Coefficient of Linear Thermal Expansion (ASTM D 696): 0.0000225 in/in/degree F.
 - 6. Water Absorption (ASTM D 570): 0.75 percent in 24 hrs. @ 77 degrees F.
- C. Size:
 - 1. Wall panel width: 48 inches.
 - 2. Wall panel length: Provide full-length panels unless substrate dimensions exceed available fabricated size.
 - 3. Ceiling panel width: 23-3/4 inches.
 - 4. Ceiling panel length: 47-3/4 inches.
 - 5. Thickness:
 - a. Wall and Ceiling Panels: 0.09 inch.
 - 6. Dimensional Tolerances:
 - a. Width and length: +/- 1/8 inch.
 - b. Thickness: +/- 10 percent.
 - c. Squareness: Not more than 1/8 inch out of square.

D. Finishes:

1. Exposed Surface: embossed pebbled textured finish.
2. Back Surface: Smooth. Imperfections that do not affect functional properties are not cause for rejection.
3. Color: As selected from manufacturer's standard colors, uniform throughout.

E. Manufacturers:

1. Crane Composites; 23525 W Eames, Channahon, IL 60410; www.cranecomposites.com
2. Marlite; 15120 Marquardt Ave., Santa Fe Springs, CA 90670; www.marlitefrp.com
3. Or Approved Equal

2.02 VINYL-WRAPPED TACKBOARD WALL PANELS**A. Vinyl-Wrapped Tackboard Wall Panels: Wood fiber substrate with factory-laminated vinyl-coated fabric wall covering.**

1. Panel Thickness: 1/2 inch.
2. Weight: approximately 0.9 lbs./sq. ft.
3. Sheet Sizes: select from standard sizes available to minimize joints, 48 inch width standard.
4. Fire Hazard Classification per ASTM E84: Class II.
 - a. Flame Spread: <75.
 - b. Smoke Developed <150.

B. Vinyl Fabric Materials: Meet or exceed FS CCC-W-408A, Type I, Class A and the following;

1. Total Weight (oz/lin. yd.) 15.0.
2. Total Weight (oz/sq. yd.) 10.0.
3. Vinyl Weight (oz/sq. yd.) 8.9.
4. Cloth Weight (oz/sq. yd.) 1.1.
5. Fire Hazard Classification per ASTM E84:
 - a. Flame Spread: <10.
 - b. Smoke Developed <5.

C. Manufacturers:

1. Chatfield-Clarke Company; 14614 Valley Blvd., Fontana, CA 92335; 909-823-4297; www.chatfield-clarke.com.
2. Or Approved Equal

2.03 TRIM ACCESSORIES**A. Fiberglass Reinforced Composite Panels: Provide panel manufacturer's standard moldings in colors and thickness matching panels, to meet project conditions.**

1. Outside angle.
2. Inside angle.
3. Panel Division Bar.

B. Laminate Wall Panels: Provide extruded aluminum panel moldings as detailed.**C. Fasteners: Non-staining, as recommended by manufacturer in writing.**

1. Match panel colors at fiberglass reinforced composite panels.
2. Concealed at laminate wall panels.
3. Length to suit project conditions.

- D. Adhesive: Structural construction adhesive as recommended by manufacturer, meeting or exceeding specified fire code criteria.
- E. Sealant: Color matched silicone sealant as recommended by manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrates that will receive panels to ensure that surfaces are smooth, dry, true, and free of dirt, dust, oil, or grease.
- B. Remove high spots. Fill low spots.
- C. Apply leveling coat of plaster to concrete block walls, if required to bring surface to a true plane.
- D. Verify that substrate construction is completed and approved.
- E. Correct deficiencies in substrate before installing panels.
- F. All panels shall be allowed to equalize to the moisture and temperature in the room environment prior to installation, and in accordance with manufacturer's limitations.
- G. Panel edges must be refinished to manufacturer's instructions after field cutting, before installation. Field refinishing shall be provided as to match pre-finished edge.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's printed installation instructions.
- B. Apply adhesive at temperature between 50 and 90 degrees F, unless otherwise recommended by manufacturer for specific project conditions.
 - 1. Spread adhesive 1/4-inch deep over entire back side of panel to achieve 100 percent coverage.
 - 2. Do not use beads of adhesive.
 - 3. Do not use mechanical fasteners or adhesive alone.
 - 4. Allow open time recommended by adhesive manufacturer before setting panels into position.
 - 5. Once in position, apply sufficient pressure to make full contact between panel and wall.
 - 6. Roll panel surface to ensure complete contact.
 - 7. If necessary, install bracing to maintain intimate contact until adhesive cures in accordance with manufacturer's instructions.
- C. Moldings:
 - 1. Trim division bar to accommodate ceiling and base moldings.
 - 2. Check plumb.
 - 3. Apply sealant to leading edge of molding to receive next panel. Allow 1/8 inch clearance when installing panel.
 - 4. Remove excess sealant from panels and moldings.
- D. Sealants: Seal corner seams, ceiling and base junctures, around door frames and other openings, and between penetrating items and panel cut-outs.

3.03 ADJUST AND CLEAN

- A. Remove scraps and debris from the site, and leave in a neat and clean condition.
- B. Protect installed Work from subsequent construction operations.

END OF SECTION

**SECTION 09 9000
PAINTING AND COATING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Surface preparation.
- B. Field application of paints, stains, varnishes, and other coatings.
- C. Materials for backpriming woodwork.
- D. Finish of interior and exterior surfaces exposed to view and semi-exposed and unless otherwise indicated.
- E. Do Not Paint or Finish the Following Items:
 - 1. Items fully factory-finished unless specifically so indicated; materials and products having factory-applied primers are not considered factory finished.
 - 2. Items indicated to receive other finishes.
 - 3. Items indicated to remain unfinished.
 - 4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
 - 5. Floors, unless specifically so indicated.
 - 6. Glass.
 - 7. Concealed pipes, ducts, and conduits.
- F. See Schedule - Surfaces to be Finished, at end of Section.

1.02 RELATED REQUIREMENTS

- A. Pertinent sections specifying above ground piping and items requiring finishes by this section.
- B. Pertinent sections of Division 05 specifying shop-primed and galvanized metal items.
- C. Section 07 9005- Joint Sealers.
- D. Pertinent Sections of Division 08 specifying wood veneer samples for finishing.
- E. Section 09 7200- Wall Covering.
- F. Factory finishes and prime coats are specified in various sections.
- G. Pertinent sections specifying civil, mechanical and electrical work requiring painting.

1.03 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications.
- C. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Base Materials.
- D. Manufacturer's recommendations and specifications, including installation instructions.

- E. Woodwork Institute of California, Manual of Millwork.
- F. SSPC (PM1) - Good Painting Practice: SSPC Painting Manual, Vol. 1; Society for Protective Coatings.
- G. USGBC LEED-NC - LEED Green Building Rating System for New Construction and Major Renovations; U.S. Green Building Council.

1.04 DEFINITIONS

- A. "Paint": Coating systems materials, including primers, emulsions, enamels, stains, sealers, and fillers, other applied materials whether used as a prime, intermediate or finish coat.

1.05 SUBMITTALS

- A. Product Data: Provide data on all finishing products, special coatings, and materials, including VOC content. Provide the following information for each coating:
 - 1. Resin Type.
 - 2. Total VOC Content in grams per liter.
 - 3. Composition-By-Weight. Demonstrate composition by percentage related to total weight of all components.
 - 4. Film Thickness Per Coat, Wet and Dry.
 - 5. Prime Pigment: Demonstrate prime pigment by percentage related to total volume of all components.
- B. Samples for Selection: Paper chip samples, 2 x 3 inch in size illustrating range of colors and textures available for each surface finishing product scheduled. Manufacturer color wands or booklets are acceptable.
- C. Samples for Verification: Painted samples, illustrating selected colors and textures for each color and system selected with specified coats cascaded. Submit on tempered hardboard, 8 x 10 inch in size.
- D. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.
- E. Maintenance Data: Submit data on cleaning, touch-up, and repair of painted and coated surfaces.

1.06 DESIGN REQUIREMENTS

- A. Design Intent: Paint all Work which is normally painted in a building of this type and quality, whether or not the item or surface is specifically identified within the Contract Documents.
 - 1. The number of coats specified is the minimum to be applied. Provide paint finishes of even, uniform color, free from cloudy or mottled surfaces. Provide one additional coat if necessary where "deep colors" are selected.
 - 2. Non-scheduled items: Provide manufacturer's approved and recommended system as set forth in Manufacturer's "Specifications Architectural Finishes".
 - 3. All paints and coatings used within the interior of the building shall meet the low VOC requirements of USGBC LEED-NC v2009 IEQ Credit 4.2

1.07 QUALITY ASSURANCE

- A. Manufacturer's proprietary names or catalog numbers are indicated for convenience in identifying products. Manufacturer's complete product catalog description and composition for indicated product names or numbers shall constitute requirements for each product specified. Products shall incorporate all attributes set forth in the manufacturer's catalog description for the specified item, except for such modifications thereto as may be indicated in the Contract Documents.

1.08 REGULATORY REQUIREMENTS

- A. Conform to CBC Title 24 code for flame and smoke rating requirements for products and finishes.
- B. Conform to Air Pollution Control Rules in the District in which project is located.
- C. Provide products conforming with local, State and Federal government requirements limiting the amount of volatile organic compounds contained in the product, for its intended application. If specified product exceeds current requirement, provide conforming product at no additional cost.

1.09 MOCK-UP

- A. For each specified finish, provide panel, 8 feet long by 10 feet wide, illustrating specified coating color, texture, and finish.
- B. Provide door and frame assembly illustrating paint coating color, texture, and finish.
- C. Final color selections and acceptance will be made only after review of mock-ups under lighting conditions approximating finish conditions.
- D. Locate in mutually accepted location.
- E. Mock-up may remain as part of the work.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.11 FIELD CONDITIONS

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply exterior coatings during fog, mist, rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

1. Do not paint exterior materials when inclement weather is expected within the full drying time specified by the manufacturer.
- D. Schedule work to avoid painting surfaces, when surfaces are exposed to direct sunlight.
- E. Minimum Application Temperatures for Latex Paints: 45 degrees F for interiors; 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.
 1. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated and dry within temperature and humidity limits specified by paint manufacturer during application and drying periods.
- F. Minimum Application Temperature for Varnish Finishes: 65 degrees F for interior or exterior, unless required otherwise by manufacturer's instructions.
- G. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

1.12 EXTRA MATERIALS

- A. Supply 1 gallon of each color; store where directed.
- B. Label each container with color, type, texture, and room locations in addition to the manufacturer's label.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Provide all paint and coating products used in any individual system from the same manufacturer; no exceptions.
- B. Paints:
 1. Base Manufacturer: Dunn Edwards Corp. Los Angeles, CA. www.dunnedwards.com
 2. Kelly Moore, San Carlos, CA, 650-592-8337, X-211, www.kellymoore.com.
 3. Glidden Professional: www.gliddenprofessional.com.
 4. Or Approved Equal
- C. Transparent Finishes:
 1. Base Manufacturer: Dunn Edwards Corp.
 2. Kelly Moore.
 3. Or Approved Equal
- D. Stains:
 1. Base Manufacturer: Dunn Edwards Corp.
 2. Kelly Moore.
 3. Or Approved Equal
- E. Primer Sealers: Same manufacturer as top coats.
 1. Base Manufacturer: Dunn Edwards Corp.
 2. Kelly Moore.
 3. Or Approved Equal

2.02 PAINTS AND COATINGS - GENERAL

- A. Systems: Furnish primers and other undercoat paint produced by same manufacturer as finished coats.

- B. Paints and Coatings: Ready mixed, unless intended to be a field-catalyzed coating.
 - 1. Provide paints and coatings of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
 - 2. Supply each coating material in quantity required to complete entire project's work from a single production run.
 - 3. Do not reduce, thin, or dilute coatings or add materials to coatings unless such procedure is specifically described in manufacturer's product instructions.
 - 4. Solids Content By Volume SCBV (not solids by weight). All products shall be minimum 35% SCBV.
- C. Primers: Where the manufacturer offers options on primers for a particular substrate, use primer categorized as "best" by the manufacturer.
- D. Chemical Content: The following compounds are prohibited:
 - 1. Aromatic Compounds: In excess of 1.0 percent by weight of total aromatic compounds (hydrocarbon compounds containing one or more benzene rings).
 - 2. Acrolein, acrylonitrile, antimony, benzene, butyl benzyl phthalate, cadmium, di (2-ethylhexyl) phthalate, di-n-butyl phthalate, di-n-octyl phthalate, 1,2-dichlorobenzene, diethyl phthalate, dimethyl phthalate, ethylbenzene, ethylene glycol, formaldehyde, hexavalent chromium, isophorone, lead, mercury, methyl ethyl ketone, methyl isobutyl ketone, methylene chloride, naphthalene, toluene (methylbenzene), 1,1,1-trichloroethane, vinyl chloride.
- E. Fabricate paints and stains in accordance with the Color Schedule which will include both standard colors and special, non-standard colors.
 - 1. If deep colors are not available in a specified product, propose substitute formula for approval
 - 2. Tint undercoats slightly to approximate finish coat color
- F. Finish Sheen: The following designations are measured in percentage of reflectance when viewed at a 60 degree angle. Provide manufacturer's standard sheen most closely matching the characteristic of specified sheen.
 - 1. Flat: 0-5%.
 - 2. Velvet: 5-9%.
 - 3. Eggshell: 10-15%.
 - 4. Low Sheen: 20-25%.
 - 5. Semi-Gloss: 40-50%
 - 6. Gloss: 70-80%
 - 7. High Gloss: >85%

2.03 PAINT SYSTEMS - EXTERIOR

- A. Paint WE-OP-3L - Wood, Opaque, Latex, 3 Coat:
 - 1. One coat of latex primer sealer.
 - a. Dunn-Edwards, "E-Z PRIME Premium EZPR00".
 - b. Kelly-Moore, "255 ACRY-SHIELD".
 - 2. Gloss: Two coats of latex enamel;
 - a. Dunn-Edwards, "EVERSHIELD EVSH60".
 - b. Kelly-Moore, "1680 DURA-POXY".

3. Semi-gloss: Two coats of latex enamel;
 - a. Dunn-Edwards, "EVERSHIELD EVSH50".
 - b. Kelly-Moore, "1250 ACRY-SHIELD".
- B. Paint WE-TR-V - Wood, Transparent, Varnish, No Stain:
 1. One coat sealer.
- C. Paint ME-OP-3A - Ferrous Metals, Primed or Unprimed, Alkyd, 3 Coat:
 1. One coat of alkyd primer.
 - a. Dunn-Edwards, "BLOC-RUST BRPR00-1-WH" for light finish colors;
 - b. Kelly-Moore, "1711 KEL-GUARD", Alkyd Rust-Preventative White Primer for light finish colors; "1710 KEL-GUARD", Alkyd Rust-Preventative Red Primer for dark finish colors.
 2. Gloss: Two coats of alkyd enamel;
 - a. Dunn-Edwards, "Syn-Lustro 10V".
 - b. Kelly-Moore, "1700 KEL-GUARD".
 3. Semi-gloss: One coat of alkyd enamel;
 - a. Dunn-Edwards, "Syn-Lustro 9".
 - b. Kelly-Moore, 2 coats, "1930 KM PROFESSIONAL Water - Oil Hybrid Int/Ext Semi-Gloss".
- D. Paint MgE-OP-3A - Galvanized Metals, Alkyd, 3 Coat:
 1. Pretreatment, reduce to minimum level for finish coat adhesion]. One coat.
 - a. Dunn-Edwards, "Supreme Chemical Metal Clean and Etch ME01".
 - b. Kelly-Moore, "Jasco Prep & Prime".
 2. Prime Coat:
 - a. Dunn-Edwards, "GALV-ALUM Premium GAPR00" corrosion inhibitive primer.
 - b. Kelly-Moore, "1725 ACRY-SHIELD".
 3. Gloss: One coat of alkyd enamel;, exterior handrails and guardrails.
 - a. Dunn-Edwards, "Syn-Lustro 10V".
 - b. Kelly-Moore, "1700 KEL-GUARD".
 4. Semi-gloss: One coat of alkyd enamel;, all other locations.
 - a. Dunn-Edwards, "Syn-Lustro 9V".
 - b. Kelly-Moore, "1930 KM PROFESSIONAL Water - Oil Hybrid Int/Ext Semi-Gloss".
- E. Paint MaE-OP-3A - Aluminum, Unprimed, Alkyd, 3 Coat:
 1. One coat etching primer.
 - a. Dunn-Edwards, "GALV-ALUM Premium GAPR00".
 - b. Kelly-Moore, "1725 ACRY-SHIELD".
 2. Gloss: Two coats of alkyd enamel;
 - a. Dunn-Edwards, "Syn-Lustro 10V".
 - b. Kelly-Moore, "1700 KEL-GUARD".
 3. Semi-gloss: Two coats of alkyd enamel;
 - a. Dunn-Edwards, "Syn-Lustro 9V".
 - b. Kelly-Moore, "1930 KM PROFESSIONAL Water - Oil Hybrid Int/Ext Semi-Gloss".

2.04 PAINT SYSTEMS - INTERIOR

- A. Paint WI-OP-3L - Wood, Opaque, Latex, 3 Coat:

1. One coat of latex primer sealer.
 - a. Cedar, redwood, architectural glue-laminated beams, provide number of coats necessary for sufficient stain resistance:
 - 1) Dunn-Edwards "E-Z PRIME Premium EZPR00".
 - 2) Kelly-Moore "255 ACRY-SHIELD".
 - b. All other interior wood:
 - 1) Dunn-Edwards; "INTER-KOTE Premium IKPR00".
 - 2) Kelly-Moore "975 ACRY-PLEX".
 2. Semi-gloss: Two coats of latex enamel;; typical interior wood trim with opaque finish.
 - a. Dunn-Edwards "SUPREMA SPMA50".
 - b. Kelly-Moore "/ 1685 DURA-POXY".
 3. Eggshell: Two coats of latex enamel, typical exposed interior beams above 8'-0".
 - a. Dunn-Edwards "SUPREMA SPMA30".
 - b. Kelly-Moore "1245 ACRY-SHIELD".
- B. Paint WI-TR-V - Wood, Transparent, Varnish, No Stain:
1. One coat sealer: MC80-1931 "Stain Controller & Wood Sealer".
 2. Semi-Gloss: Two coats of varnish; MC80-6702 "Heirloom Interior S/G Varnish".
- C. Paint MI-OP-3A - Ferrous Metals, Primed or Unprimed, Alkyd, 3 or 4 Coat (As specified and as required to achieve specified appearance):
1. One coat of alkyd primer:
 - a. Dunn Edwards, "BLOC-RUST Premium BRPR00-1-WH".
 - b. Kelly-Moore, "1711 KEL-GUARD Alkyd Rust-Preventative White Primer".
 2. Gloss (Handrails and Guardrails): Alkyd enamel;
 - a. Dunn Edwards, One coat, "Syn-Lustro 10V".
 - b. Kelly-Moore, 2 coats, "1700 KEL-GUARD Alkyd Rust-Preventative Gloss Enamel".
 3. Semi-gloss (All other surfaces): Alkyd enamel;;
 - a. Dunn Edwards, One coat, "Syn-Lustro 9V".
 - b. Kelly-Moore, 2 coats, "6630 PLASTI-NAMEL Alkyd Rust Preventative Semi-Gloss Enamel".
 4. Eggshell (For use in matching sheen of metal elements in wall surfaces): Latex enamel;
 - a. Dunn Edwards, One coat, "Decosheen W440V".
 - b. Kelly-Moore, 2 coats "1930 KM PROFESSIONAL Water - Oil Hybrid Int/Ext Semi-Gloss".
- D. Paint MI-OP-3L - Ferrous Metals, Primed or Unprimed, Latex, 3 Coat: Surfaces 8 feet or more above finish floor, trusses, metal roof deck, ductwork.
1. One coat of alkyd primer:
 - a. Dunn Edwards, "BLOC-RUST Premium BRPR00-1-WH".
 - b. Kelly-Moore, "1711 KEL-GUARD Alkyd Rust-Preventative White Primer".
 2. Gloss (Exposed Spiral Ductwork): 2 coats of latex enamel;
 - a. Dunn Edwards, "EVERHSIELD EVSH60".
 - b. Kelly-Moore, "1680 DURA-POXY + 100% Acrylic Gloss Enamel".
 3. Semi-gloss (Other Surfaces): 2 coats of latex enamel;
 - a. Dunn Edwards, "SUPREMA SPMA50".
 - b. Kelly-Moore, "1650 ACRY-PLEX Interior 100% Acrylic Semi-Gloss Enamel".

- E. Paint MgI-OP-3A - Galvanized Metals, Alkyd, 3 Coat:
1. One coat Pretreatment, reduce to minimum level for finish coat adhesion.
 - a. Dunn Edwards, "Supreme Chemical Metal Clean and Etch ME01".
 - b. Kelly-Moore, "Jasco Prep & Prime".
 2. One coat alkyd metal primer;
 - a. Dunn Edwards, "GALV-ALUM Premium GAPR00".
 - b. Kelly-Moore, "1725 ACRY-SHIELD", 100% Acrylic Metal Primer.
 3. Gloss (Handrails, Guardrails): One coat of alkyd enamel;
 - a. Dunn Edwards, "Syn-Lustro 10V".
 - b. Kelly-Moore, "2 coats 1700 KEL-GUARD Alkyd Rust-Preventative Gloss Enamel".
 4. Semi-gloss (All Other Locations): One coat of alkyd enamel;
 - a. Dunn Edwards, "Syn-Lustro 9V".
 - b. Kelly-Moore, 2 coats, "1930 KM PROFESSIONAL Water -Oil Hybrid Int/Ext Semi-Gloss".
- F. Paint MgI-OP-3L - Galvanized Metals, Latex, 3 Coats: Surfaces 8 feet or more above finished floor, metal roof deck, ductwork, etc.
1. Solvent wash to remove oily residue.
 2. One coat galvanize primer:
 - a. Dunn Edwards, "ULTRA-GRIP Premium UGPR00".
 - b. Kelly-Moore, "1725 ACRY-SHIELD 100% Acrylic Metal Primer".
 3. Gloss (Exterior of Exposed Mechanical Ductwork): Two coats of latex enamel;
 - a. Dunn Edwards, "EVERSHIELD EVSH60".
 - b. Kelly-Moore, "1680 DURA-POXY + 100% Acrylic Gloss Enamel".
 4. Semi-gloss (All Other Surfaces): Two coats of latex enamel;
 - a. Dunn Edwards, "SUPREMA SPMA50".
 - b. Kelly-Moore, "1650 ACRY-PLEX Interior 100% Acrylic Semi-Gloss Enamel".
 5. Flat (Black color at visible interiors of mechanical ductwork): Two coats of latex enamel;
 - a. Dunn Edwards, "SUPREMA SPMA10".
 - b. Kelly-Moore, "1240-407 ACRY-SHIELD 100% Acrylic Exterior Flat Finish", Color: Carbon.
- G. Paint GI-OP-3A-LGypsum Board/Plaster, Acrylic, Low-VOC, 3 Coat:
1. One coat of low odor/low-VOC vinyl acrylic primer sealer: pigmented.
 - a. Dunn Edwards, "ENSO ENSO00".
 - b. Kelly-Moore, "973 Acry-Plex Zero VOC Interior Primer/Undercoat".
 2. Semi-gloss: Two coats of low odor/low-VOC acrylic.
 - a. Dunn Edwards, "ENSO ENSO50."
 - b. Kelly-Moore, "1520 ENVIRO-COAT Zero VOC, Interior 100% Acrylic Semi-Gloss Enamel".
 3. Eggshell: Two coats of low odor/low-VOC acrylic enamel
 - a. Dunn Edwards, "ENSO ENSO30."
 - b. Kelly-Moore, "1510 ENVIRO-COAT Zero VOC, Interior Acrylic Eggshell Enamel".
 4. Flat: Two coats of low odor/low-VOC Acrylic Wall Paint.
 - a. Dunn Edwards, "ENSO ENSO10."
 - b. Kelly-Moore, "1500 ENVIRO-COAT Zero VOC, Interior Acrylic Flat Wall Paint."

2.05 ACCESSORY MATERIALS

- A. Accessory Materials: Provide all primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials required to achieve the finishes specified whether specifically indicated or not; commercial quality.
- B. Patching Material: Latex filler, type recommended by paint manufacturer. match for color where stain or transparent finishes are scheduled.
- C. Sanding materials: 120-180 grit, for architectural woodwork, finish carpentry, wood doors, or other surfaces requiring touch-up.
- D. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
 - 1. Identify dirt, rust, scale, grease, moisture, scuffed surfaces, and other conditions detrimental to formation of a durable paint film.
- B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.
- C. Test shop-applied primer for compatibility with subsequent cover materials.
- D. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the manufacturer-recommended maximums.

3.02 PROTECTION OF ADJACENT WORK

- A. Protect surrounding elements from damage from painting procedures. Provide temporary facilities and barricades required.
- B. Carefully remove and store removable items located in areas to be painted, including fixtures, fittings, finish hardware, and accessories; reinstall upon completion.
- C. Separate areas to be protected from painting areas using means adequate to prevent damage.
- D. Cover existing landscaping with tarpaulins or similar covers.
- E. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures.
- F. When using cleaning methods that involve water or other liquids, install drainage devices to prevent runoff over adjacent surfaces unless those surfaces are impervious to damage from runoff.

3.03 PREPARATION

- A. Clean surfaces thoroughly and correct defects prior to coating application.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

- C. General: In accordance with Referenced Standards for each particular substrate condition.
- D. Remove surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Surfaces: Correct defects and clean surfaces which affect work of this section. Feather-edge patches to make finished edges inconspicuous.
- F. Make surfaces to be painted clean and dry. Remove bond breakers and curing agents.
- G. Provide barrier coats over incompatible primers, or remove and re-prime.
- H. Spot prime shop primed materials in field as required to assure that all surfaces are primed before finished coats are applied. Prime coats specified in this Section shall be provided in addition to shop prime coats on materials supplied for field finish.
- I. Verify compatibility of specified products with shop applied primer(s). In the event of incompatibility of products specified in the Section, recommend alternate compatible product for review.
- J. Provide full number of coats specified for each coating system indicated. Where recommended alternate compatible primers or undercoats require fewer coats than specified products, provide additional finish coat so that specified number of coats is not reduced.
- K. Seal surfaces that might cause bleed through or staining of topcoat.
- L. Remove mildew from impervious surfaces by scrubbing with solution of tri-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- M. Concrete and Unit Masonry Surfaces to be Painted: Remove dirt, loose mortar, scale, salt or alkali powder, and other foreign matter. Remove oil and grease with a solution of tri-sodium phosphate; rinse well and allow to dry. Remove stains caused by weathering of corroding metals with a solution of sodium metasilicate after thoroughly wetting with water. Allow to dry.
- N. Gypsum Board Surfaces to be Painted: Fill minor defects with filler compound. Spot prime defects after repair.
- O. Plaster Surfaces to be Painted: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- P. Insulated Coverings to be Painted: Remove dirt, grease, and oil from canvas and cotton.
- Q. Galvanized Surfaces to be Painted: Remove surface contamination and oils and wash with solvent. Apply coat of etching primer.
- R. Uncorroded Uncoated Steel and Iron Surfaces to be Painted: Remove grease, mill scale, weld splatter, dirt, and rust. Where heavy coatings of scale are evident, remove by power tool wire brushing or sandblasting; clean by washing with solvent. Apply a treatment of phosphoric acid solution, ensuring weld joints, bolts, and nuts are similarly cleaned. Prime paint entire surface; spot prime after repairs.

- S. Shop-Primed Steel Surfaces to be Finish Painted: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
- T. Interior Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.
- U. Interior Wood Surfaces to Receive Transparent Finish: Wipe off dust and grit prior to sealing, seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after sealer has dried; sand lightly between coats. Prime concealed surfaces with gloss varnish reduced 25 percent with thinner.
- V. Exterior Wood Surfaces to Receive Opaque Finish: Remove dust, grit, and foreign matter. Seal knots, pitch streaks, and sappy sections. Fill nail holes with tinted exterior calking compound after prime coat has been applied. Back prime concealed surfaces before installation.
- W. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

3.04 APPLICATION

- A. Exterior Wood to Receive Opaque Finish: If final painting must be delayed more than 2 weeks after installation of woodwork, apply primer within 2 weeks and final coating within 4 weeks.
- B. Apply products in accordance with manufacturer's instructions.
- C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as recommended by coating manufacturer.
- D. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- E. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied. Do not re-coat until;
 - 1. Paint has dried until firm to the touch.
 - 2. Paint does not deform or feel sticky under moderate thumb pressure.
 - 3. Application of another coat of paint will not cause lifting or loss of adhesion of the undercoat.
- F. Apply each coat to uniform appearance.
- G. Sand wood and metal surfaces lightly between coats to achieve required finish.
- H. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- I. Make work uniform without sags, runs, skips or brush marks. Make all edges sharp including interior intersections and transitions between split finishes.
- J. Paint primed hinges to match the door frame to which they are attached.
- K. Backprime all concealed surfaces of finish carpentry, architectural woodwork, wood doors and unclad wood windows.

- L. Wood to Receive Transparent Finishes: Tint fillers to match wood. Work fillers into the grain before set. Wipe excess from surface.
- M. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.05 FINISHING MECHANICAL AND ELECTRICAL EQUIPMENT

- A. Paint shop-finished equipment (electrical panels, load centers, and similar elements) exposed to view. Factory coatings intended for finished exposure may remain in utility areas.
- B. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.
- C. Finish equipment, piping, conduit, and exposed duct work throughout in colors according to the color schedule.
- D. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.06 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.07 SCHEDULE - SURFACES TO BE FINISHED

- A. Do Not Paint or Finish the Following Items:
 - 1. Items fully factory-finished unless specifically noted.
 - 2. Fire rating labels, equipment serial number and capacity labels.
 - 3. Stainless steel items.
 - 4. Ceramic tile, pre-finished wall, ceiling and floor coverings, unless specifically scheduled for field painting
 - 5. Bright metal, glass, exterior brick, integral colored materials except exterior colored plaster, and surfaces indicated not to be painted.
- B. General: Paint the surfaces described below under Schedule - Paint Systems. All surfaces exposed to weather, or visible to the eye, exterior and interior, unless specifically excluded by the Article titled "Do Not Paint or Finish the Following Items". If a coating system is not specified for a particular surface or substrate, provide a three-coat finish system recommended by the paint or coating manufacturer for that surface or substrate. Include all preparation necessary as appropriate for a similar substrate listed in the Article 1.1E "PREPARATION", or preparation for that substrate as recommended by the paint or coating manufacturer.
- C. Mechanical and Electrical: Use paint systems defined for the substrates to be finished.
 - 1. Paint all insulated and exposed pipes, fabricated sheet metal items, and other items including but not limited to occurring in finished areas None - N/A to match background surfaces, unless otherwise indicated.
 - 2. Paint shop-primed items occurring in finished areas, fabricated sheet metal items, and other items including but not limited to.

3. Paint interior surfaces of air ducts and convector and baseboard heating cabinets, fabricated sheet metal items, and other items including but not limited to that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
 4. Paint dampers exposed behind louvers, grilles, and convector and baseboard cabinets, fabricated sheet metal items, and other items including but not limited to to match face panels.
- D. Paint behind moveable equipment and furniture.
 - E. Paint access doors, conduits and exposed plumbing piping.
 - F. Paint all exposed and semi-exposed galvanized metal, projections through and on roofs.
 - G. Paint reveal moldings, exterior expansion joints, and interior handrails.
 - H. Paint tube column and miscellaneous connections.
 - I. Provide split finishes for painted doors and interior windows where different connected room colors are selected.
 - J. Paint continuous surfaces with the same paint system. Do not change systems at elevation breaks.
 - K. Touch-up factory paint finishes where damaged.
 - L. Paint both sides and edges of plywood backboards for electrical and telephone equipment before installing equipment.

3.08 SCHEDULE - PAINT SYSTEMS

- A. Concrete: Finish only surfaces exposed to view which are indicated to receive paint.
 1. Exterior: Flat sheen.
 2. Interior: Semi-gloss sheen.
- B. Gypsum Board: Finish all surfaces exposed to view.
 1. Interior Ceilings and Bulkheads: GI-OP-3L, flat.
 2. Interior Walls: Semi-gloss at Toilet Rooms, Custodians, Storage Room.
 3. Interior Walls: Eggshell at Classrooms, Corridors, Administrative Offices and Work Rooms.
- C. Wood: Finish all surfaces exposed to view.
 1. Exterior trim, beams, soffits and frames: WE-OP-3L.
 - a. Semi-gloss sheen.
 2. Interior: WI-OP-3L
 - a. Trim and frames: Semi-gloss sheen.
 - b. Beams: Low Sheen.
- D. New Wood Doors: Factory-finished
- E. Steel Doors and Frames: Finish all surfaces exposed to view and to weather, including door tops and bottoms. Select prime coats compatible with finish color selections.
 - a. Semi-gloss sheen.

- F. Metal Fabrications: Finish all surfaces exposed to view and concealed, before installation..
Select prime coats compatible with finish color selections.
 - a. Exterior - Handrails and Guardrails: Gloss sheen.
 - b. Exterior - All Other Surfaces: Semi-gloss sheen.
 - c. Interior - Handrails and exposed spiral seamed ductwork: Gloss sheen.
 - d. Interior - All Other Surfaces: Semi-gloss sheen.

- G. Galvanized Steel and Shop-Primed Metal Items: Exterior and Interior; Finish all surfaces exposed to view and to weather, including exposed portions of roof deck systems.
 - a. Exterior - Handrails and Guardrails: Gloss sheen.
 - b. Exterior - All Other Surfaces: Semi-gloss sheen.
 - c. Interior - Handrails, Guardrails and exposed spiral seamed ductwork: Gloss sheen.
 - d. Interior - All Other Surfaces: Semi-gloss sheen.

- H. Miscellaneous metals, conduits, non factory finished access panels: As specified for either unprimed or shop primed metals, modified as required to make sheen match adjacent surfaces.
 - a. Finish the following items:
 - a.Exposed portions of metal roof deck systems.
 - b.Exposed surfaces of lintels.
 - c.Exposed surfaces of steel stairs, fences, gates and railings.
 - d. Mechanical equipment.
 - e.Electrical equipment.

END OF SECTION

DIVISION 10
SPECIALTIES

SECTION 10 1116
VISUAL DISPLAY BOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Porcelain enamel markerboards, fixed and sliding.
- B. Visual display board accessories.

1.02 RELATED SECTIONS

- A. Section 06 4100 - Architectural Woodwork: Reference standards for installation of sliding visual display boards into custom cabinets.
- B. Section 11 5200 - Audio-Visual Equipment
- C. Section 12 3559 - Display Casework

1.03 REFERENCES

- A. ASTM E84 Standard Test Method for Surface Burning Characteristics for Building Materials.
- B. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- C. GREENGUARD Environmental Institute
 - 1. GREENGUARD indoor Air Quality Certified

1.04 SUBMITTALS

- A. Product Data: Provide technical data for products specified. Include Material Safety Data Sheets, when applicable.
- B. Shop Drawings: Provide shop drawings for each type of visual display board specified.
- C. Selection Samples: Submit set of color chips displaying manufacturer's full range of colors and finishes.
- D. Maintenance Data: Provide data on cleaning requirements, stain removal, and recommended maintenance precautions.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's instructions for handling and storage of units.

1.06 FIELD CONDITIONS

- A. Do not begin installation of visual display boards until environmental conditions approximate normal occupied conditions.

1.07 WARRANTY

- A. Submit manufacturer's "Life of the Building" warranty, stating that under normal usage and maintenance, and when installed in accordance with manufacturer's instructions and recommendations, porcelain enamel steel chalkboards and markerboards are guaranteed for the life of the building.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Acceptable Manufacturers:
 - 1. Claridge Products and Equipment, Inc, www.claridgeproducts.com
 - 2. Platinum Visual Systems as distributed by ABC School Equipment. www.pvsusa.com
 - 3. Or Approved Equal

2.02 MARKERBOARD MATERIALS

- A. Markerboard writing surface: "LCII Porcelain Enamel Steel"; Vitrified glass-hard ceramic surface fused to light gauge enameling grade steel at approximately 700°C. High resistance to impact damage, abrasion, scratching, and color fading, suitable for magnetic accessories, noncombustible, bacteria, mold and chemical resistant.
- B. Core Material: 7/16" honeycomb.015 aluminum sheet backing, with aluminum frame mechanically fastened to each panel.
- C. Backing Material: Aluminum sheet
- D. Metal Trim and accessories: ASTM B 221 (ASTM B 221M) aluminum alloy.
- E. Adhesive: As recommended by manufacturer for project conditions.

2.03 PORCELAIN ENAMEL MARKERBOARDS

- A. Fixed Markerboards: sizes as indicated.
 - 1. Metal Trim and Accessories: Heavy gage aluminum extrusions.
 - a. Finish: Etched and anodized satin finish.
 - b. Chalktrough: Standard continuous solid type, with ribbed section and curved open ends with radius.
 - c. Map Rail: Standard continuous rail with cork insert and end stops, and as follows:
 - 1) Height: 1 in.
 - 2) Map Hooks: 1 hook for each 3 feet of rail.
 - 3) Flag Holder: 2 holders per rail.
 - 2. Size: Standard 4 feet height by lengths as shown on drawings.
 - 3. Color: As selected from manufacturer's standard colors.
- B. Horizontal Sliding Markerboards: double or triple panel types as indicated.
 - 1. Metal Trim and Accessories: Heavy gage aluminum extrusions one piece aluminum housing with 2 inch wide fascia.
 - a. Finish: Etched and anodized satin finish.
 - b. Chalktrough: Standard continuous solid type, with ribbed section and curved open ends with radius, profile suitable for incorporation into custom cabinets.
 - c. Sliding hardware: Two adjustable ball bearing carriers per panel, nylon roller guides in bottom track, fingerpulls at each operating panel, resilient bumper stops at each end.
 - d. Map Rail: Standard continuous rail with cork insert and end stops, and as follows:
 - 1) Height: 1 in.
 - 2) Map Hooks: 1 hook for each 3 feet of rail.
 - 3) Flag Holder: 2 holders per rail.

2. Size: Standard 4 feet height by lengths as shown on drawings.
3. Color: As selected from manufacturer's standard colors.

C. Anchors: As indicated and required to securely fasten markerboards to walls.

2.04 CABINET BULLETIN BOARDS

- A. Lockable cabinet with integrated bulletin board, as indicated.
 1. Mounting: Surface, using stainless steel fasteners of gauge and spacing recommended by manufacturer.
 2. Metal display case, door frame, trim and accessories: Heavy gage radiused aluminum; powder coated finish of selected color.
 3. Door face glazing: Clear tempered Glass.
 4. Hardware: Cylinder lock, key all cabinets alike, continuous piano hinge.
 5. Tackboard surfacing: Designer fabric of selected color, on 7/32 inch cork underlay with 1/4 inch hardboard back.
 6. Product: Claridge model #1026, or approved equal, 4 feet high by 6 feet wide.

2.05 FABRICATION

- A. Laminate facing sheet and backing sheet to core material under pressure, using manufacturer's recommended adhesive.
- B. Provide factory-assembled visual display boards, except where sizes demand partial field assembly.
 1. Free of cups and bows, facing sheet and core continuous with no joints for entire length of board.
- C. Assemble units in one piece without joints, wherever possible. Where required dimensions exceed maximum panel size available, provide 2 or more pieces of equal length, as indicated on approved shop drawings. Assemble to verify fit at factory, then disassemble for delivery and final assembly at project site.
- D. Miter corners to neat hairline closure.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrates are properly prepared to receive visual display boards. Do not begin installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Comply with manufacturer's installation instructions.
 1. Install all grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for a complete installation.
- B. Where sliding visual display boards are installed in custom cabinets, provide track stops as recommended by board manufacturer to prevent sliding boards from impacting cabinet frames and comply with Referenced Standards for cabinet work.
- C. Install visual display boards level and plumb, keeping perimeter trim aligned in accordance with manufacturer's recommendations.

3.03 ADJUSTING AND CLEANING

- A. Verify that all accessories are installed as required for each unit.
- B. Upon completion of installation, clean surfaces and trim in accordance with manufacturer's recommendations, leaving all materials ready for use.
- C. Protect completed work from damage until acceptance. Replace damaged work.

END OF SECTION

SECTION 10 1400
SIGNAGE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Plaque signs with raised tactile letters and braille.
- B. Vinyl Graphics
- C. Signs made of individual plastic or metal letters.

1.02 RELATED SECTIONS

- A. Pertinent sections of Division 02 specifying work adjacent to site and monument signage.
- B. Pertinent sections of Division 03, specifying concrete, formwork, and reinforcement.
- C. Section 03 3010 - Cast-In-Place Concrete
- D. Division 08: Pertinent sections specifying doors and glazing materials serving as the mounting surface for signage.
- E. Division 09: Pertinent sections specifying wall finishes and substrates serving as the mounting surface for signage.

1.03 REFERENCES

- A. 36 CFR 1191 - Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Rule; Federal Register.
- B. C.C.R., Title 24, Part 2. California Building Code, Section 1011.3, 1115B, and 1117B.
- C. Manufacturer's recommendations and specifications.

1.04 SUBMITTALS

- A. Product Data: Include material descriptions including dimension, finish, and performance limitations of each product component.
 - 1. Provide paint manufacturer's written specifications and durability guarantee against color fading, chipping and peeling.
 - 2. Provide manufacturer's written specifications and durability guarantee.
- B. Shop Drawings: Indicate sign styles, lettering font, foreground and background colors, locations, overall dimensions of each sign.
 - 1. Submit shop drawing at scaled size for each typical sign. Indicate: Proposed copy, letter height, spacing and location of lettering on the sign field, colors and materials of each element and lettering. Tabular listing of signage and copy alone is not acceptable.
 - 2. Submit tabular listing for each sign keyed to location indicated on drawings, including all text and adjacent space for Owner modification/confirmation of text.
 - 3. Provide all drawings and detail documents necessary to complete the project.
 - 4. Where sizes for signs are impacted by dimensions of surfaces or locations on which they are to be installed, verify dimensions by field measurement. Indicate measurements and signage locations on shop drawings for approval prior to production.

5. Indicate for monument sign: Member and material profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details
- C. Samples for Selection: For each exposed material type, provide selection samples, minimum 4 inch by 6 inch, indicating manufacturer's full range of available finishes, including anodizing and/or powder coating.
- D. Samples for Verification: Sample plaque signs of each type, actual size, illustrating type, style, letter font, and colors specified; method of attachment.
- E. Manufacturer's Installation Instructions: Include written instructions, installation template and attachment devices.

1.05 REGULATORY REQUIREMENTS

- A. Conform to applicable code for requirements for the physically handicapped.
 1. C.C.R., Title 24, Part 2. California Building Code, Section 1011.3, 1115B and 1117B, requirements governing signage design, location and attributes.
 2. Braille Symbols: California Contracted Grade 2 Braille symbols shall be used per CBC 1117B.5.6. Provide only domed Contracted Grade 2 Braille symbols as follows: Dots shall be 1/10 inch on center in each cell, with 2/10 inch space between cells. Dots shall be raised minimum of 1/40 inch above background.

1.06 DELIVERY, STORAGE, AND PROTECTION

- A. Store adhesive materials at ambient room temperatures.
- B. Prevent contact with materials which may cause discoloration or staining. Clean materials which are discolored or stained.
- C. Replacements: In the event of damage, immediately make repairs and replacements necessary to the approval of the Owner without change in contract amount or time.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Plaque Signs:
 1. Advance Corporation / Braille-Tac Division; Product Braille-Tac Etched Magnesium (Chemsast): 8200 - 97th Street South, Cottage Grove, Minnesota 55016: Telephone 800-328-9451; www.advancecorp.com/brailletac
- B. Vinyl Graphics:
 1. 3M / Commercial Products Division; Product 3M Premium Grade Vinyl: 3M Center, Building 220-6W-06, Post Office Box 33220, St. Paul, Minnesota 55133-3220: Telephone 800-374-6772.

2.02 MATERIALS

- A. Concrete: Type specified in Section 03 0000.

2.03 PLAQUE SIGNS

- A. Plaque Signs: One piece magnesium metal construction with raised copy and braille and thermal-set, polyurethane finish. Tactile legends and Braille shall comply with Americans with Disabilities Act (ADA), California Building Code (CBC) and requirements indicated for quantities, sizes, layouts, materials, finishes, color, etc. as specified in the Graphics Schedule and Drawings/Specifications.
 - 1. Exterior durability rating: 3 years minimum.
 - 2. Painted Finish:
 - a. Weatherability: When tested in accordance with ASTM G 53, after 500 hours in a Weatherometer (equivalent to 3 years of exterior exposure) gloss retention of not less than 88.0 determined in accordance with ASTM D 523 as a 60 degree angle.
 - b. Color Fade Resistance: Color shall not change more than 1.68 units determined in accordance with ASTM D 2244 and measured with a Hunter colorimeter, Model D25.
 - c. Durability: Sign finish shall show no effect after requested use of cleaners such as Graffiti Remover #1120 manufactured by Fine Organics Corp., Lodi, NJ.
 - 3. Colors: Custom, as selected by Owner.
 - 4. Character Font: As Indicated.
 - 5. Total Thickness: 0.153 inches.
 - 6. Edges: Square.

2.04 VINYL GRAPHICS

- A. Base Material: Premium Grade with an outdoor durability rating of five years.
 - 1. Color: Manufacturer Standard.
 - 2. Character Font: As Indicated.

2.05 ACCESSORIES

- A. Mounting Hardware: Vandal-proof screws, stainless steel, size recommended by manufacturer to suit applications and resist applied loads.
- B. Adhesive: 3M corporation, "VHB", or Approved Equal, applied in 5 mil thickness covering entire back of sign plaque without void or bubble.
- C. Tape Adhesive: Double sided tape, permanent adhesive, 1/16 inch thick by 1/2 wide, 3M Corp. #4416, black, or Approved Equal.
- D. Silicon Adhesive: Silglaze II #2801 GE Clear - Silicone Sealant / Adhesive, or Approved Equal.
- E. Accessories and materials required for complete installation as indicated.

2.06 MIXES

- A. Materials: Types specified in Section 03 0000.

PART 3 EXECUTION

3.01 COORDINATION

- A. For signs supported by or anchored to permanent construction such as building such as building fascias, advise installers about specific requirements for placement of anchorage devices and similar items to be used for attaching signs.

3.02 EXAMINATION

- A. Confirm visibility of site signage and graphics in indicated locations. Do not install signs in locations where they will not be visible or where they will obstruct visibility of other related building elements, such as exit signage or life safety equipment provided under other contracts or sections. Request direction from Owner in the event of conflict with signage and building elements.
- B. Verify that substrate surfaces are ready to receive work.

3.03 INSTALLATION

- A. Install in accordance with manufacturer's written instructions.
- B. Install signs after surfaces are finished, in locations indicated.
- C. Position signs as indicated on drawings.
- D. Install signage and graphics plumb, level and proportionally spaced or kerned as required for uniform appearance; centered on, or aligned with related building elements, measured from established lines and levels, accurately fitted, free from distortion or defects.
- E. All vinyl graphics to be installed flat smooth, free of defects, bubbles dust, blemishes and air pockets.
- F. Plaque Mounting on Glazing: Install on glazing with double stick tape and silicone adhesive. Provide self-adhesive opaque plastic film, in matching or contrasting color as selected, to conceal reverse side of signs mounted on glazing. No exposed fasteners, adhesives or glazing tapes permitted. Film backer must be computer cut to match the shape of the plaque(s).
- G. Plaque Mounting at all other interior locations: Provide double stick tape and silicone.
- H. Plaque Mounting at all other exterior locations: Provide double stick tape and anchorage devices and fasteners as necessary for securing items to in-place construction; including threaded fasteners for concrete inserts, toggle bolts, through-bolts, lag bolts, wood screws, wedge anchors and other connectors as required.
- I. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing items to in-place construction; including threaded fasteners for concrete inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.
- J. Coordinate with installation of electrical and signal systems.
- K. Position low level exits signs as required by prevailing codes.

3.04 ADJUSTING

- A. Correct all damaged work by cleaning, repairing or replacing, and repainting, as acceptable to Owner.

3.05 CLEANING

- A. Clean-up: During progress of work, remove from site discarded materials and rubbish at end of each work day. No waste materials shall be placed in Owner's dumpsters. Removal of project wastes is sole responsibility of the Contractor.

- B. Clean completed work.
- C. Protect installed work from subsequent construction operations.

END OF SECTION

SECTION 10 2113
REINFORCED COMPOSITE TOILET COMPARTMENTS

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Reinforced Composite toilet compartments.
- B. Urinal screens.

1.02 RELATED SECTIONS

- A. Section 05 5000 - Metal Fabrications: Concealed steel support members.
- B. Pertinent sections of other divisions specifying backing and blocking for compartment support.
- C. Section 10 2800 - Toilet Accessories.

1.03 REFERENCES

- A. ADA, Accessibility Guidelines for Buildings and Facilities, Federal Register Volume 56, Number 144, Rules and Regulations.
- B. ANSI A117.1-Specifications for Making Buildings and Facilities Accessible to and Usable by Physically Handicapped People.
- C. American Society for Testing and Materials Standards:
 - 1. ASTM A 666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
 - 2. ASTM E84-01 Standard Test Method for Surface Burning Characteristics of Building Material.
 - 3. ASTM D2794-93e1 Standard Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
 - 4. ASTM D2197-98 Standard Test Method for Adhesion of Organic Coatings by Scrape Adhesion.
 - 5. ASTM D6578-00 Standard Practice for Determination of Graffiti Resistance.
- D. Manufacturer's recommendations for installation.
- E. C.C.R., Title 24, Part 2. California Building Code.
- F. US Green Building Council (USGBC) Leadership in Energy and Environmental Design (LEED) Program.

1.04 PERFORMANCE REQUIREMENTS

- A. Conform to applicable codes and referenced standards for accessibility requirements.
- B. Graffiti Resistance: Partition material shall have the following graffiti removal characteristics when tested in accordance with ASTM D6578-00 Standard Practice for Determination of Graffiti Resistance in accordance with Section 9, "Graffiti Removal Procedure Using Manual Solvent Rubs":
 - 1. Cleanability: Five (5) required staining agents shall be cleaned off material.

- C. Scratch Resistance: Partition material shall have the following characteristics when tested in accordance with ASTM D2197-98(2002) Standard Test Method for Adhesion of Organic Coating by Scrape Adhesion, using Gardner Stock #PA-2197/ST pointed stylus attachment on scrape tester:
 - 1. Scratch Resistance: Maximum Load Value shall exceed 10 kilograms.
- D. Impact Resistance: Partition material shall have the following characteristics when tested in accordance with ASTM D2794-93(1999)e1 Standard Test Method for Resistance of Organic Coating to the Effects of Rapid Deformation (Impact), using .625" hemispherical indenter with 2-lb impact weight:
 - 1. Impact Resistance: Maximum Impact Force value shall exceed 30 inch-lbs.
- E. Fire Resistance: Partition material shall comply with the following requirements, when tested in accordance with ASTM E 84: Standard Test Method for Surface Burning Characteristics of Building Materials:
 - 1. Smoke Developed Index: Not to exceed 450.
 - 2. Flame Spread Index: Not to exceed 75.
 - 3. Material Fire Ratings:
 - a. National Fire Protection Association (NFPA): Class B.
 - b. International Code Council (ICC): Class B.

1.05 SUBMITTALS

- A. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings, anchorage, accessory items and finishes. Provide location drawings for bolt hole locations in supporting members for attachment of compartments.
- B. Product Data: Provide data on panel construction, hardware, and accessories, demonstrate conformance with specified requirements.
- C. Samples:
 - 1. Selection Samples: Partition panels, 3 x 3 inch in size illustrating panel finish, color, and sheen.
 - 2. Verification Samples: Provide, upon request, additional samples of partition panels for use in preparing final color boards.
 - 3. Scale Model: Upon request, provide scale model of compartments, including stile, shoe, door, door hardware, divider panel, and mounting brackets. Provide sections showing stile anchoring and leveling devices, concealed threaded inserts, panel, stile, and edge construction. Scale models will be returned following review.
- D. Manufacturer's Installation Instructions: Indicate special procedures.
- E. Cleaning and maintenance information including how to obtain replacement parts. Include in Installation, Operation, and Maintenance Manuals.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store items in manufacturer's original unopened protective packaging, prevent physical damage or wetting.
- B. Prevent damage to finished surfaces during handling.

1.07 WARRANTY

- A. Provide ten-year limited warranty for panels, doors, and stiles against breakage, corrosion, delamination, and defects in factory workmanship.
- B. Provide one-year guarantee against defects in material and workmanship for stainless steel door hardware and mounting brackets.

1.08 COORDINATION

- A. Coordinate the work with placement of support framing and anchors in wall.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Reinforced Composite Toilet Compartments: "Sierra™ Series 1092.67 " as manufactured by Bobrick Washroom Equipment, Inc., www.bobrick.com, as represented by R. E. Edwards, 925-829-2942, or Approved Equal.
- B. Toilet partitions constructed of High Density Polyethylene (HDPE) or High Density Polypropylene will not be acceptable.

2.02 MATERIALS

- A. Reinforced Composite Material: composed of dyes, organic fibrous material, and polycarbonate/ phenolic resins; non-ghosting, graffiti-resistant surface integrally bonded to core through a series of manufacturing steps requiring thermal and mechanical pressure. Edges of material shall be the same color as the surface., with solid integral color through the full depth of the panel.
- B. Stainless Steel: ASTM A 666, 18-8 Type 304 stainless steel with No. 4 finish.
- C. Aluminum: Satin finish, extruded anodized aluminum. Provide for specified items only.

2.03 COMPONENTS

- A. Toilet Compartments: Solid reinforced composite panels, doors, and pilasters, floor-mounted headrail-braced. Stiles, Panels, Doors, and Screens shall be all be manufactured from Solid Color Reinforced Composite material.
 - 1. Provide materials selected for surface flatness and smoothness. No exposed surfaces which show pitting, seam marks, roller marks, stains, discoloration, or other imperfections.
 - 2. Color: As selected by Owner from Manufacturer's standards.
- B. Panel and Bench Thickness: 1/2 inch.
- C. Door and Stile Dimensions:
 - 1. Thickness: 3/4 inch.
 - 2. Door Width: 24 inch.
 - 3. Door Width for Handicapped Use: 36 inch, out-swinging.
- D. Urinal Screens: Urinal screens are to be floor-anchored with 6" stile mounted to panel. Stile to be 3/4" thick material, with urinal panel made of 1/2" thick material attached to wall with two mounting brackets.

2.04 ACCESSORIES

- A. Hardware - General: Polished stainless steel at all locations, unless noted otherwise below:
- B. Vandal-Resistant Hinges:
 - 1. 16-gauge (1.6-mm) continuous piano hinge, self-closing type.
 - 2. At wheelchair accessible stalls, provide self-closing type, adjustable to closed position at out-swinging application.
 - 3. Provide exterior emergency access feature.
- C. Door Stop Plates: 11-gauge (3-mm) stainless steel with attached rubber bumpers, two per door to resist door from being kicked in/out beyond stile.
- D. Vandal-Resistant Latch:
 - 1. Sliding door latch 14 gauge (2 mm) on nylon track.
 - 2. Operate with less than 5-lb force. Twisting latch operation will not be acceptable.
 - 3. Attach Latch track to door by machine screws into factory-installed threaded brass inserts.
 - 4. Threaded brass inserts: Factory installed for door hinge and latch connections.
 - 5. Latch keeper-to-stile connections: Through-bolted, stainless steel, pin-in-head Torx sex bolt fasteners.
- E. Door Strike and Keeper with rubber bumper; mounted on pilaster in alignment with door latch.
- F. Coat Hook: Stainless steel with rubber bumper; one per compartment, mounted on door. Maximum projection 1-1/8 inches, Bobrick B-233 Clothes Hook. Secure to door by through-bolted, theft-resistant, pin-in-head Torx stainless steel screws. Or Approved Equal.
- G. Mounting Brackets:
 - 1. Stainless steel, mounted inside compartment.
 - 2. Provide double thickness 11 gauge brackets at wall mounted urinal screens.
- H. Panel-to-Stile connections.
 - 1. Mounting brackets: 18-gauge (1.2- mm) stainless steel, full height of panel.
 - 2. U-channels: Panel-to-stile connections.
 - 3. Angle brackets: Secure stiles to walls and panels to walls.
- I. Leveling Device: 7-gauge, 3/16" (5-mm) hot rolled steel bar; chromate-treated and zinc-plated; through-bolted to base of solid color reinforced composite stile.
 - 1. Provide adjustment for floor variations with screw jack through steel saddles integral with pilaster.
- J. Stile Shoe: One-piece, 4" (102-mm) high, 22-gauge (0.8-mm) stainless steel. Top shall have 90° return to stile. Shoe: one-piece of stainless steel and capable of being fastened (by clip) to stiles starting at wall line.
- K. Headrail (Overhead Braced Configurations): Aluminum (.125" / 3-mm thick) with anti-grip profile.
- L. Door Pull: Stainless steel "wire-type" or u-shaped type, outside of outswinging doors and one at each side of wheelchair accessible stall doors.

M. Fasteners and Threaded Inserts:

1. Theft-and-Vandal-resistant, pin-in-head Torx stainless steel machine screws with factory-installed, threaded brass inserts.
2. Theft-and-Vandal-resistant, through-bolted pin-in-head Torx stainless steel sex bolt fasteners.
3. Fasteners secured directly into the core are not acceptable.
4. All fasteners and threaded brass inserts shall withstand a direct pull force exceeding 1,500 lbs per fastener or insert.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify that field measurements are as indicated.
- B. Verify correct spacing of and between plumbing fixtures.
- C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

- A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions. Installation methods shall conform to manufacturer's recommendation for backing and proper support.
- B. Maintain 3/8 to 1/2 inch space between wall and panels and between wall and end pilasters.
- C. Attach panel brackets securely to walls using anchor devices.
- D. Conceal evidence of drilling, cutting, and fitting to room finish.
- E. Maintain uniform clearance at vertical edge of doors.
- F. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.
- G. Field touch-up of scratches or damaged finish will not be permitted. Replace damaged or scratched materials with new materials.
- H. Install coat hooks in accessible stalls at elevation of 48 inches above finish floor maximum to the top edge of the hook.

3.03 ERECTION TOLERANCES

- A. Maximum Variation From True Position: 1/4 inch.
- B. Maximum Variation From Plumb: 1/8 inch.

3.04 ADJUSTING

- A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.
- B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.
- C. Adjust adjacent components for consistency of line or plane.

3.05 CLEANING AND PROTECTION

- A. Clean exposed surfaces of partition systems using materials and methods recommended by manufacturer, and provide protection as necessary to prevent damage during remainder of construction period.
- B. Protect finished work until acceptance. Replace damaged panels as required.

END OF SECTION

SECTION 10 2233
ACCORDION FOLDING PARTITIONS

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Accordion folding partitions.
- B. Track and operating hardware.

1.02 RELATED REQUIREMENTS

- A. Section 05 4000 - Cold Formed Metal Framing

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements.
- C. ASTM E413 - Classification for Rating Sound Insulation.
- D. ASTM E557 - Standard Guide for The Installation of Operable Partitions.
- E. ASTM F793 - Standard Classification of Wallcovering by Use Characteristics.

1.04 SUBMITTALS

- A. Shop Drawings: Indicate opening sizes, track layout, details of track and required supports, static and dynamic loads, adjacent construction and finish trim, and stacking sizes.
- B. Product Data: Provide data on partition operation, hardware and accessories, electric operating components, track switching components, colors and finishes available.
- C. Samples: of full manufacturer's color range for selection of colors.
- D. Maintenance Data: Describe cleaning materials detrimental to vinyl fabric surfaces and hardware finish. Include recommended cleaning methods, cleaning materials, and stain removal methods.

1.05 QUALITY ASSURANCE

- A. Sound Transmission Class (STC): As indicated, calculated in accordance with ASTM E413, based on tests performed in accordance with ASTM E90, on panel size of 100 sq ft.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Design is based on Panelfold, www.modernfold.com.; Product 2100.
- B. Other Acceptable Manufacturers:
 - 1. Hufcor, Inc: www.hufcor.com.
 - 2. Or Approved Equal

2.02 PARTITION CONSTRUCTION: FOLDING DOOR.

- A. Lead, Intermediate and Jamb: aluminum, color coordinated with panel connector
- B. Panels: Natural hardwood
- C. Panel Connector: Extruded Vinyl, sand
- D. Sweep Strip: Extruded vinyl
- E. Hinge System: Steel, clear
- F. Track: Aluminum, clear
- G. Wheels: Ball bearing nylon wheels on steel axles
- H. Latch: Deadlatch with thumb turn
- I. Manual operation.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that field measurements are as indicated.
- C. Verify track supports are laterally braced and will permit track to be leveled within 1/4 inch of required position and parallel to the floor surface.
- D. Verify floor flatness of 1/8 in 10 feet, non-cumulative.
- E. Verify wall plumbness of 1/8 in 10 feet, non-cumulative.

3.02 INSTALLATION

- A. Install accordion door in accordance with manufacturer's instructions
- B. Fit and align partition assembly level and plumb.
- C. Fit and align accordion door assembly level and plumbing.
- D. Lubricate moving components.

3.03 ADJUSTING

- A. Adjust door assembly to provide smooth operation from closed to full open position.

END OF SECTION

SECTION 10 2800
TOILET ACCESSORIES

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Accessories for toilet rooms and utility rooms.

1.02 RELATED REQUIREMENTS

- A. Section - 05 4000 - Cold Formed Metal Framing
- B. Section 10 2113 - Reinforced Composite Toilet Compartments
- C. Divisions 22 and 26: Pertinent sections specifying plumbing and electrical work.

1.03 REFERENCE STANDARDS

- A. 36 CFR 1191 - Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities; Final Rule; Federal Register.
- B. C.C.R., Title 24, Part 2, California Building Code for accessibility standards.
- C. Manufacturer's recommendations and specifications.
- D. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- E. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
- F. ASTM C1036 - Standard Specification for Flat Glass.
- G. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror.

1.04 SUBMITTALS

- A. Product Data: Provide data on accessories describing size, finish, details of function, attachment methods.
- B. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

1.05 COORDINATION

- A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Products listed are made by Bobrick Washroom Equipment, Inc..
- B. Other Acceptable Manufacturers:
 - 1. Bobrick Washroom Equipment, Inc.
 - 2. American Specialties, Inc: www.americanspecialties.com.
 - 3. Bradley Corporation: www.bradleycorp.com.

4. Tubular Specialties Manufacturing, "TSM".
 5. Or Approved Equal
- C. All items of each type to be made by the same manufacturer.

2.02 MATERIALS

- A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.
1. Grind welded joints smooth.
 2. Fabricate units made of metal sheet of seamless sheets, with flat surfaces.
- B. Keys: Provide 2 keys for each accessory to Owner; master key all lockable accessories.
- C. Mirror Glass: Float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.
- D. Adhesive: Two component epoxy type, waterproof.
- E. Fasteners, Screws, and Bolts: Hot dip galvanized, tamper-proof, security type.

2.03 FINISHES

- A. Stainless Steel: No. 4 satin brushed finish, unless otherwise noted.
- B. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 TOILET ROOM ACCESSORIES

- A. Toilet Paper Dispenser: Double roll, surface mounted bracket type, stainless steel, spindleless type for tension spring delivery designed to prevent theft of tissue roll.
1. Product: B-274 manufactured by Bobrick.
- B. Paper Towel Dispenser: Folded paper type, stainless steel, surface-mounted, with viewing slots on sides as refill indicator and tumbler lock.
1. Capacity: 300 C-fold minimum.
 2. Product: B-262 manufactured by Bobrick.
 3. Or Approved Equal
- C. Soap Dispenser: Liquid soap dispenser, wall-mounted, surface, with stainless steel cover and horizontal stainless steel tank and working parts; push type soap valve, check valve, and window gage refill indicator, tumbler lock.
1. Minimum Capacity: 40 ounces.
 2. Product: B-2111 manufactured by Bobrick.
 3. Or Approved Equal
- D. Mirrors: Stainless steel framed, 6 mm thick float glass mirror.
1. Size: as indicated.
 2. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; No.4 finish.
 3. Product: B-292 1836 manufactured by Bobrick for mirrors with integral shelf.
 4. Or Approved Equal

- E. Seat Cover Dispenser: Stainless steel, surface-mounted, reloading by concealed opening at base, tumbler lock.
 - 1. Minimum capacity: 250 seat covers.
 - 2. Product: B-221 manufactured by Bobrick.
 - 3. Or Approved Equal
- F. Grab Bars: Stainless steel, 1-1/4 inches outside diameter, minimum 0.05 inch wall thickness, concealed flange mounting; 1-1/2 inches clearance between wall and inside of grab bar.
 - 1. Conform to CBC accessibility requirements and referenced standards, support vertical loading of 400 pounds and horizontal loading of 200 pounds applied at any portion of the bar.
 - 2. Length and configuration: As indicated on drawings.
 - 3. Product: B5806 manufactured by Bobrick.
 - 4. Or Approved Equal
- G. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
 - 1. Product: B-353 manufactured by Bobrick, recessed mounted. Or Approved Equal
 - 2. Product: B-254 manufactured by Bobrick, surface mounted. Or Approved Equal

2.05 UTILITY ROOM ACCESSORIES

- A. Combination Utility Shelf/Mop and Broom Holder: B-239 x 34, 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation. Conform to referenced standards and applicable codes.
- C. Verify that field measurements are as indicated on drawings.

3.02 PREPARATION

- A. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

- A. Install accessories in accordance with manufacturers' instructions.
- B. Install plumb and level, securely and rigidly anchored to substrate.
- C. Mounting Heights and Locations: As required by accessibility regulations and as indicated on drawings

END OF SECTION

SECTION 10 4400
FIRE EXTINGUISHERS AND CABINETS

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Hand-Portable Fire Extinguishers.
- B. Fire Extinguisher Cabinets

1.02 REFERENCES

- A. 29 CFR 1910.157 - Portable Fire Extinguishers; Code of Federal Regulations.
- B. NFPA 10 - Standard for Portable Fire Extinguishers; National Fire Protection Association.
- C. UL 711 - Fire Extinguishers, Rating and Fire Testing of; Underwriters Laboratories Inc.; 1995. (ANSI/UL 711)

1.03 SUBMITTALS

- A. Product Data: Manufacturer's descriptive literature for specified products; indicate compliance to specified requirements.
- B. Shop Drawings: Indicate location of each type product specified; include mounting heights.
- C. Manufacturer's Instructions: Printed installation instructions for each product, including product storage requirements.
- D. Installation, Operation and Maintenance Manual: Information on required maintenance.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Acceptable Manufacturers:
 - 1. Larsen's Manufacturing Company, Minneapolis, MN, www.larsensmfg.com, is specified.
 - 2. Potter-Roemer Inc., Cerritos, CA, www.potterroemer.com.
 - 3. J.L. Industries., Bloomington, MN, www.jlindustries.com.

2.02 FIRE EXTINGUISHERS

- A. General:
 - 1. Conform to requirements of 29 CFR 1910.157, NFPA 10, and UL 711.
 - 2. Attach manufacturer's standard metal foil label to cylinder, with printing and graphics indicating information and instructions required by local authorities having jurisdiction. Include current certification tag.
- B. Fire Extinguishers: Multi-purpose dry-chemical ammonium phosphate, UL rated as scheduled.
 - 1. Agent: Stored-pressure multi-purpose dry-chemical ammonium phosphate, discharged as fine silicone-coated particles.
 - 2. Tank: Steel, with red powder epoxy paint coating.
 - 3. Valve assembly: Nickel/chrome plated brass or anodized aluminum.

4. Wall mounting bracket: Type specified in manufacturer's product literature for indicated tank size, with wall anchoring devices for indicated wall type.

2.03 FIRE EXTINGUISHER CABINETS

- A. Metal: Formed primed steel sheet; 0.036 inch thick base metal.
- B. Cabinet Configuration: Semi-recessed type. Larsen "Cameo" or Approved Equal.
 1. Sized to accommodate accessories.
 2. Form cabinet enclosure with right angle inside corners and seams. Form perimeter trim and door stiles.
- C. Door: 0.036 inch thick, reinforced for flatness and rigidity; latch. Hinge doors for 180 degree opening with continuous piano hinge. Provide roller type catch.
- D. Door Glazing: Plastic, clear, 1/8 inch thick acrylic. Set in resilient channel gasket glazing.
- E. Cabinet Mounting Hardware: Appropriate to cabinet. Pre-drill for anchors.
- F. Weld, fill, and grind components smooth.
- G. Finish of Cabinet Exterior Trim and Door: Baked enamel, color as selected.
- H. Finish of Cabinet Interior: White enamel.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products specified in this section in accordance with NFPA 10, shop drawings, and manufacturer's instructions.
- B. Ensure recessed cabinet installation does not compromise fire rating of wall. Continuous layers of gypsum wallboard as required for indicated fire rated assembly inside cabinet recess.
- C. Immediately prior to Substantial Completion, ensure extinguishers are fully charged and bear tag recording date of charging and signature of verifying entity.

3.02 PROTECTION OF INSTALLED PRODUCTS

- A. Protect finishes of fire extinguishers from damage by subsequent construction activities
- B. Repair minor damage to finishes in accordance with manufacturer's recommendations; replace components which cannot be repaired to Owner's acceptance.

3.03 SCHEDULES

- A. Location: Kitchens and food preparation areas, Type K.
- B. Location: Classrooms and Administrative areas: Type 2A-10-BC.

END OF SECTION

DIVISION 11
EQUIPMENT

SECTION 11 5200
AUDIO-VISUAL EQUIPMENT

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Video Projector Mounting Brackets.
- B. Projection screens.
 - 1. Wall hung manual

1.02 RELATED SECTIONS

- A. 09 2216 - Non-structural Metal Framing
- B. Section 09 2116 - Gypsum Wallboard.
- C. Division 26: Pertinent sections specifying electrical power connections and conduits/raceways for control systems.

1.03 SUBMITTALS

- A. Product Data: Provide brochures, installation instructions.
- B. Shop Drawings: Indicate in large scale detail, drawings of fabricated equipment showing construction methods, type and gage of metal, hardware and fittings, with plan and front elevation..
- C. Certificates: Certify that products of this section meet or exceed specified requirements, Include certification number.

1.04 QUALITY ASSURANCE

- A. Television Monitor and Video Projector Mounting Brackets: Listed and classified by California Office of Statewide Health Planning and Design "OSHPD" as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver products to site and store in enclosed areas protected from the weather.

1.06 PROJECT CONDITIONS

- A. Coordinate installation with size, location and installation of service utilities.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

PART 2 PRODUCTS**2.01 VIDEO PROJECTOR MOUNTING BRACKETS**

- A. Video Projector Mounts - General: Accommodate maximum dimensions overall 17"W x 27"D x 16"H. Projector; held in place by 14-gauge minimum steel arms; allow air flow and access to functions on all sides of the projector. Mount shall have roll, pitch and yaw adjustments to fine tune projector alignment. Hanger support system allows one-man installation, allowing

projector mounting right-side up or upside down. Mount shall easily re-adjust for exchanging projectors. Finished in Black powder paint.

1. Ceiling Mounted Suspended Type: TPMUNI4, or Approved Equal. Provide with manufacturer standard 1-1/2 inch diameter black pipe and ceiling mounting brackets, rods and accessories required to suit applications indicated.

2.02 MANUAL OPERATION PROJECTION SCREENS

- A. Projection screens for wall bracket installation.
 1. Matte White viewing surface, flame retardant, mildew resistant.
 2. Standard case and mounting brackets.
 3. Size: Viewing/Projection Area 60 inches x 80 inches.
- B. Manufacturers:
 1. Da-Lite "Model B" series is specified, www.da-lite.com.
 2. Draper, www.draperinc.com.
 3. Or Approved Equal

2.03 ACCESSORIES

- A. Wall Brackets: 6 inch, non-adjustable extension brackets. Provide for locations where surface mounting of screens is not feasible.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that ventilation outlets, service connections, and supports are correct and in scheduled location.
- B. Verify projector focal range prior to final location of projector mounts and/or projector screen. Obtain Owner's written acceptance of positioning for each condition prior to installation.
- C. Correct unsatisfactory conditions prior to beginning installation.
- D. Beginning of installation means acceptance of existing conditions.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Use anchoring devices provided or required by the manufacturer.

3.03 ADJUSTING

- A. Clean and adjust equipment and apparatus to ensure proper working order and conditions.
- B. Adjust limit switches of motorized screens as appropriate for project conditions. Do not allow extended screens to touch floor.

3.04 CLEANING

- A. Remove masking or protective covering from finished surfaces. Wash and clean equipment
- B. Protect installed equipment from subsequent construction operations.

END OF SECTION

DIVISION 12
FURNISHINGS

SECTION 12 2100
WINDOW SHADE SYSTEMS

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Manually-operated window shades and accessories for sun/glare/heat control and room darkening.
- B. Motorized window shades and accessories for sun/glare/heat control and room darkening.

1.02 RELATED SECTIONS

- A. Section 09 2216 - Non-structural Metal Framing
- B. Division 08: Pertinent sections specifying window, door and/or storefront opening systems.
- C. Division 09: Pertinent Sections specifying wall finishes adjacent to window shades.

1.03 SUBMITTALS

- A. Product Data: Manufacturer's catalog data, product descriptions, installation instructions, detail sheets, and specifications for each type system specified.
- B. Samples for Selection: Manufacturer's color chart or sample sets;
 - 1. Color swatches for initial blind color selection from manufacturer's full range of available colors.
 - 2. Standard aluminum finish color samples from manufacturer's range of standard colors.
- C. Manufacturer's standard installation instructions.
- D. Design Data, Test Reports, Certificates: Current reports from independent testing laboratories demonstrating compliance with specified criteria.

1.04 QUALITY ASSURANCE

- A. Fire Resistance: Provide shade fabrics tested in accordance with:
 - 1. 1989 NFPA 701 small scale Vertical Burn Test and rated "PASS".
 - 2. 1996 NFPA 701 small scale Vertical Burn (telephone booth test) and rated "PASS."
- B. Toxicity: Provide shade fabrics tested in accordance with University of Pittsburgh Toxicity Protocol including LC50 analysis and toxicity characteristics.
- C. Anti-microbial: ASTM G-22-80 results for ATCC6538 (*Staphylococcus aureus*) and ATCC13388 (*Pseudomonas aeruginosa*) indicating minimum 5mm (0.197 inches) 'No Growth Contact Area'.
 - 1. ASTM G-21-85 results for ATCC9642, ATCC9644, ATCC9348 and ATCC9645 indicating 'No Growth'.
- D. Do not fabricate shades without obtaining field dimensions for each opening. Coordinate construction of surrounding conditions to allow for timely field dimension verification.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Deliver products to project site in manufacturer's original cartons.
- B. Individually package and mark shades with room number and opening number.
- C. Inspect the materials upon delivery to assure that specified products have been received.
- D. Store and handle shades to prevent damage to fabrics, finishes, and operators prior to installation.
- E. Do not deliver items to the project until all concrete, masonry, plaster, painting and other wet work has been completed and dry.

1.06 WARRANTY

- A. Shadecloth and all other components of shade system are warranted to be fit for the use intended for a minimum of 10 years.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. MechoShade Systems Inc.: www.mechoshade.com. Or Approved Equal.
- B. Provide all window shade systems from a single manufacturer.

2.02 EQUIPMENT

- A. Bead/Chain Operation: Bi-directional, wrap spring clutch made of high-strength fiberglass-reinforced polyester and high carbon steel.
 - 1. Continuous loop, certified No. 10 metal bead chain in appropriate length.

2.03 ROLLER SHADE ASSEMBLIES

- A. Shadebands: Construction of shadeband includes the fabric, the hembar and hempocket, and the attachment of the shadeband to the roller tube:
 - 1. Vinyl Room darkening Shadecloth (single-fabric): MechoShade Systems, Inc., "0700 Series", Blackout material, or Approved Equal, washable and colorfast laminated and embossed vinyl coated fabric, 0.012 inches thick (.30 mm) blackout material and weighing 0.81 lbs. per square yard, with a minimum of 62 threads per square inch in colors selected from manufacturer's available range.
 - 2. Exposed (Blackout) Hembar: 3/8 x 1-1/2 inches with vinyl seal and concealed attachment to shadecloth. Bevel top and bottom of hembar to smoothly travel up and down inside side channels. Extend shadeband and hembar into side channel as a single element where side channels are required.
- B. Shade Hardware and Shade Brackets:
 - 1. Provide shade hardware constructed of minimum 1/8" thick (3.175 mm) cadmium plated steel or thicker as required to support 150% of the full weight of each shade.
 - 2. Allow for removal of shade roller tube from brackets without removing hardware from opening or without requiring end or center support brackets to be removed.
 - 3. Allow for removal and re-mounting of the shade bands without having to remove the shade tube, drive or operating support brackets.
 - 4. Allow for field adjustment of motor or replacement of any operable hardware component without requiring removal of brackets regardless of mounting position (inside or outside mount).
 - 5. Allow for removable regular roll fascia(s) to be mounted continuously across two or more shades without requiring exposed fasteners.
 - 6. Allow for operation of multiple shadebands offset by a maximum of (12) (45) from the motor axis between shadebands, (6) (22.5) on each side of the radial line, by a single motor (Multi-banded shades) subject to manufacturer's design criteria.
 - 7. Provide positive mechanical engagement of drive mechanism to shade roller tube. Friction fit connections for drive mechanism to shade roller tube shall not be acceptable.
 - 8. Use only Delrin engineered plastics by DuPont, or Approved Equal, for all plastic components of shade hardware. Styrene based plastics are not acceptable: polyester or reinforced polyester shall not be acceptable.
 - 9. Shade roller and shadecloth attachment:
 - 10. Use extruded aluminum shade roller tube of diameter and wall thickness required to support shade fabric without (excessive) deflection. Roller tubes less than 2.55 inches (65 mm) in diameter are not acceptable.

11. Provide for positive mechanical engagement with drive / brake mechanism.
12. Provide for positive mechanical attachment of shadeband without requiring use of adhesives, adhesive tape, staples or rivets. Two sided pressure sensitive adhesive tape is not acceptable, shade bands stapled to roller tube shall not be acceptable.
13. Attach shadebands to tube such that removal and replacement of a shadeband can be accomplished without removing either the tube from the brackets or without removing shade brackets or the drive operator. Shadebands must be replaceable on site.

C. Shade Motors and Motor Control System Hard-wired system:

1. Shade Motors:
 - a. Tubular, asynchronous (non-synchronous) motors with built-in reversible capacitor operating at 110V AC (60hz), single phase, temperature Class A, thermally protected, totally enclosed, maintenance free with line voltage power supply equipped with locking disconnect plug assembly furnished with each motor.
 - b. Conceal shade motors inside shade roller tube.
 - c. Each shade motor draws a maximum current of 2.3 amps.
 - d. Use motors rated at the same nominal speed for all shades in the same room.
 - e. Total hanging weight of shadeband shall not exceed 80% of the rated lifting capacity of the shade motor and tube assembly.
2. Wall Switches: 3 button architectural flush mounted switches with metal cover plates and no exposed fasteners.
 - a. Connect local wall switches to control system components via low voltage (12V DC) 4 conductor modular cable equipped with RJ-11 type connectors supplied, installed and certified under Section 16 0000.
 - b. Connect master wall switches to control system components via low voltage (12V DC) 6 conductor modular cable equipped with RJ-12 type connectors supplied, installed and certified under Section 16000.
3. Motor Control System:
 - a. Shade Motors and Control System [Intelligent Motor Control System]: (Software, two way communication). Specifications and Design are based on the IMC motor control system as manufactured by MechoShade Systems, Inc. Other systems may be acceptable provided that all of the following performance capabilities are provided. Motor control systems not in complete compliance with these performance criteria shall not be accepted AS EQUAL TO OR EQUIVALENT SYSTEMS.
 - b. Provide power to each shade motor via individual 3 conductor line voltage circuits connecting each motor to the relay based Intelligent controllers (IQ/MLC).
 - c. Control system components provide appropriate (spike and brown out) over-current protection (+/- 10% of line voltage) for each of the four individual motor circuits and shall be rated by UL or ETL as a recognized component of this system and tested as an integrated system.
 - d. Motor control system allows each group of four shade motors in any combination to be controlled by each of four local switch ports, with up to fourteen possible "sub-group" combinations via local 3 button wall switches and all at once via a master 3 button switch. System shall allow for overlapping switch combinations from 2 or more local switches.
 - e. Multiple "sub-groups" from different IQ/MLC control components may be combined to form "groups" operated by a single 3 button wall switch, from either the master port or in series from a local switch port.
 - f. Each shade motor shall be accessible (for control purposes) from up to four local switches and one master switch.
 - g. Control system shall allow for automatic alignment of shade hembars at 25%, 50% and 75% of opening heights, or up to three user defined intermediate stopping positions in addition to all

up / all down positions regardless of shade height, a total of 5 positions. Control system shall allow shades to be stopped at any point in the opening height, however, shade hembars may not be in alignment at these non-defined positions.

- h. Control system shall have two standard operating modes: Normal Mode allowing the shades to be stopped anywhere in the window's opening height and Uniform Mode allowing the shades to only be stopped at the predefined intermediate stop positions. Both modes shall allow for all up/all down positioning.
 - i. Control system components shall allow for interface with low voltage Audio Visual system components via a dry contact terminal block.
 - j. Control system components shall allow for interface with external analog input control devices such as solar activated controllers, wind activated controllers, 24 hour timers, etc. via a dry contact terminal block.
 - k. Reconfiguration of switchable groups [as specified above] shall not require rewiring of the hardwired line voltage motor power supply wiring or the low voltage control wiring. Reconfiguration of switch groups shall be accomplished within the motor control device (IQ/MLC).
- D. Regular Roll Fascia:
- 1. Continuous removable extruded aluminum fascia (Owner to select color from manufacturer's standards) that attaches to shade mounting brackets without the use of adhesives, magnetic strips or exposed fasteners.
 - 2. Fascia shall be able to be installed across two or more shadebands in one piece.
 - 3. Fully conceal brackets, shade roller and fabric on the tube.
 - 4. Chain drive shall fall behind the bottom return edge of the fascia without requiring notching of the fascia.

2.04 FABRICS

- A. Fabric for Sun/Glare/Heat Control: Style 1500 Thermo Veil; PVC, or Approved Equal, coated fiberglass and polyester weave, 3 percent open; 14.6 ounces per square yard, 0.027 inch thick; meet or exceed California flame tests.
 - 1. Color: As selected from manufacturers standards.

2.05 FABRICATION

- A. Fabricate units to completely fill existing openings from head to sill and jamb to jamb, unless specifically indicated otherwise. Comply with Manufacturer's edge clearance standards and recommendations.
- B. Fabricate shadecloth to hang flat without buckling or distortion. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling. Fabricate unguided shadecloth to roll true and straight without shifting sideways more than 1/8 inch in either direction per 8 feet of shade height due to warp distortion or weave design.
- C. Provide battens in non-railroded shades as required the by Manufacturer to assure proper tracking and uniform rolling of the shadebands, in accordance with the manufacturer's published width x height fabricate guide and standards.
- D. Weighted batten bars: At locations recommended by manufacturer.
- E. For railroded shadebands, provide seams or battens in railroded multi-width shadebands as required by Manufacturer to meet Width:Height ratios and size requirements.
- F. Provide batten pockets utilizing self-colored fabric front and back, RF welded into the shadecloth.

- G. Provide a self-colored opaque liner front and back to eliminate any see through of the batten pocket and shall not exceed 1-1/2 inches (38 mm) high and be totally opaque. A see-through moiré effect which occurs with multiple layers of transparent fabrics is not acceptable. Reinforce batten pockets using coil coated, roll formed spring steel to ensure flatness of shadebands in accordance with manufacturer's standards. Concave formed profile of batten stiffeners to be compatible with diameter of shade roller tube.

2.06 FINISHES

- A. Aluminum Components: Owner shall select from Manufacturer's standard PPG Duracron baked enamel colors, or Approved Equal.
- B. Steel Components: Cadmium-plated, satin-finished, or bonderized prior to painting with Manufacturer's standard baked-enamel finish.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine substrate and conditions for installation. Do not commence installation until conditions are satisfactory. Commencement of installation indicates acceptance of site conditions by Contractor.
- B. Verify that utilities and control conduits are of the correct types and in correct locations.

3.02 INSTALLATION

- A. Install window shade systems in accordance with manufacturer's instructions and these specifications. Install units to comply with the Manufacturer's instructions for the type of mounting and operation required. Provide units plumb, true, and securely anchored in place with recommended hardware and accessories to provide smooth operation without binding.
- B. Assume responsibility for all field dimensions and mounting surfaces.
- C. Adjust window shade systems for proper operation.
- D. Tolerances:
 - 1. Maximum variation of gap at window opening perimeter: 1/4 inch, per 8 feet (+/- 1/8 inch) of shade height (6.35 mm per 2438 mm +/- 3.2 mm).
 - 2. Maximum offset from level: 1/16 inch per 5 feet of shade width (1.587 per 1524 mm of shade width).

3.03 ADJUST AND CLEAN

- A. Adjust drive / brake mechanism of units for smooth operation. Adjust shade and shadecloth to hang flat without buckling or distortion. Replace any units or components which do not hang properly or operate smoothly.
- B. Touch up damaged finishes and repair minor damage in order to eliminate evidence of repair. Remove and replace work that cannot be satisfactorily repaired.
- C. Clean exposed surfaces, including metal and shadecloth, using non-abrasive materials and methods recommended by the Shadecloth Manufacturer. Remove and replace work which cannot be satisfactorily cleaned

3.04 DEMONSTRATION

- A. Demonstrate operation method and instruct Owner in the proper operation and maintenance of the window shade systems.

END OF SECTION

SECTION 12 3100
LABORATORY CASEWORK

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Epoxy resin counter tops.

1.02 RELATED SECTIONS

- A. Section 07 9005 - Joint Sealers.
- B. Pertinent sections specifying assembly, installation, and connection of plumbing work, plumbing elements penetrating countertops or splashes.
- C. Pertinent sections specifying assembly, installation, and connection of electrical work, electrical elements penetrating countertops or splashes.

1.03 REFERENCES

- A. BHMA A156.9 - American National Standard for Cabinet Hardware; Builders Hardware Manufacturers Association; 1994 (ANSI/BHMA A156.9).
- B. NEMA LD 3 - High-Pressure Decorative Laminates; National Electrical Manufacturers Association.

1.04 SUBMITTALS

- A. Product Data: Provide component dimensions, configurations, construction details, joint details, and attachments, utility and service requirements and locations, and manufacturer's standard catalog numbers.
- B. Shop Drawings: Indicate casework locations, large scale plans, elevations, cross sections, rough-in and anchor placement dimensions and tolerances, clearances required, and location and size of all cut-outs.
- C. Samples: Samples, minimum size 3x3 inch of each color of base metal, or other finish.
- D. Samples: Manufacturer's standard size, of countertop material.
- E. Contract Close-out: Manufacturer's printed operating instructions and maintenance data.

1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Accept casework on site. Inspect on arrival for damage. Protect from damage.
- B. Coordinate size of access and route to place of installation.

1.06 PROJECT CONDITIONS

- A. Coordinate casework installation with size, location and installation of service utilities.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Epoxy Resin Fabrications:
 - 1. Laboratory Tops Inc, www.labtops.com.
 - 2. Thermo Scientific Hamilton; www.thermoscientific.com.
 - 3. Epoxyn Products, www.epoxyn.com...
 - 4. Approved Equal

2.02 MATERIALS

- A. Counter Tops, Back Splash, and Side Splash: Modified epoxy resin, acid resistant.. Provide square edges at splash with coved transition to countertop. Extend side splashes at countertop ends returned against walls or cabinets. Provide "marine edge" countertop, 1 inch overhang with square nosing, route underside of overhang for drip.
- B. Service Fittings and Fixtures: Types specified in Division 22.
- C. Sealant: Sanitary type, specified in Section 07 9005.

2.03 FABRICATION - GENERAL

- A. Form edges and seams to be smooth. Form material for counter tops, shelves, and drain boards from continuous sheets.
- B. Epoxy Resin Countertops and Sinks: 1-inch thick epoxy resin, fabricate in accordance with WI AWS Section 11, Countertops and manufacturer's recommendations.
- C. Provide cutouts for plumbing fixtures and electrical items. Verify locations of cutouts from on-site dimensions.
- D. Cut and drill counter tops, backs, and other components for service outlets and fixtures.
- E. Install fixtures and fittings built into or part of casework. Provide access panels for maintenance of utility service and mechanical and electrical components.

PART 3 EXECUTION**3.01 EXAMINATION**

- A. Verify adequacy of support framing and anchors.

3.02 INSTALLATION

- A. Install casework, components and accessories in accordance with manufacturer's instructions.
- B. Use anchoring devices to suit conditions and substrate materials encountered.
- C. Set casework items plumb and square, securely anchored to building structure.
- D. Countertops: Anchor securely to base units and other support systems. Conform to requirements of referenced WI AWS standards. Install level to tolerance of 1/16 inch.
- E. Scribe to abutting surfaces and align adjoining components. Apply matching filler pieces where casework abuts dissimilar construction.

- F. Close ends of units, splash aprons, shelves and bases with sealant.
- G. Connection of sinks to plumbing systems as specified in pertinent sections of Division 22.
- H. Field touch-up blemishes to original finish.

3.03 CLEANING

- A. Clean casework, counters, shelves, legs, hardware, fittings and fixtures.

3.04 PROTECTION OF FINISHED WORK

- A. Do not permit finished casework to be exposed to continued construction activity.
- B. Do not store materials or products on countertops. Do not stand or walk on countertops or use for construction access to building elements above floor level.
- C. Protect countertops with durable panel materials secured in place using methods which will not damage surfaces or finishes. Do not remove until Owner acceptance following move-in.

END OF SECTION

SECTION 12 3559
DISPLAY CASEWORK

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Wall-mounted Display Casework.
- B. Display casework accessories.

1.02 RELATED SECTIONS

- A. Section 06 4100 - Architectural Wood Casework: Reference standards for installation of display cases into custom cabinets.
- B. Section 10 1116 - Visual Display Boards.
- C. Section 13 3419 - Metal Building Systems
- D. Pertinent sections of Division 26 specifying electrical connections for cabinet lighting.

1.03 REFERENCES

- A. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.

1.04 SUBMITTALS

- A. Product Data: Provide technical data demonstrating conformance to specified criteria.
- B. Selection Samples: Submit set of color chips displaying manufacturer's full range of colors and finishes.
- C. Verification Samples: Submit samples not less than 6 inches square to illustrate materials, finish, color, and texture of each type of material for which color selection is required.
- D. Maintenance Data: Provide data on cleaning requirements, stain removal, and recommended maintenance precautions.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Comply with manufacturer's instructions for handling and storage of units.

PART 2 PRODUCTS**2.01 MANUFACTURERS**

- A. Acceptable Manufacturers
 - 1. Claridge Products and Equipment, Inc; Harrison, Arkansas, www.claridgeproducts.com
 - 2. Nelson-Adams Co., Corona, CA.
 - 3. Substitutions: See Section 01 6000 - Product Requirements.
 - 4. Or Approved Equal

2.02 MANUFACTURED UNITS

- A. Wall Mounted Bulletin Board Case: Claridge Products and Equipment, Inc., Contemporary Series Bulletin Board Cabinet. Surface mounted, hinged doors. Model 2044. Or Approved Equal.
 - 1. Metal Trim and Accessories: Heavy gage aluminum extrusions.
 - a. Finish: Satin anodize finish.
 - b. Corners: Mitered and safety wrapped.
 - c. Door: Tempered clear glass, aluminum frame with continuous hinge.

- d. Lock: Cylinder type, manufacturer's standard, provide 6 keys per lock.
 - 2. Back Panel: Fabric covered cork, color selected from manufacturer's standards.
 - 3. Back Panel: Claridge cork, color selected from manufacturer's standards.
 - 4. Size: As indicated on drawings.
- B. Anchors: As indicated and required to securely fasten units to framing. Stainless steel at exterior locations.

2.03 FABRICATION

- A. Provide factory-assembled units.
 - 1. Free of cups and bows, facing sheet and core continuous with no joints for entire length of board.
- B. Assemble units in one piece without joints.
- C. Miter corners to neat hairline closure.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that substrates are properly prepared to receive work. Do not begin installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Comply with manufacturer's installation instructions.
 - 1. Install all grounds, clips, backing materials, adhesives, brackets, anchors, trim, and accessories necessary for a complete installation.
- B. Where units are installed in custom cabinets, provide information to related sections and comply with Referenced Standards for cabinet work.
- C. Install units level and plumb, keeping perimeter trim aligned in accordance with manufacturer's recommendations.

3.03 ADJUSTING AND CLEANING

- A. Verify that all accessories are installed and doors operate smoothly, free of warp or bind.
- B. Upon completion of installation, clean surfaces and trim in accordance with manufacturer's recommendations, leaving all materials ready for use.
- C. Protect completed work from damage until acceptance. Replace damaged work.

END OF SECTION

DIVISION 13
SPECIAL CONSTRUCTION

SECTION 13 3419
METAL BUILDING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Manufacturer-engineered, shop-fabricated structural steel building frame, roof covering system and exterior wall system.

1.02 RELATED REQUIREMENTS

- A. Section 05 5000 - Metal Fabrications.
- B. Section 07 9005 - Joint Sealers.
- C. Section 07 6200 - Sheet Metal Flashing and Trim
- D. Section 08 3323 - Overhead Coiling Doors
- E. Section 08 5113 - Aluminum Windows.
- F. Section 08 8000 - Glazing.

1.03 REFERENCE STANDARDS

- A. AISC 360 - Specification for Structural Steel Buildings; American Institute of Steel Construction, Inc.
- B. ASTM A36/A36M - Standard Specification for Carbon Structural Steel.
- C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
- D. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60 000 PSI Tensile Strength.
- E. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Tensile Strength (Metric).
- F. ASTM A490 - Standard Specification for Structural Bolts, Alloy Steel, Heat Treated, 150 ksi Minimum Tensile Strength.
- G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- H. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
- I. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality.
- J. ASTM A572/A572M - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
- K. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

- L. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process.
- M. NAIMA 202 - Standard for flexible fiberglass insulations used in metal buildings.
- N. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
- O. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
- P. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society.
- Q. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society.
- R. IAS AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems.
- S. MBMA (LR) - Low Rise Building Systems Manual; Metal Building Manufacturers Association.
- T. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings.
- U. UL 580 - Standard for Tests for Uplift Resistance of Roof Assemblies; Underwriters Laboratories Inc.; Current Edition, Including All Revisions.

1.04 DESIGN REQUIREMENTS

- A. California Building Code
- B. Installed Thermal Resistance of Wall System: R value of 19.
- C. Installed Thermal Resistance of Roof System: R value of 19.
- D. Design Requirements
 - 1. Bay size: As shown in drawings
 - 2. Roof pitch: As shown in drawings
 - 3. Building location zip code: 95436
 - 4. Roof Live Loads: 20 psf
 - 5. Rainfall intensity per hour: 1 inch.
 - 6. Seismic Loads: Calculate in accordance with applicable code.
 - 7. Building use/importance category II, Soil Profile: C.
 - 8. Floor Load Mezzanine: 250 psf
 - 9. Steel frames to be designed to not require flange bracing
 - 10. Dead loads, including the weight of all indicated permanent construction:
 - a. Elements required for support of lights and light battens, hanging fixtures, mechanical equipment, projector, fire sprinkler piping, ceiling hanger wires, and all other items required to provide a complete building and not specifically indicated on the drawings.
 - b. Interior plywood panels to 8 ft. above finish slab.

11. Wind Loads:

- a. Roof Wind Load: Calculate in accordance with applicable code, using 90 mph Basic Wind Speed, Exposure Category C, and Importance Factor of ASCE 7, Section 6.5.5
- E. Exterior wall and roof system shall withstand imposed loads with maximum allowable deflection of 1/90 of span.
- F. Permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to temperature range of 30 degrees F (100 degrees C).
- G. Size and fabricate wall and roof systems free of distortion or defects detrimental to appearance or performance.

1.05 SUBMITTALS

- A. Product Data: Provide data on profiles, component dimensions, fasteners.
- B. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections; wall and roof system dimensions, panel layout, general construction details, anchorages and method of anchorage, installation; framing anchor bolt settings, sizes, and locations from datum, foundation loads; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature.
- C. Selection Samples: color chips representing manufacturer's full range of colors and patterns.
- D. Samples: precoated metal panels for each color selected, 6 inches square in size illustrating color and texture of finish.
- E. Manufacturer's Instructions: Indicate preparation requirements, anchor bolt placement.
- F. Project Record Documents: Record actual dimensioned locations of concealed components and utilities.
- G. Welder's certifications
- H. Complete loads, base reactions and details as required for foundation design by others.
- I. Erector Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.

1.06 QUALITY ASSURANCE

- A. Design structural components, develop shop drawings, and perform shop and site work under direct supervision of a Professional Structural Engineer experienced in design of this Work.
 1. Design Engineer Qualifications: Licensed in the State in which the Project is located.

2. Conform to applicable code for submission of design calculations as required for acquiring permits.
 3. Cooperate with regulatory agency or authority and provide data as requested.
- B. Perform work in accordance with AISC 360 - Specification for Structural Steel Buildings.
1. Maintain one copy on site.
- C. Perform welding in accordance with AWS D1.1.
- D. Erector Qualifications: Company specializing in performing the work of this section with minimum 5 years experience.

1.07 WARRANTY

- A. Provide five year manufacturer warranty for: materials and workmanship.
1. Include coverage for exterior pre-finished surfaces to cover pre-finished color coat against chipping, cracking or crazing, blistering, peeling, chalking, or fading. Include coverage for weather tightness of building enclosure elements after installation.
- B. Weather-tight and finishes 10 year.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Metal Buildings:
1. Butler Manufacturing Company: www.butlermfg.com/speclink.
 2. VP Buildings: www.vp.com.
 3. Nucor Building Systems: www.nucorbuildingsystems.com
 4. Or Approved Equal

2.02 METAL BUILDING

- A. Single span solid web
- B. Primary Framing: Rigid frame of rafter beams and columns, canopy beams, and wind bracing.
- C. Secondary Framing: Purlins and Girts, and other items as required for a complete installation.
- D. Wall System: Preformed metal panels of vertical profile, with sub-girt framing/anchorage assembly, thermal blocks and accessory components.
- E. Roof System: Preformed standing seam metal panels oriented parallel to slope, with sub-girt framing/anchorage assembly, insulation, liner panels, and thermal blocks, and accessory components.

2.03 MATERIALS - FRAMING

- A. Structural Steel Members: ASTM A 572/A 572M, Grade 50.

- B. Structural Tubing: ASTM A 500, Grade B cold-formed.
- C. Plate or Bar Stock: ASTM A 529/A 529M, Grade 50.
- D. Anchor Bolts: ASTM A307, galvanized to ASTM A153/A153M.
- E. Bolts, Nuts, and Washers: ASTM A325 (ASTM A325M), Type 1, galvanized to ASTM A153/A153M, Class C.
- F. Welding Materials: Type required for materials being welded.
- G. Primer: SSPC-Paint 20, zinc rich.
- H. Grout: ASTM C1107/C1107M, Non-shrink type, premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents, capable of developing minimum compressive strength of 2400 psi (17 MPa) in two days and 7000 psi (48 MPa) in 28 days.

2.04 MATERIALS - WALLS AND ROOF

- A. Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, SS Grade 33/230, with G90/Z275 coating.
- B. Insulation: ASTM C665 Type I; 6 inches thick.
 - 1. Facing: Sheet vinyl, 0.0015 inch thick, white.
- C. Joint Seal Gaskets: Manufacturer's standard type.
- D. Fasteners: Manufacturer's standard type, galvanized to comply with requirements of ASTM A153/A153M, finish to match adjacent surfaces when exterior exposed.
- E. Bituminous Paint: Asphaltic type.
- F. Sealant: Manufacturer's standard type.
- G. Trim, Closure Pieces, Caps, Flashings, Rain Water Diverter: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

2.05 COMPONENTS

- A. Doors and Frames: Specified in Section 08 1100.
- B. Overhead Coiling Doors: Specified in Section 08 3323.
- C. Windows:
 - 1. Windows: Specified in Section 08 5113
 - 2. Glass and Glazing: Specified in Section 08 8000.
- D. Thermal Blocks: Superblock, or Approved Equal, 1 inch by 3-1/2 inch extruded polystyrene thermal space strips capped by 22 gage galvanized channels with swaged end for interconnection along the purlin/ girt run, metal tabs at 2 feet on center at SSR clip locations, and pre-punched fastener holes.

2.06 FABRICATION - FRAMING

- A. Fabricate members in accordance with AISC Specification for plate, bar, tube, or rolled structural shapes.

- B. Anchor Bolts: Formed with bent shank, assembled with template for casting into concrete.
- C. Provide framing for skylight openings.

2.07 FABRICATION - WALL AND ROOF PANELS

- A. Siding: Minimum 20 gauge inch metal thickness, IC72 profile by Metal Sales Manufacturing, Inc. , 1.5 inch deep, lapped edges fitted with continuous gaskets.
- B. Roofing: SLR II panels, minimum 22 gauge metal thickness, flat profile, with a 2 inch standing seam.
- C. Liner: Width; 12 inches, Minimum 22 gauge metal thickness wall, 24 gauge at ceilings, perforated at interior, non-perforated at exterior, flat profile indicated, lapped V edges fitted with continuous gaskets.
- D. Girts/Purlins: Rolled formed structural shape to receive siding, roofing and liner sheet.
- E. Internal and External Corners: Same material thickness and finish as adjacent material, profile brake formed to required angles.
- F. Flashings, Closure Pieces, Fascia: Same material and finish as adjacent material, profile to suit system.
- G. Fasteners: To maintain load requirements and weather tight installation, same finish as cladding, non-corrosive type.

2.08 FABRICATION - GUTTERS AND DOWNSPOUTS

- A. Fabricate of same material and finish as roofing metal.
- B. Form sections in maximum possible lengths. Hem exposed edges. Allow for expansion at joints.
- C. Fabricate support straps of same material and finish as roofing metal, color as selected.

2.09 FINISHES

- A. Framing Members: Clean, prepare, and shop prime. Do not prime surfaces to be field welded.
- B. Exterior Surfaces of Wall Components and Accessories: Precoated enamel on steel of modified silicone finish, color as selected from manufacturer's standard range.
- C. Interior Surfaces of Wall Components and Accessories: Precoated enamel on steel of modified silicone finish, color as selected from manufacturer's standard range.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position

3.02 ERECTION - FRAMING

- A. Erect framing in accordance with AISC 360 - Specification for Structural Steel Buildings.
- B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as indicated.
- C. Set column base plates with non-shrink grout to achieve full plate bearing.
- D. Do not field cut or alter structural members without approval.
- E. After erection, prime welds, abrasions, and surfaces not shop primed.

3.03 ERECTION - WALL AND ROOF PANELS

- A. Install in accordance with manufacturer's instructions.
- B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.
- C. Provide thermal blocks wherever roof or wall panels attach to structure.
- D. Fasten cladding system to structural supports, aligned level and plumb.
- E. Locate end laps over supports. End laps minimum 2 inches (50 mm). Place side laps over bearing.
- F. Provide expansion joints where indicated.
- G. Use concealed fasteners.
- H. Install insulation and vapor retarder utilizing framing for attachment. Place wire mesh under vapor retarder for support between framing members.
- I. Install sealant and gaskets to prevent weather penetration.

3.04 ERECTION - GUTTERS AND DOWNSPOUTS

- A. Rigidly support and secure components. Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts.
- B. Slope gutters minimum 1/8 inch/ft.
- C. Connect downspouts to storm drain system.

3.05 INSTALLATION - ACCESSORIES

- A. Install door frames, doors, overhead doors, and windows and glass in accordance with manufacturer's instructions.
- B. Seal wall and roof accessories watertight and weather tight with sealant in accordance with Section 07 9005.
- C. Apply bituminous paint on aluminum surfaces of units in contact with dissimilar metals.

3.06 TOLERANCES

- A. Framing Members: 1/4 inch (6 mm) from level; 1/8 inch (3 mm) from plumb.
- B. Siding and Roofing: 1/8 inch (3 mm) from true position.

END OF SECTION

DIVISION 21
FIRE SUPPRESSION

SECTION 21 0000
WET-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Pipes, fittings, and specialties.
 - 2. Fire-protection valves.
 - 3. Other fire sprinkler related appurtenances
- B. Related Sections:
 - 1. Division 26 or 28, Section "Digital Addressable Fire Alarm Systems"

1.02 DESCRIPTION OF WORK

- A. Scope: Provide design and construction of a complete wet-pipe automatic sprinkler system, and associated equipment, ready for operation for each separate building;
 - 1. Building 1: 2,582 square foot educational center.
 - 2. Building 2: 2,024 square foot education center
- B. Description of Work: The work includes new site fire protection piping including all thrust blocks, post indicator valves, risers, check valves and complete functional sprinkler system per NFPA-13. Each building is to be provided with a separate and independent riser.
- C. Compliance: The entire wet-pipe automatic sprinkler system shall be designed in accordance with the specification. Any reference to "authority having jurisdiction" shall be interpreted to mean the County of Sonoma. All material and equipment used shall be listed or approved by UL, FM or another nationally recognized testing agency approved by County of Sonoma, for their intended use and service.

1.03 PERFORMANCE REQUIREMENTS

- A. General: Design automatic sprinkler systems in accordance with all required and advisory provisions of NFPA 13, including all the Annexes, except where modified herein, by hydraulic calculations for ordinary hazard occupancy with uniform water distribution over the design area. Each system shall be designed using the area/density design approach as defined by NFPA 13. The room design method shall not be used. Design and provide each system to give full consideration to blind spaces, piping, electrical equipment, ducts and other construction and equipment in accordance with detailed working drawings to be submitted for approval.

1. General Design Area Sizes and Densities
 - a. Provide the appropriate sprinkler design density based on the occupancy hazard or commodity classification of the space being protected in accordance with NFPA 13.
 - b. The discharge area shall be the hydraulically most demanding 1,500 sq ft except as specifically noted. There shall be no reduction in area for the use of quick response sprinklers.
- B. Total Combined Inside & Outside Hose Allowances: Hydraulic calculations shall include an allowance of 250 gpm for each building for hose streams, added at the point of connection to the water supply.
- C. Water Supply Information
 1. Fire flow tests have not been previously performed and the following information, at a minimum is required prior to design and construction. All components below shall be tested prior to design to confirm previous results.
 - a. Date of test:
 - b. Time of test:
 - c. Performed by:
 - d. Location of Residual Fire Hydrant:
 - e. Location of Flow Fire Hydrant:
 - f. Static Pressure at Residual Fire Hydrant:
 - g. Measured Flow at Flow Fire Hydrant:
 - h. Residual Pressure at Residual Fire Hydrant:
- D. Sprinkler System Layout: Approved by County of Sonoma.
- E. Other Design Criteria:
 1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 2. Maximum protection area per sprinkler shall be per NFPA 13 unless noted otherwise.
 3. Velocities in all piping shall not exceed 20 ft/sec (6.1 m/sec).
 4. Interior pipe coatings are specifically prohibited where not listed for fire protection use.

5. Total Combined Hose-Stream Demand Requirement shall be according to NFPA 13.
 6. For Open office space:
 - a. Extended coverage sprinklers shall not be used.]
 7. For areas subject to temperatures below 40 degrees F:
 - a. Provide dry pendent or dry sidewall sprinklers.
 - b. Anti-Freeze systems shall not be installed.
 - c. Heat Tape systems shall not be installed.
- F. Seismic Performance: Sprinkler piping shall withstand the effects of earthquake motions determined according to NFPA 13.
1. Seismic Expansion Joints: Provide flexible piping systems of a length that exceeds the maximum design movement of seismic expansion joints. The use of 90 degree fittings in pipe as shown in NFPA 13 is specifically prohibited.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories. Manufacturer's data shall be provided for all products listed in Part 2 of this specification and annotated to show the specific model, type and size of each item:
- B. Shop Drawings: For wet-pipe sprinkler systems include all information as required by NFPA 13. The drawings shall be prepared on uniform sized sheets not less than 24 in by 36 in (760 by 1070 mm). Include plans, elevations, sections, details, isometric diagram of sprinkler system riser piping showing all control valve locations, and attachments to other work.
 1. Layout indicating details, plan view, elevations and sections of the system piping. Indicate the location of sprinklers and piping in relation to the ceiling layout, showing pipe lengths and sizes.
 2. Detailed riser diagram including isometric diagrams showing schematic of systems supply, supply connection, devices, valves, pipe and fittings.
 3. Provide one (1) sets of CAD based electronic shop drawings to the Owner; each set shall include DWG and DWF file formats, including all associated externally referenced electronic files (Xref's). These files shall contain externally referenced files that have been inserted (do not bind the Xref's). Provide both DWG and DWF file formats on three (3) separate recordable CD-R's (do not use CD-RW's or DVD-R/RW's). In addition, provide in each set a read only PDF copy of each As-Built drawing for archiving purposes. PDF files shall be created using the PDF Creator utility. These three (3) CD-R's shall be formatted, written to, and the recording session closed in such a manner as to prevent additional electronic file transfers to the recordable CD-R's.

- C. Hydraulic Calculations. Submit name of hydraulic program and comply with the following:
 - 1. Where a single riser supplies water to more than one floor or level, separate calculations shall be performed for the hydraulically most demanding area of each floor or level served.
 - 2. Minimum operating pressure of any sprinkler shall be according to NFPA 13 and appropriate UL listing or FM approval.
- D. Field Test Reports and Certificates: Submit test certification, to the Owner, for all pipe and fittings. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
- E. Operation and Maintenance Data: include all data relative to alarm valves, water-flow switches and tamper switches.

1.05 QUALITY ASSURANCE

- A. Qualifications:
 - 1. Layout and hydraulic calculation shall be performed by a NICET Level III or IV Technician certified in Automatic Sprinkler Systems Layout or a Registered Fire Protection Engineer.
 - 2. Installation shall be performed by a licensed sprinkler contractor who is experienced in the layout and installation of automatic sprinkler systems (minimum 3 years) of comparable size and type.
 - 3. Installer's responsibilities include layout, fabrication, and installation of sprinkler systems. Layout calculations shall be based on the test data as performed in 1.04, C.
 - 4. Drawings shall be sealed by a licensed Professional Fire Protection Engineer or be stamped by a NICET Level III or IV Technician certified in Automatic Sprinkler Systems Layout.
- B. Applicable References: Sprinkler system equipment, specialties, accessories, installation, and testing shall comply with the following codes and standards:
 - 1. National Fire Protection Association (NFPA), including all amendments and annexes
 - a. NFPA 13, "Installation of Sprinkler Systems."
 - 2. Underwriter's Laboratories (UL)
 - a. "Fire Protection Equipment Directory"
 - 3. Factory Mutual Global (FM)

- a. Approval Guide
 - b. Property Loss Prevention Data Sheet 2-2, "Installation Rules For Suppression Mode Automatic Sprinklers"
4. American Standard for Testing Materials (ASTM)
- a. ASTM A53/A53M, "Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless"
 - b. ASTM A47/A47M, "Standard Specification for Ferritic Malleable Iron Castings"
 - c. ASTM A153, "Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware"
 - d. ASTM A234/A234M, "Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service"
 - e. ASTM A536, "Standard Specification for Ductile Iron Castings"
 - f. ASTM A733, "Standard Specification for Welded and Seamless Carbon Steel and Austenitic Stainless Steel Pipe Nipples"
 - g. ASTM A795, "Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use"
 - h. ASTM A865, "Standard Specification for Threaded Couplings, Steel, Black or Zinc-Coated (Galvanized) Welded or Seamless, for Use in Steel Pipe Joints"
5. American Water Works Association (AWWA)
- a. AWWA C110, "Standard for Ductile Iron and Gray Iron Fittings for Water"
 - b. AWWA C606, "Standard for Grooved and Shouldered Joints"
6. American Society of Mechanical Engineers (ASME)
- a. ASME B1.20.1, "Pipe Threads, General Purpose"
 - b. ASME B16.1, "Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250"
 - c. ASME B16.3, "Malleable Iron Threaded Fittings"
 - d. ASME B16.4, "Gray Iron Threaded Fittings"
 - e. ASME B16.5, "Pipe Flanges and Flanged Fittings: NPS 1/2 through 24"

- f. ASME B16.9, "Factory-Made Wrought Buttwelding Fittings"
- g. ASME B16.21, "Nonmetallic Flat Gaskets for Pipe Flanges"
- 7. American Welding Society (AWS)
 - a. A5.8, "Specification for Filler Metals for Brazing and Braze Welding"
- 8. California Building Code (CBC)

1.06 COORDINATION

- A. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Sprinklers shall be located in center of ceiling tile in all acoustical tile drop ceilings.

PART 2 - PRODUCTS

2.01 All Products shall be UL listed or FM approved for Fire Protection Service unless specifically allowed otherwise by this specification.

2.02 PIPING MATERIALS

- A. Materials shall be steel, ductile iron, or copper.

2.03 STEEL PIPE AND FITTINGS

- A. Schedule 40, Black-Steel Pipe: ASTM A795, in NPS 2 in (DN 50) and smaller. Pipe ends may be factory or field formed to match joining method.
- B. Black-Steel Pipe Nipples: ASTM A733, made of ASTM A795, Schedule 40 steel pipe with threaded ends.
- C. Steel Couplings: ASTM A865, threaded.
- D. Gray-Iron Threaded Fittings: ASME B16.4, Class 125, standard pattern.
- E. Malleable- or Ductile-Iron Unions: UL listed.
- F. Cast-Iron Flanges: ASME 16.1, Class 125.
- G. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
- H. Steel Welding Fittings: ASTM A234/A234M and ASME B16.9.
- I. Malleable Iron Fittings: ASMT B16.3, Class 150
- J. Grooved-Joint, Steel-Pipe Appurtenances:
 - 1. Pressure Rating: 250 psig (1725 kPa)

2. Grooved-End Fittings for Steel Piping: ASTM A47/ A47M, malleable-iron casting or ASTM A536, ductile-iron casting; with dimensions matching steel pipe.
3. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 rigid pattern, unless otherwise indicated by this specification, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.04 COPPER TUBE AND FITTINGS

- A. Hard Copper Tube: ASTM B88, Type K drawn copper.
- B. Wrought-Copper, Solder-Joint Fittings: ASME B16.22, pressure fittings.
- C. Bronze Flanges: ASME B16.24, Class 150, with solder-joint ends.
- D. Copper Unions: MSS SP-123, cast-copper-alloy, hexagonal-stock body, with ball-and-socket, metal-to-metal seating surfaces, and solder-joint or threaded ends.
- E. Grooved-Joint, Copper-Tube Appurtenances:
 1. Grooved-End, Copper Fittings: ASTM B75 (ASTM B75M), copper tube or ASTM B584, bronze castings.
 2. Grooved-End-Tube Couplings: To fit copper-tube dimensions, with design similar to AWWA C606. Include ferrous housing sections, EPDM-rubber gasket suitable for fire protection service, and bolts and nuts.
- F. Copper-Tube, Extruded-Tee Connections:
 1. Description: Tee formed in copper tube according to ASTM F2014.

2.05 PIPING JOINING MATERIALS

- A. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch (3.2 mm) thick.
 1. Class 125, Cast-Iron Flanges and Class 150, Bronze Flat-Face Flanges: Full-face gaskets.
 2. Class 250, Cast-Iron Flanges and Class 300, Steel Raised-Face Flanges: Ring-type gaskets.
- B. Metal, Pipe-Flange Bolts and Nuts: ASME B18.2.1, carbon steel unless otherwise indicated by this specification.
- C. Brazing Filler Metals: AWS A5.8/ A5.8M, BCuP Series, copper-phosphorus alloys for general-duty brazing unless otherwise indicated by this specification.
- D. Welding Filler Metals: Comply with AWS D10.12M/ D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

2.06 VALVES

A. General Requirements:

1. Minimum Pressure Rating for Standard-Pressure Piping: 175 psig (1200 kPa).

B. Ball Valves:

1. Standard: UL listed, except with ball instead of disc.
2. Valves NPS 1-1/2 (DN 40) and Smaller: Bronze body with threaded ends.
3. Valves NPS 2 and NPS 2-1/2 (DN 50 and DN 65): Bronze body with threaded ends or ductile-iron body with grooved ends.
4. Valves NPS 3 (DN 80): Ductile-iron body with grooved ends.

C. Bronze Butterfly Valves:

1. Pressure Rating: 175 psig (1200 kPa).
2. Body Material: Bronze.
3. End Connections: Threaded.

D. Iron Butterfly Valves:

1. Pressure Rating: 175 psig (1200 kPa).
2. Body Material: Cast or ductile iron.
3. Retain one of two subparagraphs below.
4. Style: Lug or wafer.
5. End Connections: Grooved.

E. Check Valves:

1. Pressure Rating: 250 psig (1725 kPa) minimum
2. Type: Swing check.
3. Body Material: 2-1/2 (DN 65) inches or more: Cast iron.
4. Body Material: 2 inches or less (DN 50): Bronze with screw ends
5. End Connections: Flanged or grooved.

F. Bronze OS&Y Gate Valves:

1. Pressure Rating: 175 psig (1200 kPa).

- 2. Body Material: Bronze.
 - 3. End Connections: Threaded.
 - G. Iron OS&Y Gate Valves:
 - 1. Pressure Rating: 250 psig (1725 kPa) minimum
 - 2. Body Material: Cast or ductile iron.
 - 3. End Connections: Flanged or grooved.
 - H. Indicating-Type Butterfly Valves:
 - 1. Pressure Rating: 175 psig (1200 kPa) minimum.
 - 2. Valves NPS 2 (DN 50) and Smaller:
 - a. Valve Type: Ball or butterfly.
 - b. Body Material: Bronze.
 - c. End Connections: Threaded.
 - 3. Valves NPS 2-1/2 (DN 65) and Larger:
 - a. Valve Type: Butterfly.
 - b. Body Material: Cast or ductile iron.
 - c. End Connections: Flanged, grooved, or wafer.
 - 4. Valve Operation: Integral electrical, 115-V ac, prewired, two-circuit, supervisory switch visual indicating device.
 - I. Indicator Posts:
 - 1. Type: Horizontal for wall mounting.
 - 2. Body Material: Cast iron with extension rod and locking device.
 - 3. Operation: Wrench
- 2.07 TRIM AND DRAIN VALVES
- A. General Requirements:
 - 1. Pressure Rating: 175 psig (1200 kPa) minimum.
 - B. Provide Angle Valves, Ball Valves, Globe Valves, Plug Valves

2.08 SPECIALTY VALVES

A. General Requirements:

1. Pressure Rating:
 - a. Standard-Pressure Piping Specialty Valves: 175 psig (1200 kPa) minimum.
 - b. High-Pressure Piping Specialty Valves 300 psig (2070 kPa).
2. Body Material: Cast or ductile iron.
3. Size: Same as connected piping.
4. End Connections: Flanged or grooved.

B. Alarm Valves:

1. Design: For horizontal or vertical installation.
2. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gages, and fill-line attachment with strainer.
3. Drip Cup Assembly: Pipe drain with check valve to main drain piping.

C. Automatic (Ball Drip) Drain Valves:

1. Pressure Rating: 175 psig (1200 kPa) minimum.
2. Type: Automatic draining, ball check.
3. Size: NPS ¾ (DN 20).
4. End Connections: Threaded.]

2.09 FIRE DEPARTMENT CONNECTIONS

A. Exposed-Type, Fire-Department Connection:

1. Type: Exposed, projecting, for wall mounting.
2. Pressure Rating: 175 psig (1200 kPa) minimum.
3. Body Material: Corrosion-resistant metal.
4. Inlets: Brass with threads according to local fire-department sizes and threads. Include extension pipe nipples, brass lugged swivel connections, and check devices or clappers.
5. Caps: Brass, lugged type, with gasket and chain or plastic.

6. Escutcheon Plate: Round, brass, wall type.
7. Outlet: Back, with pipe threads.
8. Number of Inlets: Two.
9. Escutcheon Plate Marking: Similar to "AUTO SPKR & STANDPIPE"
10. Finish: Rough Brass or Bronze.

2.10 SPRINKLER SPECIALTY PIPE FITTINGS

A. Branch Outlet Fittings:

1. Use welded, threaded or grooved outlets only.
2. Mechanical fastened tees are not permitted.
3. Where welded outlets are used, cutouts shall be fastened to the pipe from which they are cut.

B. Flow Detection and Test Assemblies:

1. Pressure Rating: 175 psig (1200 kPa) minimum
2. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
3. Size: Same as connected piping.
4. Inlet and Outlet: Threaded.

C. Sprinkler Inspector's Test Fittings:

1. Pressure Rating: 175 psig (1200 kPa) minimum
2. Body Material: Cast- or ductile-iron housing with sight glass.
3. Size: Same as connected piping.
4. Inlet and Outlet: Threaded.

2.11 SPRINKLERS

A. General Requirements:

1. Pressure Rating for Automatic Sprinklers: 175 psig (1200 kPa) minimum.
2. Pressure Rating for High-Pressure Automatic Sprinklers: 250 psig (1725 kPa)
3. Sprinklers with O-rings are not permitted.

B. Automatic Sprinklers with Heat-Responsive Element:

1. Early-Suppression, Fast-Response Applications: FM Global Loss Prevention Data Sheet 2-2.
 2. Characteristics: Nominal ½-inch (12.7-mm) orifice with Discharge Coefficient K of 5.6, and 8.0 for “Ordinary” temperature classification rating unless otherwise indicated by this specification or required by application.
 3. Provide ½ inch NPS thread for K5.6 and ¾ inch NPS thread for K8.0.
- C. Sprinkler Finishes:
1. Chrome plated.
 2. Bronze.
 3. Painted.
- D. Special Coatings:
1. Corrosion resistant coating.
- E. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
1. Ceiling Mounting: Chrome-plated steel, one piece, flat.
 2. Sidewall Mounting: Chrome-plated steel, one piece, flat.
- F. Sprinkler Guards:
1. Type: Wire cage with fastening device for attaching to sprinkler.

2.12 ALARM DEVICES

- A. Water-Flow Indicators:
1. Water-Flow Detector: Electrically supervised.
 2. Components: Two double-throw circuit switches for isolated alarm and auxiliary contacts, complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 3. Type: Paddle operated with screw terminals.
 4. Pressure Rating: 250 psig (1725 kPa).
 5. Design Installation: Horizontal or vertical.
 6. Time Delay Feature: from 0 to 30 seconds
- B. Valve Supervisory Switches:

1. Type: Electrically supervised with screw terminals.
 2. Components: Double-pole, double-throw switch with normally closed contacts.
 3. Design: Signals that control valve is in other than fully open position.
- C. Indicator-Post Supervisory Switches:
1. Type: Electrically supervised with screw terminals.
 2. Components: Double-throw switch with normally closed contacts.
 3. Design: Signals that controlled indicator-post valve is in other than fully open position.

2.13 PRESSURE GAGES

- A. Type: Liquid filled
- B. Dial Size: 4-1/2-inch (90- to 115-mm) diameter.
- C. Pressure Gage Range: 0 to 250 psig (0 to 1725 kPa) minimum.
- D. Water System Piping Gage: Include "WATER" or "AIR/WATER" label on dial face.

2.14 PIPE ESCUTCHEONS

- A. General: Manufactured ceiling, floor, and wall escutcheons and floor plates.
- B. One-Piece, Cast-Brass Escutcheons: Polished chrome-plated finish with set-screws.
- C. One-Piece, Deep-Pattern Escutcheons: Deep-drawn, box-shaped brass with chrome-plated finish.
- D. One-Piece, Stamped-Steel Escutcheons: Chrome-plated finish with set-screw.
- E. Split-Casting, Cast-Brass Escutcheons: Polished chrome-plated.
- F. Split-Plate, Stamped-Steel Escutcheons: Chrome-plated finish with concealed hinge.
- G. One-Piece Floor Plates: Cast-iron flange with holes for fasteners.
- H. Split-Casting Floor Plates: Cast brass with concealed hinge.

2.15 SLEEVES

- A. Steel-Pipe Sleeves: ASTM A53/A53M, Type E, standard weight, plain ends.

2.16 HANGERS

- A. Materials available by product type. Provide materials to comply with location and application requirements unless noted otherwise on drawings and schedules.

1. Pipe rings - Malleable iron, carbon steel.
 2. Clevis - Carbon steel.
 3. Steel pipe clamps - Carbon steel, alloy, stainless steel.
 4. Socket clamps - Carbon steel.
 5. Beam clamps - Malleable/ductile iron, hardened steel, carbon steel, forged steel.
 6. Structural attachments - Carbon steel, malleable iron.
 7. Ceiling plates/ceiling flanges - Plastic, cast iron, malleable iron.
 8. Concrete inserts and attachments - Malleable iron, carbon steel; stainless steel body, fiberglass bars, polypropylene disc (iron cross design).
 9. Rod attachments - Carbon steel, malleable iron, forged steel.
 10. Pipe supports - Carbon steel, cast iron.
 11. Pipe shields and saddles - Carbon steel, alloy steel, stainless steel.
 12. Pipe rolls - Cast iron, carbon steel.
 13. Guides - Carbon steel; slides, carbon steel with PTFE slide plates.
 14. Engineered hangers - Carbon steel, stainless steel, chrome molybdenum steel.
 15. Powder driven studs - Not permitted
- B. Finishes: Provide finishes to comply with location and application requirements unless noted otherwise on drawings and schedules.
1. Electro-plating galvanizing process per ASTM B633.
 2. Hot Dipped galvanizing process per ASTM A153.
 3. Epoxy paint.
 4. Zinc-rich paint.
 5. Copper
 6. Standard primer shall meet Fed Spec TT-P-636.

2.17 SIGNAGE

- A. Provide plastic signs for each valve and to identify hydraulic design. Signs shall have white lettering on a red background with holes for easy attachment. Enter pertinent data for each system on the hydraulic placard.

2.18 SPRINKLER CABINET

- A. Provide metal cabinet(s) as required containing a stock of spare sprinkler heads of all types and ratings installed as well as any special tools required for removal or replacement of the heads. The number of spare sprinklers shall conform to NFPA 13. The cabinet shall be located, in an area where the temperature will not exceed 100 degrees F (38 degrees C), and approved by the local fire department.

PART 3 - EXECUTION

3.01 WATER-SUPPLY CONNECTIONS

- A. Install shutoff valve, check valve, pressure gage, and drain at connection to water supply.

3.02 PIPING INSTALLATION

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated, as far as practical.
 - 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with the Owner and the County of Sonoma before deviating from approved working plans.
- B. Where required to be protected against damage from earthquakes, install seismic restraints on piping in accordance with NFPA 13.
- C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes. Reductions in pipe sizes shall be made with tapered fittings, bushings shall not be permitted.
- D. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13. Trapeze type supports shall utilize angle iron. Use of pipe for trapeze supports is prohibited.
- E. Install pressure gages on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gages with connection not less than NPS 1/4 (DN 8) and with soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and install where they will not be subject to temperatures below 40 degrees F. Install pressure gages on both sides of every pressure reducing valve.
- F. Provide a check valve at the connection to the system riser(s) at each floor connection.

3.03 JOINT CONSTRUCTION

- A. Install couplings, flanges, flanged fittings, unions, nipples, transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated by this specification.
- B. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 (DN 65) and larger end connections.

- C. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- D. Remove scale, slag, dirt, and debris from inside and outside of pipes, tubes, and fittings before assembly.
- E. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- F. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to the requirements and recommendations of NFPA 13.
 - 1. Shop weld pipe joints where welded piping is indicated. Do not weld to galvanized-steel pipe.
 - 2. Affix cutout disks, which are created by cutting holes in the walls of pipe for flow switches and non-threaded pipe connections to the respective waterflow switch or pipe connection near to the pipe from where they were cut.
- G. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- H. Brazed Joints: Join copper tube and fittings according to CDA's "Copper Tube Handbook," "Braze Joints" Chapter.
- I. Copper-Tubing Grooved Joints: Roll rounded-edge groove in end of tube according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join copper tube and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.04 SPRINKLER INSTALLATION

- A. Temperature Rating: Install ordinary temperature sprinklers, unless modified herein. Sprinklers installed in higher ambient temperature areas shall be installed in accordance with NFPA 13.
- B. Sprinkler Guards: Provide mechanical guards as required to prevent mechanical damage in accordance with NFPA 13, and as follows:
 - 1. Sprinklers installed below 7 ft. (2.1 m.)

- C. Corrosion Protection: Provide corrosion-resistant sprinklers in locations where chemicals, moisture, or other corrosive vapors sufficient to cause corrosion of such devices exist, and as follows:
 - 1. Install corrosion-resistant sprinklers where exposed to the exterior.
- D. Quick Response Sprinklers:
 - 1. Install in all areas where listed for use and in accordance with NFPA 13.
- E. Flexible sprinkler fittings shall not be used.

3.05 DRAINS

- A. Pipe drains to discharge at safe points outside of the building or to sight cones attached to drains of adequate size to readily carry the full flow from each drain under maximum pressure. Do not provide a direct drain connection to sewer system or discharge into sinks. Install drips and drains where necessary and required by NFPA 13.
 - 1. Drain discharge outlets on the outside of the building shall be located no higher than 1 foot (0.3 meters) above grade level.
 - 2. Drains provided as part of floor control valves shall discharge to an express drain located adjacent to the sprinkler riser. Drains shall be of the combination inspector's test/drain type.

3.06 SIGNAGE

- A. Securely attach identification signs to control valves, drain valves, and test valves. Locate hydraulic placard information signs at each sectional control valve where there is a zone water flow switch. Where more than one sprinkler zone is provided, signs shall indicate the specific zone served by the valve.

3.07 FIRESTOPPING AND FIREPROOFING

- A. Firestop all holes for piping, or other penetrations which pass through floor slabs, fire-rated walls, partitions with fire-rated doors, vertical service shafts, or any fire-rated assemblies in accordance with the specification. Existing holes through which new piping for this project passes shall be totally firestopped in a manner that restores the fire protection rating of the penetrated wall, floor, ceiling or other structure.
- B. Where structural fireproofing is disturbed, damaged, or destroyed as a result of the sprinkler system installation, the contractor shall be responsible for restoring the fire proofing to the required fire resistance rating in an approved manner. This restoration shall be done in accordance with the UL listing or FM approval of the fireproofing materials, requirements of the building, fire, and life safety codes in effect for the project, and in accordance with NFPA.

3.08 SLEEVE INSTALLATION

- A. General Requirements: Install sleeves for pipes and tubes passing through penetrations in concrete or masonry walls and floors.

- B. Cut sleeves to length for mounting flush with both surfaces unless otherwise indicated by this specification.
- C. Install sleeves that are large enough to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pipe. In seismic zones, for pipe 2½ inch (65 mm) and smaller install sleeves that are large enough to provide 1 inch (25 mm) annular clear space between sleeve and pipe, for pipe larger than 2½ (65 mm) inch install sleeves that are large enough to provide 2 inch (50 mm) annular clear space between sleeve and pipe.
- D. Sleeves in Masonry and Concrete Walls, Floors, and Roofs: Provide hot-dip galvanized steel, ductile-iron, or cast-iron sleeves. Core drilling of masonry and concrete may be provided in lieu of pipe sleeves when cavities in the core-drilled hole are completely grouted smooth.
- E. Sleeves in Other Than Masonry and Concrete Walls, Floors, and Roofs: Provide 26 gauge galvanized sheet steel.
- F. Escutcheon plates shall be installed where exposed piping penetrates through walls, ceilings and floors.

3.09 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 1. Hydrostatically test wet-pipe sprinkler system, as required by NFPA 13, in the presence of the County of Sonoma or their designated representative. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the preliminary test. Test water flow alarms, tamper switches, and all other devices for smooth and correct operation. Test the water flow alarms by flowing water through the inspector's test connection. When tests are completed and corrections made, submit signed and dated "Contractor's Material and Test Certificates" in accordance with NFPA 13, with a request for final inspection and tests.
 2. Test and adjust controls. Replace damaged and malfunctioning controls and equipment.
 3. Flush, test, and inspect sprinkler systems according to NFPA 13.
 4. Energize circuits to electrical equipment and devices.
 5. Coordinate with fire-alarm tests. Operate as required.
 6. Coordinate with fire-pump tests. Operate as required.
 7. Verify that equipment hose threads are same as local fire-department equipment.
- B. Final Inspection and Testing: Advise the County of Sonoma and Fire Department when hydrostatic and alarm tests have been completed and all necessary corrections made, so as to permit final inspection and testing. Submit request for testing at least 15 calendar days prior to test date. A final acceptance test WILL NOT BE SCHEDULED until

operation and maintenance manuals have been received by the designated representative.

1. At the final test, a material and test certificate must be provided in accordance with NFPA 13.
2. Submit up-to-date red-lined shop drawings to the Owner at the final test. These drawings shall be undamaged sets of prints of the shop drawings, with changes from the original drawings marked in red. Up-to-date drawings shall be maintained on site throughout construction.
3. The final test shall be witnessed by County of Sonoma and Fire Department. The Contractor and an authorized representative from each supplier of equipment shall be in attendance at the final test.
4. Final testing shall include, but is not limited to, full flow testing through both the main drain and the inspector's test connection as well as testing of all water flow and tamper switches.

C. Coordination of Installation:

1. The Contractor shall coordinate this sprinkler system work with other trades to avoid conflicts, assure system completion and testing within the project schedule and to assure a quality, workmanlike finished product.
2. Delineate phasing of construction to ensure that installations of new systems are expedited, and existing systems are kept in service until the replacement system is operational.

3.10 CLEANING AND PAINTING

- A. Clean dirt and debris from sprinklers.
- B. Remove and replace sprinklers with paint other than factory finish.
- C. Paint sprinkler pipe as required by Division 9, Painting.

END OF SECTION

DIVISION 22
PLUMBING

SECTION 22 0000
GENERAL REQUIREMENTS - PLUMBING

PART 1 - GENERAL

1.01 DESCRIPTION -

This Section 22 20 00 includes General Requirements for the work comprising the following sections:

- | | | |
|----|----------|---|
| A. | 22 05 29 | Hangers and Supports |
| B. | 22 07 00 | Plumbing Insulation |
| C. | 22 11 16 | Domestic Water Systems |
| D. | 22 11 19 | Plumbing Specialties |
| E. | 22 13 13 | Condensate Drainage System |
| F. | 22 13 16 | Drain, Waste, and Vent Systems |
| G. | 22 33 13 | Instantaneous Domestic Water Heaters |
| H. | 22 33 33 | Light-Commercial Electric Water Heaters |
| I. | 22 40 00 | Plumbing Fixtures |

1.02 WORK INCLUDED

- A. Provide all materials, equipment, labor, fabrication, specialties, and items necessary and incidental to the installations.
- B. Work included shall also include transportation, storage, utilities and required licenses and permits.

1.03 RELATED WORK AND REQUIREMENTS

- A. The work of this Section shall require work in coordination with other Divisions outside of this Section as follows:
- | | | | |
|----|-------------|---|---|
| 1. | Division 03 | - | Concrete |
| 2. | Division 23 | - | Heating, Ventilating and Air Conditioning |
| 3. | Division 26 | - | Electrical |

1.04 CODES, REGULATIONS, STANDARDS, AND GUIDELINES

- A. Work shall be in accordance with requirements of the following:
- | | | | |
|----|-----|---|--------------------------|
| 1. | CBC | - | California Building Code |
|----|-----|---|--------------------------|

- 2. CMC - California Mechanical Code
- 3. CPC - California Plumbing Code
- 4. NEC - National Electric Code
- 5. CEC - California Energy Commission (Title 24)

B. The work shall comply with the following guidelines and standards:

- 1. AGA American Gas Association
- 2. ANSI American National Standards Institute
- 3. ASHRAE American Society of Heating Refrigerating and Air Conditioning Engineers
- 4. ASME American Society of Mechanical Engineers
- 5. ASPE American Society of Plumbing Engineers
- 6. ASTM American Society for Testing and Materials
- 7. ASSE American Society of Sanitary Engineering
- 8. AWWA American Water Works Association
- 9. NEC National Electric Code
- 10. NFPA National Fire Protection Association
- 11. UL Underwriters Laboratories

1.05 QUALITY CONTROL

- A. Mixing of manufacturers shall not be allowed for product lines. All items of a like type shall be from the same manufacturer.
- B. Products shall be new.

1.06 SUBMITTALS

- A. Each piece of equipment shall be submitted separately.
- B. Submit all items at same time.

1.07 SITE VISIT AND FAMILIARIZATION

- A. Visit the site and become familiar with the Drawings and Specifications. Examine the site and understand the conditions under which the Contract shall be performed.

1.08 REVIEW OF CONSTRUCTION

- A. Work may be reviewed, without prior notice, at any time by Owner.
- B. Advise Owner when work is ready for review at the following times:

1. Prior to concealment of Work in walls and above ceilings and any other enclosable spaces. Conceal Work only after obtaining Owner & PRMD consent.

1.09 DEFINITIONS

- A. Definitions following may not match those in other sections. Definitions listed here govern this part of the Work and take precedence over those listed elsewhere.
1. Concealed: Embedded in masonry or other construction, installed in furred spaces, within partitions or hung ceilings, in trenches, crawl spaces, or in enclosures.
 2. Connect: Complete hook-up of items with required services.
 3. Down: A vertical pipe or piece of work that does penetrate a floor.
 4. Drop: A vertical pipe or piece of work that does not penetrate a floor.
 5. Exposed: Not installed underground or "concealed" as defined within this list.
 6. Provide: To furnish, supply, install and connect up complete and ready safe and regular operation of particular work referred to unless specifically noted.
 7. Install: To erect, mount and connect complete with related accessories.
 8. Riser: A vertical pipe or piece of work having a vertical length greater than one story height.
 9. Indicated, Shown or Noted: As indicated, shown or noted on Drawings and Specifications.
 10. Other Division(s): Specification Sections that do not include the HVAC Divisions.
 11. Motor Controllers: Manual or magnetic starters (with or without switches), individual pushbuttons or hand-off-automatic (HOA) switches controlling the operation of the motors.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials, equipment and supplies shall be new and latest types and models of manufacturers and shall bear identification markings, nameplates and labels.
- B. Equipment specified by manufacturer's number shall include all accessories, controls, etc., listed in catalog as standard with equipment. Provide optional or additional accessories as specified or scheduled incidental to the Work such as, but not limited to, caulking, gaskets, sealants, fasteners, etc.
- C. Where no specific make of material or equipment is mentioned, any first class product of good reputable manufacturer may be used, provided it conforms to requirements of system and meets acceptance of Owner.

- D. Equipment, material and supplies damaged during transportation, installation and operation is considered as totally damaged and shall be replaced with new. Variance from this is permitted only with approval of Owner.
- E. Electrical Work performed in the service of the HVAC installation shall conform to Division 26 Electrical requirements. Provide weatherproof devices and installations for Work exposed to the elements.

PART 3 - EXECUTION

3.01 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery and handling shall be performed in accordance with manufacturer's recommendations. Provide dust and weather covers.
- B. Protect materials from loss or damage. Lost or damaged materials shall be replaced with new at no increase in Contract Sum.

3.02 PROTECTION OF WORK

- A. Cap all fixture, pipe and equipment openings daily to protect from dust, moisture and incidental debris.
- B. Porous materials that become wetted shall be replaced with new. Drying is not sufficient as it introduces the possibility of microbial growth. This applies to insulation and any material that acts as a sponge.
- C. All air distribution shall be capped during construction to prevent accumulation of dirt, dust and debris.

3.03 CLEANING AND PRESENTATION

- A. Prepare Work for painting by leaving surfaces free of oil, dust, rust, scale, adhesions and debris.
- B. Remove all shipping labels and tags.
- C. Exterior surfaces of piping, insulation, and equipment shall be left clean.
- D. Discoloration or damage to systems, building finishes or furnishings resulting from failure to properly clean the respective systems shall be repaired or replaced by the Contractor at no extra cost to the Owner.
- E. Scratched and marred surfaces of factory painted equipment and materials shall be touched up with matching color/type paint.
 - 1. Scratched and marred plumbing fixtures shall be replaced with new.
- F. Cut ends of strut pieces and uncoated/ungalvanized steel materials exposed to the elements shall be painted with two coats of rust inhibiting paint of Rust-Oleum grade with color and type matched to installation.

3.04 CUTTING OF STRUCTURE

- A. Cut no beams, girders, columns, or other structural members, or run any pipes or Work through slabs, unless specifically shown on the Drawings, or unless written approval is obtained from the Owner. Cutting of walls, floors, or other parts of the building or repairing any Work due to neglect of properly directing the locations of necessary openings and framing beforehand shall be done at no additional cost to the Owner.

3.05 SPECIAL TOOLS

- A. Furnish to Owner one set of special tools required to operate, adjust, dismantle, or repair any equipment of this section. Special tools mean those not normally found in possession of mechanics or maintenance personnel. Also provide location of supplier where extra sets can be purchased.

3.06 COMPLETION

- A. When Work is completed, or when Owner representative directs, remove surplus equipment, material, waste, and rubbish and leave building in satisfactory condition.
- B. Adjust faucets and flush valves to give proper supply of water and leave in first class condition.

END OF SECTION

SECTION 22 0529
HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide complete hangers and supports for the HVAC systems and all related accessories, specialties and where shown on the Drawings.

PART 2 - PRODUCTS

2.01 STRUCTURAL ATTACHMENTS

- A. Model numbers are Superstrut, or approved equal, unless otherwise indicated.
- B. Anchor bolts shall be sized as specified for hanger rods.
- C. Beam Clamps
 - 1. All with U-568 safety strap.
 - 2. All with locknuts on set screws and hanger rods.
 - 3. Bottom flange attachment
 - a. Loading 150 lb. and less use U-563
 - b. Loading 150 lb to 300 lb use U-562
 - c. Loading more than 300 lb use U-560
 - 4. Top flange attachment
 - a. Permitted only when bottom flange attachment cannot be used.
 - b. Loading 400 lb and less use M-777
 - c. Loading more than 400 lb use M-778
 - 5. Welded beam attachments shall be similar to C-780
 - 6. Side beam brackets shall be similar to No. 542
- D. Hanger Rods:
 - 1. ASTM A575 hot rolled steel
 - 2. ANSI B1.1 Unified inch screw threads
 - 3. Threaded both ends, threaded one end or continuous threaded.

4. Hanger Rod Fixtures:
 - a. Turnbuckles shall be similar to No. F-112
 - b. Linked Eye Rod shall be rod swivel type similar to E-131
 5. Clevis shall be similar to No. F-111
- E. Steel Deck Inserts
1. Factory stud with:
 - a. Clip
 - b. Spring
 - c. Coupling
 2. Similar to ITT Phillips Red Head
- F. Miscellaneous Metal:
1. Steel plate, shapes and bars, ASTM A36
 2. Steel pipe columns: ASTM A53, Schedule 40, black
 3. Bolts and nuts: regular hexagon-head, ASTM A307, Grade A.
 4. Lag bolts: square head type, Fed. Spec. FF-B-561
 5. Plain washers: round, carbon steel, Fed. Spec. FF-W.92.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation products in accordance with the manufacturer's written instruction, Commercial and Industrial Standards, and recognized industry practices to ensure that the insulation serves the intended purpose. Surfaces to be attached to shall be thoroughly cleaned prior to making attachments.

3.02 ATTACHMENTS TO STRUCTURE

- A. Steel Beam Anchors
 1. Beam or channel clamps.
 2. Do not cut or weld to structural steel without permission of Owner.
- B. Steel Deck Anchors
 1. Concrete filled: as specified above.

2. Decking without concrete:
 - a. Through rod support:
 1. Weld to spare plate, 1/4" inch thick.
 2. Plate to distribute load over minimum of two full cells.
 3. Coordinate with floor layouts to clear cells with wiring.
- C. Side Wall Supports
 1. Concrete walls: shall be as specified for hangers
 2. Stud walls:
 - a. Toggle bolts.
 - b. Studs welded to structural studs.
- D. Support Spreaders:
 1. Install spreaders spanning between structural members when hangers fall between them, and hanger load is too great for slab or deck attachment.
 2. Spreaders may be one of methods listed below, or combination of both as required.
 - a. Fabricated from structural channel.
 1. End fittings bolted or welded.
 2. Secure to structural members:
 - a) As required by construction.
 - b. Formed channels with fittings, similar to Superstrut.
- E. Submit manufacturers calculations for installation.

END OF SECTION

SECTION 22 0700
PLUMBING INSULATION

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide complete plumbing system insulation work for piping, equipment, and other items where shown on the drawings.
- B. Insulation work shall comply with the requirements of the CEC.
- C. All insulation that is exposed to weather shall be protected with weather covers of stainless steel or aluminum jacketing. PVC jacketing may be used for this project but shall be subject to approval.
- D. Insulate all piping where the fluid and or air being transported is 60 degrees or below in temperature and where the fluid or air being transported is 100 degrees or above in temperature. Insulate all hot surfaces above 120 degrees in temperature to prevent personnel burns. Insulate all hot water and hot water recirculation piping, and cold water piping where it occurs in un-conditioned spaces (attics, etc.). Insulate all piping, equipment, valves, tanks, etc., which require insulation but come uninsulated from the manufacturer.
- E. All work of this section shall comply with Section 22 00 00 GENERAL REQUIREMENTS - PLUMBING

PART 2 - PRODUCTS

2.01 GENERAL

- A. The type of insulation and its installation shall be in accordance with this Specification for each service and the application technique shall be as recommended by the manufacturer.
- B. Fire Rating of all insulation shall have a composite (insulation, jacket or facing and adhesive used to adhere facing or jacket to insulation) fire and smoke hazard, as tested by ASTM E84, NFPA 255, and U.L. 723, not to exceed a flame spread of 25 and smoke developed by 50.
 - 1. Accessories such as adhesives, mastics, tapes, and cements shall have the same component ratings as listed.
 - 2. Products shall have integral factory labeling indicating that flame spread and smoke developed ratings do not exceed the above requirements.

2.02 FIXTURE INSULATION

- A. ADA accessible fixtures shall have the hot water supply and waste piping insulated from connections at sink to connections at wall, building, or cabinetry surfaces. ADA-conforming, wheelchair accessible lavatory P-trap and angle valve assemblies shall be

covered with the molded, antimicrobial TRUEBRO, INC. Lav-Guard, or approved equal, undersink protective pipe covering of white color. Covers shall be secured with Snap-Clip flush reusable fasteners, angle stop shall have Lock-Lid locking access covers. Provide with accessory covers to fit standard 5" offset wheelchair strainers and 6" Kohler offset wheelchair strainers, where occurs.

1. There shall be no sharp or abrasive surfaces under lavatories.

2.03 PIPING INSULATION

A. Type A: Molded fiberglass

1. Maximum K factor: 0.23 at 75 deg. F mean temperature
2. Minimum Density: 4 lb/PCF
3. Factory applied all service or all purpose jacket (ASJ): Fire retardant laminate of white Kraft facing, glass scrim reinforcing and aluminum foil.
4. Similar to Owens-Corning 650 ASJ.

B. Type B: Molded fiberglass fittings

1. Maximum K Factor: 0.23 at 75 deg. F mean temperature
2. Minimum Density: 4 lb/PCF
3. Similar to Epolux Hamfab molded fittings

C. Finishes, Adhesives, Sealants and Jackets for Piping Insulation:

1. Type 1: Fitting covers
 - a. Molded white PVC jacket
 - b. U.L. Class 1
 - c. Maximum permeance: 0.05
 - d. Similar to Manville Zeston
2. Type 2: Vapor barrier coating
 - a. White vapor barrier coating with 10 x 10 or 20 x 20 mesh white glass, polyester or nylon cloth reinforcing membranes.
 - b. 31 mil dry film thickness
 - c. Maximum permeance: 0.05
 - d. Similar to Foster Tite-Fit 30-35, U.L. Label

D. Wire, Banding and Fastening Devices for Piping Insulation:

1. Wire: Minimum 16 gauge copper clad annealed steel wire
2. Bands: Aluminum, 3/4 in. nominal width with wing seals, or minimum 0.020 inch thick, where specified.
3. Staples: Outward clinching type of corrosion resistant steel.
4. Weld pins to support and fasten duct insulation: Minimum 1/8 in. diameter with speed washer or integral flange of minimum 1-3/8 in. diameter.
5. Insulation Tape
 - a. U.L. rated
 - b. All service or foil-scrim jacket to match insulation
 - c. Width as noted
 - d. Similar to Compac Corp. UL ASJ or FKJ PS Tape

E. Piping, Valves and Fittings Insulation Applications:

1. Low temperature hot piping systems - 100 deg F to 250 F.
 - a. Low temperature hot water supply and recirculation piping.
 - b. Insulation schedule:

Insulation Schedule - Low Temperature
Hot and Cold Water Piping Systems

	INDOOR
Type:	A
Finish:	1 or 2
Type	B
Finish	1 or 2
Thickness: Up to 2 in. IPS	1-1/2 In.
Thickness: 2-1/2 - 4 in. IPS	2 in.
Vaporseal	Not required

2. Miscellaneous Cold Piping:
 - a. Including:
 1. Domestic cold water concealed in unconditioned spaces and exposed outside to the elements.
 - b. Insulation Requirements.
 1. Insulation: Type A
 2. Vapor seal required.
 3. Fittings: Type B with Type 2 finish
3. Non-Insulated Piping: Natural gas, vents and drains.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation products in accordance with the manufacturer's written instruction, Commercial and Industrial Standards, and recognized industry practices to ensure that the insulation serves the intended purpose. Surfaces shall be thoroughly cleaned with all testing successfully completed prior to insulating.
- B. In addition to where specified provide insulation by type and locations as indicated on the Drawings.
- C. After the installation of insulation protect the insulation from moisture and weather damage.
- D. Before applying insulation:
 1. Required pressure and leakage tests of joints and connections shall be completed.
 2. Surfaces shall be clean of dust, grease and foreign matter and dry before application of insulation.
 3. All insulation joints shall be butted firmly together and all jackets shall be smoothly and securely installed.
 4. Insulate each pipe individually. Do not use scrap pieces of insulation where a full-length section will fit. Except for specific exceptions, insulate entire piping system as specified.
- E. Piping:
 1. Longitudinal Overlaps:
 - a. 2 in. minimum.
 - b. For exposed work: toward ceiling or wall.

2. Continuous insulation passing through sleeves or other openings.
3. Metal frames to protect edges of openings in insulation.
4. Penetration of fire or smoke barriers: Wrap pipe with rock wool insulation, seal jacket seam and seal joints to adjacent sections of insulation.
5. Fill voids with Keene Super-slick insulating cement, or approved equal, applied in a single coat over hexagonal wire mesh.
6. Valves, fittings, flanges and accessory insulation:
 - a. Insulation type as noted above.
 - b. Unless otherwise noted, insulate:
 1. Valves including bonnets
 2. Flanges
 3. Fittings
 4. Strainers
 - c. Insulation for strainers, fittings and accessories requiring servicing or inspections: Insulation re movable and replaceable without damage, and enclosed within two piece, No. 18 gauge aluminum covers fastened with cadmium plated bolts and nuts.
 - d. Insulation of same thickness as adjacent piping insulation.
 - e. For piping systems insulated with fiberglass:
 1. Secure insulation with wire.
 2. Under 3 in. pipe size, built up coating of Keene Superslick insulating and finishing cement applied over hexagonal wire mesh to match thickness of adjoining pipe insulation, may be used.
 3. Finishes:
 - a) Type 1: Apply factory pre-molded cover and seal edges with Foster Foam seal 30-45, or approved equal vapor barrier sealer.
 - b) Type 2: Apply uniform layer of finish coating to cover entire surface of fitting insulation and embed layer of fiber glass tape into wet coating, extending 2 in. over adjoining pipe covering. Apply finish layer of coating over entire surface.
 - f. Flanged: Insulation sleeve of same material as pipe insulation, to cover flange and overlap insulation on adjacent piping.
7. Wiring, Banding and Fastening Devices: Secure insulation to piping in accordance with following minimum requirements:

- a. Piping insulation section 3 ft. long:
 - 1. Type A molded fiberglass: Self-sealing laps may be used. Staples not permitted on vapor sealed piping.
 - 2. Other Types: Per manufacturer's recommendations.
 - b. Pipe Fitting Insulation:
 - 1. Loops of wire to secure mitered segments of insulation.
 - 2. Wire spiraled on from end to end on blanket insulation.
8. At Pipe Hangers:
- a. For fiberglass insulated piping, provide 18 in. long calcium silicate section continuous with adjoining pipe insulation and jacket.
 - b. Insulation protection saddles and shield specified in Section "Piping for HVAC".
 - c. No hangers embedded in insulation.
 - d. Saddles filled with insulation of type specified for service, or filled with insulating cement.
9. Jackets and Facings:
- a. All staples sealed with Foster Foam seal 30-45 or approved equal vapor barrier sealant.
 - b. Adhere longitudinal laps if self-sealing laps are not used and as necessary to maintain integrity of vapor seal.
 - c. Adhere 3 in. wide joint strip, of same material as facing, at center of each butt joint, if self-sealing butt strips are not used.
 - d. Adhesives:
 - 1. Indoor: Foster Foam seal 30-45, or approved equal.
- F. Weld Pins and Anchors:
- 1. Spacings: Minimum 12 in. centers and minimum 2 rows per side of duct.
 - 2. Maximum permissible load: 5 lb for 2 in. x 2 in. base plate and 10 lb for 2-3/4 in. x 2-3/4 in. base plate.
 - 3. Clip off pin penetrations flush with insulation surface or facing.
 - 4. Seal pins and washers with 4 in. square pieces of Foster Foam seal 30-45 or approved equal vapor barrier tape to match facing and adhere with vapor seal adhesive.

D.

Adhesives and Coatings:

1. Apply at following rates in accordance with manufacturer's recommendations:
 - a. Vapor barrier coatings: 50 sq ft/gal.
 - b. Vaporseal adhesives: 100 sq. ft/gal.
2. Adhesive jackets and facings with wet coat of Foster Foam seal 30-45 adhesive.
3. Lap Sealing: Full width of lap.
4. Surfaces to be adhered: Completely coated with adhesive.

3.02 PROTECTING AND REPLACEMENT

- A. Replace damaged insulation that cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.
- B. Protection: Provide required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION

SECTION 22 1116

DOMESTIC WATER SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide complete domestic water piping plumbing systems from points of connection to Civil work to all fixtures, equipment and miscellaneous devices.
- B. System shall be complete with piping, pressure reducing valves, plug valves and related specialties required for an operational system.
- C. All work of this section shall comply with Section 22 00 00 GENERAL REQUIREMENTS - PLUMBING

PART 2 - PRODUCTS

2.01 PIPE

- A. Domestic cold, hot and hot water return piping:
 - 1. Above Grade:
 - a. 2 inches and smaller: Copper tubing, Type L, with 95/5 solder joints or mechanical coupling equal to ProPress, or approved equal.
 - b. 2-1/2 inches to 4 inches: Copper tubing, Type L, with silver brazed joints.
 - 2. Below Grade:
 - a. Copper tubing, Type K, soft drawn copper. Try to use continuous runs to avoid joints. Where joints cannot be avoided use silver brazed joints.

2.02 VALVES

- A. General:
 - 1. All general service valves shall be ball type, 600 WOG, 150 S, bronze with chrome plated brass ball, full port, PTFE seat, all stems packed (non-packed Nibco not allowed). Wrought solder end valves may be used for copper pipe sizes 2 inch and smaller.
 - 2. 2 inch and smaller, Schedule 40 black iron (ungalvanized steel), threaded connections.
 - 3. 2-1/2 inches to 4 inches, Schedule 40 black iron (ungalvanized steel), welded connections.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

- A. Provide complete domestic water piping system as shown on the drawings.
- B. Piping shall be run parallel to buildings lines and supported at intervals specified. Branches and points of connection to existing systems shall be taken from the top or side at horizontal connections, not from the bottom. All changes in direction shall be made with standard fittings.
- C. Provide a union on one side of each screwed valve, strainer, check valve, control device, etc., to allow for servicing and removal of same.
- D. Reducing fittings shall not be used to make reductions in size of pipes. Bushings will not be allowed unless approved.
- E. Where chrome plated piping is installed, cut and thread pipe so that no un-plated pipe threads are visible when the work is completed. Friction type wrenches and vises shall be used on all copper tubing, brass piping, and chrome plated tugging or fittings. Any pipe showing too marks shall be removed and replaced with new materials, without additional cost to the Owner.
- F. No structural member shall be weakened or impaired beyond a safe limit by cutting, notching or otherwise, unless provision is made for carrying structural load approved by Owner. Hangers supporting cold, hot, tempered, and circulation piping shall be equipped with rods of sufficient length to allow for free piping movement.

3.02 PIPE THREADING

- A. Brass Pipe: Threads shall be cut same as for steel pipe. Application of thread compound, same as for steel pipe. Pipe shall be made up with friction clamps and wrenches. Ream ends same as for steel pipe.
- B. Copper Tubing: Cut square and remove all burrs. Ream both ends to full size of pipe inside diameter. Thoroughly clean ends of tubing equal to depth of fittings. Use sand cloth, sand paper or steel wool for cleaning purposes. Apply a coat of Nibco Copperized Flux, or approved equal, to tubing and fittings. Solder paste of liquid flux shall not be permitted. All tubing and fittings shall be installed in accordance with manufactures instructions.

3.03 TESTING

- A. All tests shall be made in the presence of the Owner and the local authorities having jurisdiction. At least 72 hours (three days) notice shall be given in advance of all tests. Contractor shall make preliminary tests prior to giving notice of final test.
 - 1. Contractor shall furnish all pumps, gauges, instruments and any other equipment, including test medium necessary for conducting prescribed tests.

B. Domestic Water Systems

1. When the roughing-in is completed and before the fixtures are set, the entire domestic water piping systems shall be pressure tested. Where portions of the water piping systems are to be concealed before completion, these portions shall be tested separately to the same requirements for the main systems. If piping systems fail the tests the leaky portion(s) shall be redone and the systems retested until they passes at no additional cost to Owner.
 - a. Prior to testing the new systems (downstream of point of connection to existing systems, where applicable) the piping shall be cleaned by blowing the systems clear of moisture, dust, and foreign particulates with oil free air or nitrogen.
 - b. Testing shall be done prior to connecting to equipment. Test shall be for 4 hours at a pressure of 150 PSI, with no pressure drop, using air or nitrogen.

END OF SECTION

SECTION 22 1119
PLUMBING SPECIALTIES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide complete plumbing specialties, materials, equipment, and miscellaneous devices to make the plumbing systems completely functional.
- B. Items shall include, but not be limited to:
 - 1. Access Doors
 - 2. Cleanouts
 - 3. Dielectric Unions
 - 4. Escutcheons
 - 5. Fixture Stops and Supplies
 - 6. Flexible Connections
 - 7. Pipe Sleeves
 - 8. Plumbing Vent Caps
 - 9. Trap Primers
 - 10. Water Hammer Arrestors

PART 2 - PRODUCTS

2.01 ACCESS PANELS

- A. Access panels shall be provided wherever required or indicated for proper access to installed equipment, devices, valves and miscellaneous items of the work. Coordinate with the walls, ceilings, and floors in which the access panels are required to be installed. Coordinate the locations, type, style and size carefully to match the intended service, alignment with the ceiling and wall elements and per the Architectural plans.
 - 1. In areas with non-accessible ceilings and walls and where access panels are not provided under other Divisions, provide access panels for concealed valves, equipment, dampers, and control devices. Size the access panel for proper access, adjusting and maintenance, but not smaller than 14"x14" or as indicated.

2.02 CLEANOUTS

- A. Slab on Grade: Zurn ZN 1400-AR-HD "Level-Trol" Dura Coated cast iron body, or approved equal, with gas and watertight tapered thread plug with round, heavy duty scoriated, secured, polished nickel bronze top adjustable to elevation of finished floor.

- B. Slab above Grade: same as for Slab on Grade.
- C. Tile Floor on Grade: Zurn ZN 1400-AR-HD-X, or approved equal (for 1/8" tile) or Z (for 1/4" terrazzo) "Level-Trol" Dura Coated cast iron body with gas and watertight ABS tapered thread plug with round, heavy duty recessed nickel bronze top to accept tile and adjustable to elevation of finished floor.
- D. Wall: Zurn ZB 1446-VP, or approved equal, Dura Coated cast iron body with gas and watertight tapered thread plug with round polished bronze top and smooth stainless steel cover with vandal proof screw.
- E. Exposed in Piping Runs: Zurn Z 1445-BP, or approved equal, Dura Coated cast iron body with gas and watertight bronze plug.

2.03 DIELECTRICS

- A. Dielectric unions shall be used to prevent accelerated corrosion and deterioration in the piping systems due to galvanic and stray current. Install between pipes made of dissimilar metals. Unit shall consist of a union nut, two tailpieces, and a gasket that separates the tailpieces to prevent an electric current from occurring. Maximum Pressure: 250psi. Watts Series 3001A

2.04 ESCUTCHEONS

- A. Where exposed pipes pass through floors, walls, or ceilings, they shall be filled with neat, spun or stamped metal escutcheons, firmly secured to the pipes. Escutcheons shall be of sufficient outside diameter to amply cover up the sleeved openings for the pipes and shall be installed so as to provide a neat finish. Escutcheons shall be attached by means of expansion bolts, clamps or set screws.
 - 1. At exposed locations provide chrome plated finishes.

2.05 FIXTURES STOPS AND SUPPLIES

- A. Provide stops for all fixtures. Unless otherwise specified, stops exposed at lavatories and similar fixtures shall be Chicago #1016, or approved equal, chrome plated, loose key. Concealed stops shall be Chicago #1771, or approved equal.

2.06 FLASHINGS

- A. Flashing for penetrations of the roof for Plumbing pipes shall be IPS Corp, or approved equal. Water-Tite adjustable multi-size roof vent flashings with minimum 24 gauge galvanized sheet metal base and elastomer color, color finish to match roofing type.

2.07 FLEXIBLE CONNECTIONS

- A. At building joints and seismic separations use Metraflex Metraloop, or approved equal, with suitable supports each end.

2.08 PIPE SLEEVES

- A. Furnish and install sleeves, large enough to accommodate pipe and its coverings, and passing entirely through floor, ceiling, wall, partition, or other building construction. Sleeves shall be set in new concrete construction before pouring. Sleeves not provided before pouring shall be provided together with necessary cutting and the proper grouting in of the sleeves in the cut opening. Sleeve through outside wall or through slab-on-grade shall be Link-Seal or approved equal.
- B. All vertical pipes in open chases or shafts shall be provided with galvanized sleeves wired on to pipe or to covering. Provision shall be made for expansion of pipes.
- C. Penetrations at fire rated construction: Through penetrations shall be fire stopped with Hilti, or approved equal, brand firestop systems/materials/sleeves selected to suit construction type.
- D. Unless otherwise noted, sleeves through walls, floors, and partitions shall be 22 gauge galvanized steel and shall extend ¼ inch above finished tile or other finished floor.
- E. All vertical interior exposed sleeves shall be packed with mineral wool. Fiberglass shall not be acceptable.
 - 1. At lightproof or soundproof walls, floors and partitions pack space between galvanized wall pipe sleeves and piping with non-hardening caulking and non-shrinking acoustical caulking.

2.09 PLUMBING VENT CAPS

- A. Vent pipe terminations shall have vandal proof caps with cast iron sleeves and domes secured with vandal proof fasteners, Jay R Smith 1748 or approved equal.

2.10 REDUCED PRESSURE BACKFLOW PREVENTERS

- A. Backflow preventers shall be of the reduced pressure principle type consisting of two independently acting internally loaded check valves separated by a reduced pressure zone. Preventers shall be provided with bronze ball shut off valves, in-line strainer, test cocks and air gap fittings. Air gap fitting shall be piped to nearest floor drain.
 - 1. 2 inch and smaller: Watts 909QTS or approved equal.
 - 2. 2-1/2 and larger: Watts 909-FDA-S or approved equal.

2.11 TRAP PRIMERS

- A. Trap Primers shall automatic functioning needing no adjustment. Precision Plumbing Products, Inc. Prime-Rite Trap Primer Valve.

2.12 WATER HAMMER ARRESTORS

- A. Water hammer arrestors shall be PDI certified, pre-charged, copper body, piston type with Buna N O-rings, permanently sealed with threaded brass inlet. Zurn Z1705 water hammer arrestor.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

- A. Install all equipment and materials according to the manufacturers written instructions, and in good workmanship.
- B. The Contractor shall be responsible for protecting against damage from building materials, acids, tools, and equipment included in these specifications.
- C. All equipment that requires maintenance shall be easily accessible and have proper working clearances.

3.02 TRAP PRIMERS

- A. Provide trap primers for floor drains where noted on the plans. Provide a shut off valve at each trap primer. Install primer and shut off valve in wall space with access panel.

3.03 CLEANOUTS

- A. Cleanouts shall be installed at changes in direction; at base of stacks; and at a minimum of 50 ft on center for house drains. Sizes of cleanouts shall be as per local Code requirements. Cleanouts for underground house drains shall be extended up to finished floor elevations with long radius fittings.

3.04 ACCESS DOORS

- A. Provide access doors to all plumbing specialties behind walls and ceiling spaces.

3.05 FLOOR DRAINS

- A. Floor drains shall be set 1/8 inch below floor level unless otherwise noted on the Contract Drawings.

END OF SECTION

SECTION 22 1313

CONDENSATE DRAINAGE SYSTEM

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide complete condensate drainage system from point of connection at HVAC equipment to termination points. Connections to include, but not limited to;
 - 1. Primary condensate routed to approved receptor per CPC from each piece of HVAC equipment.
 - 2. Secondary condensate routed to readily observable location per CPC from each piece of HVAC equipment.
 - 3. Condensate drain lines, routed to approved receptors from all condensing flues and gas-fired heating equipment.
- B. System shall be complete with piping, pressure reducing valves, plug valves and related specialties required for an operational system.
- C. All work of this section shall comply with Section 22 00 00 GENERAL REQUIREMENTS - PLUMBING

PART 2 - PRODUCTS

2.01 PIPE

- A. DWV copper or type L copper with 95/5 solder joints and DWV or wrought fittings. (remember to insulate)

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

- A. Piping shall be run parallel to buildings lines and supported at intervals specified. All changes in direction shall be made with standard fittings. Clean out plugs shall be installed at all cumulative changes of direction of 135 degrees or more as a minimum and as shown on the Drawings.
- B. Piping shall be run free of traps (except trap at equipment connection) and shall be pitched at 1/4" vertical drop for every foot of horizontal run.
- C. Provide complete condensate drainage system as shown on the drawings
- D. Remove cutting and threading burrs before assembling piping.

3.02 PIPE JOINTS

- A. Cut square and remove all burrs. Ream both ends to full size of pipe inside diameter. Clean ends of tubing to depth of fittings. Use sand cloth, sand paper or steel wool for

cleaning. Apply a coat of Nibco Copperized Flux or approved equal, to tubing and fittings. Solder paste or liquid flux shall not be permitted.

3.03 TESTING

- A. All tests shall be made in the presence of the Owner and the local authorities having jurisdiction. At least 72 hours (three days) notice shall be given in advance of all tests. Contractor shall make preliminary tests prior to giving notice of final test.
 - 1. Contractor shall furnish all pumps, gauges, instruments and any other equipment, including test medium necessary for conducting prescribed tests.
- B. Condensate Drainage System
 - 1. Test condensate drainage systems prior to final connection to equipment. Test shall be for 4 hours with the piping filled full of water. If piping system fails the test the leaky portion(s) shall be redone and the system retested until it passes at no additional costs to Owner.

END OF SECTION

SECTION 22 1316

DRAIN, WASTE, AND VENT SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide complete drain, waste, and vent systems from point of connection to site plumbing to all fixtures, services and termination points.
- B. System shall be complete with piping and related specialties required for an operational system
- C. Cast iron soil pipe shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute and manufactured by AB&I, Charlotte or Tyler or approved equal.

PART 2 - PRODUCTS

2.01 DRAIN, WASTE, AND VENT PIPING AND FITTINGS

- A. Above ground:
 - 1. Pipe: Service weight centerline no-hub cast iron soil pipe meeting CISPI 301.
 - 2. Fittings: Centerline no-hub cast iron fittings meeting CISPI 301.
 - 3. Joints: Coupling assembly shall meet CISPI 310 and consist of heavy duty 304 stainless steel bands on all piping.
- B. Below ground:
 - 1. Pipe: Service weight centerline no-hub cast iron soil pipe meeting CISPI 301.
 - 2. Fittings: Centerline no-hub cast iron fittings meeting CISPI 301.
 - 3. Joints: Coupling assembly shall meet CISPI 310 and consist of heavy duty 304 stainless steel bands on all piping.

2.02 PENETRATIONS AT FIRE RATED CONSTRUCTION

- A. Through penetrations shall be fire stopped with Hilti brand fire-stop systems/materials selected to suit construction type, or approved equal.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

- A. Horizontal sanitary drainage piping shall be pitched and properly vented for the removal of gases.

- B. Piping shall be installed in the most direct manner possible with a uniform pitch of not less than a 1/4" inch per foot for piping 2 inch and smaller and 1/8 inch per foot for 3 inch and larger otherwise noted on the Contract Drawings.
- C. Vent piping shall not be tapped and shall be pitched to discharge all water.
- D. Changes in direction of piping and connections for branches shall be made with long radius fittings of Y branches and 1/8 or 1/6 bends in the direction of discharge.
- E. Piping shall be installed with sleeves, escutcheons and hangers as required by these specifications.
- F. Backfilling shall not be done until the underground piping has been tested and reviewed.

3.02 TESTING

- A. All tests shall be made in the presence of the Owner and the local authorities having jurisdiction. At least 72 hours (three days) notice shall be given in advance of all tests. Contractor shall make preliminary tests prior to giving notice of final test.
 - 1. Contractor shall furnish all pumps, gauges, instruments and any other equipment, including test medium necessary for conducting prescribed tests.
- B. Drain, Waste, and Vent Systems
 - 1. Rough Plumbing: The piping shall be tested upon completion of the rough piping installation and proven to be watertight. Test shall be for 4 hours with the piping filled full of water to the highest elevation or by a field installed test head of 10 feet. If piping system fails the test the leaky portion(s) shall be redone and the system retested until it passes.
 - 2. Finish Test: After the plumbing fixtures, floor drains and other miscellaneous drains have been set and their traps filled with water the entire drainage system shall be tested and proven gas tight by either a smoke test or a peppermint test.

END OF SECTION

SECTION 22 3313

INSTANTANEOUS DOMESTIC WATER HEATER

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide complete hot water generation system inclusive of all necessary heaters, controls, pumps, etc.
- B. Items shall include, but not be limited to:
 - 1. Instantaneous Water Heater
 - 2. Manifold System and Support Structures
- C. All work of this section shall comply with Section 22 00 00 GENERAL REQUIREMENTS - PLUMBING

PART 2 - PRODUCTS

2.01 WATER HEATER (WH-1, 2, 3)

- A. Tankless water heater shall be an Eemax Model, or approved equal, as scheduled on the drawings.
- B. Unit shall have ABS-UL 94Vo rated cover. Element shall be a replaceable cartridge insert.
- C. Unit shall have a replaceable filter in the inlet connector and a flow regulator in the outlet connector.
- D. Element shall be iron free, nickel chrome material.
- E. Heater shall be fitted with 3/8" compression nuts and sleeves to eliminate need for soldering.
- F. Heater shall be installed upright with water connections on top only. Hot water storage tanks are prohibited.

2.02 WATER HEATER (WH-4, 5)

- A. Tankless water heater shall be an Eemax Model, or approved equal, as scheduled on the drawings.
- B. Unit shall have ABS-UL 94Vo rated cover. Element shall be a replaceable cartridge insert.
- C. Unit shall have a replaceable filter in the inlet connector and a flow regulator in the outlet connector.
- D. Element shall be iron free, nickel chrome material.

- E. Heater shall be fitted with 1/2" compression nuts and sleeves to eliminate need for soldering. Maximum operating pressure shall be 150 PSI.
- F. Hot water storage tanks are prohibited.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION

- A. Install all equipment and materials according to the manufacturers written instructions, and in good workmanship.
- B. The Contractor shall be responsible for protecting against damage from building materials and equipment included in these specifications.
- C. Electrical disconnect switch shall be accessible per proper working clearances per NEC.

END OF SECTION

SECTION 22 3333

LIGHT COMMERCIAL ELECTRIC WATER HEATERS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Electric Water Heater:
 - 1. This Section covers the furnishing and installation of electric tank type water heaters as indicated on the Contract Drawings and Schedules and as specified herein. Included in each water heater, but not limited to the following, shall be; glass lined tank, handout cleanout, electronic controls, foam insulation, steel unit jacketing and complete factory assembly and testing of all components.
- B. All work of this section shall comply with Section 22 00 00 GENERAL REQUIREMENTS - PLUMBING

PART 2 - PRODUCTS

2.01 ELECTRIC WATER HEATER

- A. Unit shall have a seamless glass lined steel tank construction with the glass coating applied to the water side surfaces of the tank after the tank has been assembled and welded.
- B. Unit shall be designed for zero clearance to combustibles. The heater shall be factory assembled and run tested and supplied with an installed ASME rated temperature and pressure relief valve. Entire unit shall be U.L. Listed.
- C. The tank shall be insulated with a foam layer meeting Title 24 CEC minimum insulating requirements for water heaters in California. The foam layer shall be encapsulated with a heavy gauge steel jacket with a factory baked easy clean hard shell enamel finish.

PART 3 - EXECUTION

3.01 INSTALLATION- GENERAL

- A. Coordinate unit installation with work at walls, ceilings, roofs and various trades as necessary for proper interfacing and installation.
- B. Ensure that units are wired properly, with correct combustion motor rotation and positive electrical grounding.
- C. Electrical disconnect switch shall be accessible with proper working clearances per NEC code.
- D. WATER HEATER
 - 1. Unit shall be anchored or strapped to resist horizontal displacement from earthquake motion per CPC Chapter 5.

- a. In the case where strapping is chosen and unit appurtenances interfere with wrapping the straps tight to the unit the installer shall, with factory approval, run the straps under the appurtenances (such as wiring and conduits) to enable a tight, secure fit. Do not wrap straps over appurtenances. Do not damage wrapped over appurtenances by wrenching down on strap bolts.

3.02 EQUIPMENT START UP

- A. The Contractor shall provide factory supervision for the start-up of equipment. Factory supervision shall include inspection of the equipment prior to start up.

END OF SECTION

SECTION 22 4000
PLUMBING FIXTURES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Following is a brief outline descriptive of the work included, but shall not be considered as complete and all inclusive.
 - 1. Plumbing Fixtures
 - 2. Plumbing Fixture Carriers
 - 3. Trim
 - 4. Accessories

PART 2 - PRODUCTS

2.01 General:

- A. Vitreous china fixtures shall conform to ANSI A112.192; stainless steel fixtures shall conform to ANSI A112.193; acid resisting enameled cast iron fixtures shall conform to ANSI A112.19.1; fixture supports shall conform to ANSI A117.1.
- B. All exposed piping, fittings, traps, escutcheons, valves and accessories shall be polished chrome plated brass construction.
- C. Locations and elevations of all fixtures shall be as shown on the Architectural Drawings.
- D. Stops and supplies: Provide stops for all fixtures. Unless otherwise specified, stops exposed at lavatories and similar fixtures shall be Chicago #1016 or approved equal, chrome plated, loose key. Concealed stops shall be Chicago #1771 or approved equal.
- E. Force to activate all handicapped accessible fixture controls shall be no greater than 5 lbs.
- F. Self closing faucets shall remain open for at least 10 seconds when activated.
- G. No sharp or abrasive surfaces shall be allowed under lavatories or wash fountains. Hot water and drain pipes exposed under lavatories and sinks shall be insulated (2007 CBC 1134A.8, 6)

2.02 FIXTURES

- A. BF-01 BOTTLE FILLER
 - 1. Fixture: Elkay Model LK4405BF Wall mounted, outdoor, tubular bottle filling station. Textured powder coat finish and e-coat immersion coating. Lead-free and compliant with NSF/ANSI 61-ANNEX G, AB 1953 requirements, or approved equal.

- B. DF-1 DRINKING FOUNTAIN
1. Fixture: Haws Model 1119.14 "Hi-Lo" wall mounted barrier free drinking fountain shall include dual 14 gauge Stainless Steel satin finish basins with integral swirl design, 14 gauge Type 304 Stainless Steel wall bracket, 100% lead-free waterways, push-button operated stainless steel valves with front-accessible cartridge and flow adjustment, polished chrome-plated brass vandal-resistant bubbler heads with integral laminar anti-squirt flow, chrome-plated brass vandal-resistant waste strainers, vandal-resistant bottom plates, stainless steel satin finish back panel, high and low fountain mounting levels, and 1-1/4" O.D. (3.2 cm) waste pipes. (P-trap and stop require rear access) , or approved equal.
 2. Accessories: Haws Model 6700.4 wall mounting plate for use with Model 1119.14, or approved equal. Models 6603 access panel for front access where necessary. Coordinate access requirements with the Contract Documents.
- C. FD-1 FLOOR DRAIN
1. Fixture: Zurn #ZB415B-VP, "TYPE-B" round adjustable floor drain and strainer with slotted secured grate and vandal-proof secured top, or approved equal.
- D. HB-1 INTERIOR HOSE BIBB
1. Fixture: Zurn Light Commercial #Z1344 exposed, or approved equal. non-freeze wall faucet with exterior chrome finish, removable key handle and 3/4" male hose connection.
- E. HB-2 EXTERIOR HOSE BIBB
1. Fixture: Zurn #Z1350-EZ encased, moderate climate wall faucet for narrow wall installation, or approved equal. Complete with mounting brackets and key operated control valve. Hose bibb shall have 3/4" male hose connection with stainless steel box.
- F. L-1 LAVATORY
1. Fixture: Sloan model number SS-3804 white vitreous china, ADA compliant drilled for concealed arm carrier, or approved equal.
 2. Faucet: Chicago ECAST model number 2200-4E39VPABCP deck mounted single hole metering faucet, or approved equal. 0.35 gallon per cycle maximum turned down to lowest setting. Modify for cold water use only.
 3. Carrier: Zurn, or approved equal appropriate for fixture type. Coordinate construction method with concealed arm carrier, or approved equal.

- G. MS-1 MOP SINK
 - 1. Fixture: Florestone Model 87 terrazzo mop receptor, or approved equal. Fixture shall be 24"x24", angled and be 12" in height and a 2" drain connection. Provide galvanized and bonderized steel flange on all sides against walls. Drain body shall be cast bronze and terrazzo shall have a minimum of 3,000 PSI compressive strength.
 - 2. Faucet: Chicago #540-LD897SCP mechanical hot and cold water faucet, or approved equal. Faucet shall have an adjustable body between 7-1/4" and 8-3/4". Provide with 5-3/4" rigid vacuum breaker spout. Provide 3/4" male hose thread and pail hook. Provide blocking within wall studs at pail hook support and hang between framing with appropriate fasteners.

- H. SK-1 SINK
 - 1. Fixture: Just #US-ADA13518-A 18 gauge Type 304 stainless steel sink, or approved equal. Sink shall be undermounted with hand blended finish.
 - 2. Faucet: Just J-1174-KS concealed ledge-mount faucet, or approved equal. Swiveling gooseneck with 5-1/2" span. Brass quarter turn quick compression stem units. 4" chrome plated color coded wrist blade handles.
 - 3. Drain: Just J-ADA-35-SSF stainless steel strainer, or approved equal.

- I. SK-2 SINK
 - 1. Fixture: Just #J-4820-ADA, single bowl ADA compliant. 14 gauge Type 304 stainless steel, 48"x20" , or approved equal. Exposed exterior surfaces polished to standard brush finish. Support with two 14 gauge wall brackets and 14 gauge wall clips.
 - 2. Faucet: Chicago #332-ABCP ADA compliant wall mounted manual faucet with single lever operation, or approved equal. 2.2 gpm aerator and 1/2" NPT female thread inlet.

- J. SK-3 SINK
 - 1. Fixture: Just #J-1174-KS, single bowl ADA compliant. 18-8 gauge Type 304 stainless steel, self-rimming, or approved equal. Polished non-porous hand-blended finish. Fully coated underside for sound and condensate reduction.
 - 2. Faucet: Just J-1174-KS concealed ledge-mount faucet, or approved equal. Swiveling gooseneck with 5-1/2" span. Brass quarter turn quick compression stem units. 4" chrome plated color coded wrist blade handles.

3. Drain: Just J-ADA-35-SSF stainless steel strainer, or approved equal.
- K. U-1 URINAL
1. Fixture: Sloan Waterfree series model number WES-1000, touch free operation, vitreous china, and cartridge housing, or approved equal.
 2. Accessories: Cartridge kit, one-piece wall bracket and anchors, uni-coupler, drain line test cap and professional cartridge change key.
- L. WC-1 WATER CLOSET
1. Fixture: Sloan WETS 2020.1301-1.28 ES-S ADA compliant, high efficiency series water closet system, or approved equal. Wall hung vitreous china elongated bowl, siphon jet flushing action, 1-1/2" top spud inlet, 2" fully glazed trapway with integral flushing rim.
 2. Valve: Sloan Optima ES-S hard wired unit with Optima EL-1500-L self adaptive infrared sensor with indicator light. Courtesy flush override button, or approved equal.
 3. Accessories: Olsonite 10CT stainless steel self-sustaining check hinge toilet seat, or approved equal.
 4. Carrier: Zurn, JR Smith or Acorn as necessary for specified fixture, or approved equal.
- M. WC-2 WATER CLOSET
1. Fixture: Sloan WETS 2000.1301-1.28 ES-S high efficiency series water closet system, or approved equal. Wall hung vitreous china elongated bowl, siphon jet flushing action, 1-1/2" top spud inlet, 2" fully glazed trapway with integral flushing rim.
 2. Valve: Sloan Optima ES-S hard wired unit with Optima EL-1500-L self adaptive infrared sensor with indicator light, or approved equal. Courtesy flush override button,
 3. Accessories: Olsonite 10CT stainless steel self-sustaining check hinge toilet seat, or approved equal.
 4. Carrier: Zurn carrier or approved equal and coordinate type of carrier with construction method, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General:

1. All exposed piping, fittings, traps, escutcheons, valves and accessories shall be polished chrome plated brass construction.
2. Locations and elevations of all fixtures shall be as shown on the Architectural Drawings and as required for ADA compliance.
3. Each fixture shall be separately controlled with loose key handles or stops except for mop sink faucets which shall have integral stops.
4. Force to activate all handicapped accessible fixture controls shall be no greater than 5 lbs.
5. No sharp or abrasive surfaces shall be allowed under and ADA compliant fixture.
6. All carriers for plumbing fixtures shall be bolted to the floor.
7. Install all fixtures and equipment according to the manufacturers' written instructions, and in good workmanship.
8. The Contractor shall be responsible for protecting against injury from building materials, acid, tools, equipment, etc., all plumbing fixtures included in these specifications.
9. Upon completion of installation, fixtures shall be cleaned, left in first class condition and in good working order.
10. Spaces between wall mounted fixtures and wall surfaces shall be neatly pointed up with non-shrinking no stain water resistant caulking with a color to match the fixture or surface mounted to. Any other color besides white shall be approved by the Owner prior to construction.

END OF SECTION

DIVISION 23

HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

SECTION 23 0000
GENERAL REQUIREMENTS - HVAC

PART 1 - GENERAL

1.01 DESCRIPTION - This Section includes General Requirements for Division 23 work including, but not limited to the following sections:

- A. 23 05 29 Hangers and Supports
- B. 23 05 93 Testing, Adjusting and Balancing
- C. 23 07 00 Thermal Insulation for Mechanical Systems
- D. 23 23 00 Refrigerant Piping
- E. 23 31 13 Metal Ducts
- F. 23 37 13 Diffusers, Registers and Grilles
- G. 23 80 00 Decentralized HVAC Equipment

1.02 WORK INCLUDED

- A. Work included shall also include transportation, storage, utilities and required licenses and permits.
- B. Work shall include all incidental electrical requirements for a full and complete installation of the condensing unit and cooling coil. Electrical work shall include pulling new feeders and providing new breakers, disconnect switches and starters as required for a fully functional installation.
- C. Work shall include all incidental concrete work to provide a new conduit for refrigerant piping from condensing unit to cooling coil. Follow the same general path as existing and previously demolished conduit.

1.03 CODES, REGULATIONS, STANDARDS, AND GUIDELINES

- A. Work shall be in accordance with requirements of the latest jurisdiction adopted editions of the following:
 - 1. CBC California Building Code
 - 2. CMC California Mechanical Code
 - 3. CPC California Plumbing Code
 - 4. NEC National Electric Code
- B. The work shall comply with the latest editions of the following guidelines and standards:
 - 1. AABC Associated Air Balance Council

2.	AGA	American Gas Association
3.	AMCA	Air Movement and Control Association
4.	ANSI	American National Standards Institute
5.	ARI	American Refrigeration Institute
6.	ASHRAE- Conditioning Engineers	American Society of Heating Refrigerating and Air
7.	ASME	American Society of Mechanical Engineers
8.	ASTM	American Society for Testing and Materials
9.	NEBB	National Environmental Balancing Bureau
10.	NEC	National Electric Code
11.	NFPA	National Fire Protection Association
12.	SMACNA Association	Sheetmetal and Air-Conditioning Contractors National
13.	UL	- Underwriters Laboratories

1.04 QUALITY CONTROL

- A. Mixing of manufacturers shall not be allowed for product lines. All items of a like type shall be from the same manufacturer.
- B. All products shall be new.

1.05 REVIEW OF CONSTRUCTION

- A. Work may be reviewed, without prior notice, at any time by the Owner.
- B. Advise Owner when work is ready for review at the following times:
 - 1. Prior to concealment of Work in walls and above ceilings and any other enclosable spaces. Conceal Work only after obtaining Owner consent.

1.06 CONSTRUCTION DOCUMENT DESCRIPTION

- A. Specifications describe quality of materials and equipment.
- B. Drawings describe the work in diagrammatic form. Drawings do not show exact detail and arrangements. Final requirements of the Work shall be determined by the Contractor after coordination with other trades.

1.07 DEFINITIONS

- A. Definitions following may not match those in other sections. Definitions listed here govern this part of the Work and take precedence over those listed elsewhere.

1. Concealed: Embedded in masonry or other construction, installed in furred spaces, within partitions or hung ceilings, in trenches, crawl spaces, or in enclosures.
2. Connect: Complete hook-up of items with required services.
3. Down: A vertical pipe, duct or piece of work that does penetrate a floor.
4. Drop: A vertical pipe, duct or piece of work that does not penetrate a floor.
5. Exposed: Not installed underground or "concealed" as defined within this list.
6. Work: Labor, materials, equipment, apparatus, controls, accessories and other items required for complete and proper operation.
7. Install: To erect, mount and connect complete with related accessories.
8. Riser: A vertical pipe, duct or piece of work having a vertical length greater than one story height.
9. Indicated, Shown or Noted: As indicated, shown or noted on Drawings and Specifications.
10. Other Division(s): Specification Sections that do not include the HVAC Divisions.
11. Motor Controllers: Manual or magnetic starters (with or without switches), individual pushbuttons or hand-off-automatic (HOA) switches controlling the operation of the motors.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials, equipment and supplies shall be new and latest types and models of manufacturers and shall bear identification markings, nameplates and labels.
- B. Equipment specified by manufacturer's number shall include all accessories, controls, etc., listed in catalog as standard with equipment. Provide optional or additional accessories as specified or scheduled incidental to the Work such as, but not limited to, caulking, gaskets, sealants, fasteners, etc.
- C. Where no specific make of material or equipment is mentioned, any first class product of good reputable manufacturer may be used, provided it conforms to requirements of system and meets acceptance of Owner.
- D. Equipment, material and supplies damaged during transportation, installation and operation is considered as totally damaged and shall be replaced with new. Variance from this is permitted only with approval of Owner.
- E. Provide an authorized representative to constantly supervise work of this Division, check all materials prior to installation for conformance with Drawings, Specifications, reviewed Submittals and reviewed Shop Drawings.

- F. Electrical Work performed in the service of the HVAC installation shall conform to Division 26 Electrical requirements. Provide weatherproof devices and installations for Work exposed to the elements.

PART 3 - EXECUTION

3.01 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery and handling shall be performed in accordance with manufacturer's recommendations. Provide dust and weather covers.
- B. Protect materials from loss or damage. Lost or damaged materials shall be replaced with new at no increase in Contract Sum.
- C. All mechanical equipment requiring power shall be installed with the required working spaces clearances required by the California Electrical Code, Table 110.26 (A)(1) Working Spaces.
- D. All facility service piping and conduits shall be concealed behind finishes. No exposed piping or raceway permitted unless specifically noted in writing on the drawings. Coordinate with pertinent sections of other Divisions providing new finishes. Jointly determine extent of finish necessary to install all indicated facilities services systems concealed behind wall, floor, ceiling finishes.

3.02 PROTECTION OF WORK

- A. Cap all duct, pipe and equipment openings daily to protect from dust, moisture and incidental debris.
- B. Porous materials that become wetted shall be replaced with new. Drying is not sufficient as it introduces the possibility of microbial growth. This applies to duct liner, insulation wrap, flex duct and any material that acts as a sponge.
- C. All air distribution shall be capped during construction to prevent accumulation of dirt, dust and debris.

3.03 CLEANING AND PRESENTATION

- A. Prepare Work for painting by leaving surfaces free of oil, dust, rust, scale, adhesions and debris.
- B. Remove all shipping labels and tags.
- C. Exterior surfaces of piping, insulation, ducting and equipment shall be left clean.
- D. Inside visible portions of grille cans and adjacent ducting including insulation stick pins, dampers and specialties shall be painted with two coats of flat black paint.
- E. Scratched and marred surfaces of factory painted equipment and materials shall be touched up with matching color/type paint.

1. Clean as recommended by manufacturer. Do not use material or methods which may damage finish surface or surrounding construction.
- F. Cut ends of strut pieces and uncoated/un-galvanized steel materials exposed to the elements shall be painted with two coats of rust inhibiting paint of Rust-Oleum grade with color and type matched to installation.

3.04 CUTTING OF STRUCTURE

- A. Cut no beams, girders, columns, or other structural members, or run any pipes, ducts or Work through slabs, unless specifically shown on the Drawings, or unless written approval is obtained from the Owner. Cutting of walls, floors, or other parts of the building or repairing any Work due to neglect of properly directing the locations of necessary openings and framing beforehand shall be done at no additional cost to the Owner.

3.05 SPECIAL TOOLS

- A. Furnish to Owner one set of special tools required to operate, adjust, dismantle, or repair any equipment of this section. Special tools mean those not normally found in possession of mechanics or maintenance personnel. Also provide location of supplier where extra sets can be purchased.

3.06 RECORD DRAWINGS

- A. In addition to any other requirements, include on as-built Drawings the following:
1. Changes in location of piping, duct, or equipment.
 2. Ceiling access panel locations.
 3. Position of buried or concealed mains accurately dimensioned, both horizontally and vertically.

3.07 COMPLETION

- A. When Work is completed, remove surplus equipment, material, waste, and rubbish and leave building in satisfactory condition.
- B. Adjust and program thermostats and controls per owner direction.

END OF SECTION

SECTION 23 0529
HANGERS AND SUPPORTS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide complete hangers and supports for the HVAC systems and all related accessories, specialties and where shown on the Drawings.
- B. All work of this section shall comply with Section 23 0000 GENERAL REQUIREMENTS - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

PART 2 - PRODUCTS

2.01 MANUFACTURERS:

- A. Superstrut
- B. Or Approved Equal

2.02 STRUCTURAL ATTACHMENTS

- A. Model numbers are Superstrut, unless otherwise indicated, or approved equal.
- B. Anchor bolts shall be sized as specified for hanger rods.
- C. Beam Clamps
 - 1. All with U-568 safety strap.
 - 2. All with locknuts on set screws and hanger rods.
 - 3. Bottom flange attachment
 - a. Loading 150 lb. and less use U-563
 - b. Loading 150 lb to 300 lb use U-562
 - c. Loading more than 300 lb use U-560
 - 4. Top flange attachment
 - a. Permitted only when bottom flange attachment cannot be used.
 - b. Loading 400 lb and less use M-777
 - c. Loading more than 400 lb use M-778
 - 5. Welded beam attachments shall be similar to C-780

6. Side beam brackets shall be similar to No. 542
- D. Hanger Rods:
1. ASTM A575 hot rolled steel
 2. ANSI B1.1 Unified inch screw threads
 3. Threaded both ends, threaded one end or continuous threaded.
 4. Hanger Rod Fixtures:
 - a. Turnbuckles shall be similar to No. F-112
 - b. Linked Eye Rod shall be rod swivel type similar to E-131
 5. Clevis shall be similar to No. F-111
- E. Miscellaneous Metal:
1. Steel plate, shapes and bars, ASTM A36
 2. Steel pipe columns: ASTM A53, Schedule 40, black
 3. Bolts and nuts: regular hexagon-head, ASTM A307, Grade A.
 4. Lag bolts: square head type, Fed. Spec. FF-B-561
 5. Plain washers: round, carbon steel, Fed. Spec. FF-W.92.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Install products in accordance with the manufacturer's written instruction, Commercial and Industrial Standards, and recognized industry practices to ensure that the insulation serves the intended purpose. Surfaces to be attached to shall be thoroughly cleaned prior to making attachments.

3.02 ATTACHMENTS TO STRUCTURE

- A. Steel Beam Anchors
1. Beam or channel clamps.
 2. Do not cut or weld to structural steel.
- B. Side Wall Supports
1. Concrete walls: shall be as specified for hangers
 2. Stud walls:

- a. Toggle bolts.
 - b. Studs welded to structural studs.
- C. Support Spreaders:
- 1. Install spreaders spanning between structural members when hangers fall between them, and hanger load is too great for slab or deck attachment.
 - 2. Spreaders may be one of methods listed below, or combination of both as required.
 - a. Fabricated from structural channel.
 - 1. End fittings bolted or welded.
 - 2. Secure to structural members:
 - a) As required by construction.
 - b) As reviewed by Structural Engineer.
 - b. Formed channels with fittings, similar to Superstrut.
- D. Submit manufacturer's calculations for installation.

END OF SECTION

SECTION 23 0593

TESTING, ADJUSTING AND BALANCING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Work Included: This Section covers requirements for testing, adjusting, and balancing work for the air distribution systems and associated equipment and apparatus described herein.

1.02 QUALITY ASSURANCE

- A. Engage the services of an independent balancing and testing agency specializing in the balancing and testing of heating, ventilating and air conditioning systems to perform the work.
- B. AABC Compliance: Comply with AABC's Manual MN-1 "AABC National Standards", as applicable to mechanical air distribution systems and associated equipment and apparatus, except as otherwise specified.
- C. Industry Standards: Comply with American Society of Heating, Refrigerating and Air Conditioning Engineers, Inc. (ASHRAE) recommendations pertaining to measurements, instruments and testing, adjusting and balancing, except as otherwise specified.

1.03 SUBMITTALS

- A. Submit certification that balancing personnel have been trained in accordance with AABC standards.
- B. Submit certification of test equipment calibration and currency.
- C. Submit certified test reports signed by the Test and Balance Supervisor who performed testing and balancing work. In addition, have report certified by a Registered Professional Engineer who is familiar with testing and balancing work and also with project.
- D. Maintenance Data: Include in maintenance manuals, copies of certified test reports.
- E. Make all other submittals specified under this Section.

1.04 JOB CONDITIONS

- A. Do not proceed with testing, adjusting, and balancing work until work has been completed and is operable. Ensure that there is no latent residual work still to be completed.
- B. Do not proceed until work scheduled for testing, adjusting, and balancing is clean and free from debris, dirt and discarded building materials.

PART 2 - PRODUCTS

2.01 GENERAL

- A. PATCHING MATERIALS: Except as otherwise indicated, use same products as used by original installer for patching holes in insulation, ductwork and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes. In each case, patching shall be completed by original installer.
- B. TEST INSTRUMENTS: Utilize test instruments and equipment for testing and balancing work required, of type, precision, and capacity as recommended in AABC's Manual MN-1 "AABC National Standards".

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Examine installed work and conditions under which testing is to be done to ensure that work has been completed, cleaned and is operable. Do not proceed with testing and balancing work until unsatisfactory conditions have been corrected.
- B. Test, adjust and balance environmental systems and components, as indicated, in accordance with procedures outlined in applicable standards.
- C. Test, adjust and balance system during summer season for air conditioning systems and during winter season for heating systems, including at least period of operation at outside conditions within 5 °F (3 °C) wet bulb temperature of maximum summer design condition, and within 10 °F (6 °C) dry bulb temperature of minimum winter design condition. When seasonal operation does not permit measuring final temperatures, then take final temperature readings when seasonal operation does permit.
- D. Prepare report of test results, including instrumentation calibration reports, in format recommended by applicable standards.
- E. Patch holes in insulation, ductwork and housings, which have been cut or drilled for test purposes.
- F. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers and similar controls and devices, to show final settings at completion of testing and balancing work. Provide markings with paint or other suitable permanent identification materials.
- G. Prepare a report of recommendations for correcting unsatisfactory mechanical performances when system cannot be successfully balanced, including, where necessary, modifications which exceed requirements of the Contract Documents. Submit report to the Engineer for review. Carry out corrective modifications as approved by the Owner.
- H. Retest, adjust, and balance systems subsequent to significant system modifications, and resubmit test results.
- I. Units shall not be operated without air filters. Air filters shall be replaced completely after construction is complete and just prior to air balancing.

3.02 BALANCING PROCEDURES - AIR SYSTEMS

- A. Prior to balancing, the Contractor shall complete construction of air handling system with all components installed, and controls operative and calibrated. Schedule balancing for completion four calendar weeks prior to the completion of the building or the area the air system is servicing.
- B. Before balancing, check alignment of fan and motor sheaves.
- C. Obtain copies of fan pressure volume power characteristics at rated speed. Prepare line drawings of systems with identifying designations for each section of the distribution systems and all outlets.
- D. Set all fans at rated speeds for design volumes and pressure. Simultaneously operate all supply and exhaust systems serving common areas on 100% outside air or full recirculation throughout the balancing period.
- E. Measure flow and pressure in ducts by means of pitot tube and manometer or U-gage having a minimum sensitivity of 0.02 inch of water.
- F. For rectangular ducts, take readings at the center point of equal rectangles with not less than 16 and a maximum of 64 readings. Center distances between rectangular areas shall be not more than 6 inches. Take readings as far downstream of fittings as is practicable up to an equivalent of seven duct diameters.
- G. Measure fan and motor speed with a direct reading tachometer and Strobo Tach. Measure amperage and voltage with direct connected or clamp-on instruments.
- H. Measure flow at air outlets and inlets with velometer in accordance with air outlet manufacturer's instructions.
- I. Submit duplicate copies of final test and balancing measurements, drawings and operating data on fan curves.
- J. Determine actual air volume delivery of all fans by measuring fan performance point on fan pressure volume curve.
 - 1. Measure and record fan performance data on Fan Data Sheet. Plot operating point on fan pressure volume curve. Plot BHP on fan power CFM curve.
 - 2. Measure total system flow in main supply duct by means of pitot tube traverse.
 - 3. If volumes determined by each method described in 1 and 2 above are within 5% of one another, continue test. If, in excess of 5% notify Owner and have fan checked by manufacturer, then repeat pitot tube traverse.
 - 4. If measured volumes are within 5% of one another but at other than design volume, readjust fan speed for design volume delivery.
- K. Test and record static pressure drop across all filters and note the condition of the filter at the time of test.

- L. Test and record entering and leaving db and wb temperature after the air systems have been balanced. Note whether system is on the heating or ventilation cycle.
- M. After all fans have been adjusted, proceed with balancing of systems. Adjust outside quantities by temperature of outside air, recirculated air and mixture on a day in which outside air is at least 30 °F colder than room air. Maximum and minimum air volumes through outdoor, return and exhaust air combination are to be adjusted in conjunction with automatic controls manufactured by means of linkage stops on damper motors.
- N. Balance systems to the following tolerances:
 - 1. Fans: Design volume plus 5%
 - 2. Outlets: Design volume plus 5%
 - 3. Leakage: 3%
- O. Where duct joints present leakage, the contractor shall reseal joints with 3M EC-800 cement, or approved equal.
- P. The following data shall be measured and recorded for all systems after balancing and adjusting to within limits specified herein, for submission of balancing report:
 - 1. Fan Data:
 - a. Manufacturer and model number (where available)
 - b. CFM, design
 - c. CFM, actual
 - d. RPM
 - e. Inlet static pressure
 - f. Discharge static pressure
 - g. Total static pressure
 - h. For purpose of balancing, fan BHP shall be calculated as follows:

Actual Amps X Actual Volts

$$\text{BHP} = \text{Nameplate Amps} \times \text{Nameplate Volts} \times \text{Nameplate HP}$$

- i. If more accurate reading is necessary for resolution of performance data conflict, use a calibrated wattmeter for measuring power.
- 2. Motor Data:
 - a. Manufacturer model number

- b. Horsepower
 - c. Phase
 - d. Frequency
 - e. NEMA code letter
 - f. Rated volts
 - g. Actual volts
 - h. Rated amperes
 - i. Actual amperes
 - j. Calculated operating BHP
 - k. Locked rotor amperes
3. Air Outlet Data:
- a. Schedule showing all air outlet locations and numbers assigned to outlets for purpose of test
 - b. Air outlet manufacturer and model number where available
 - c. Size
 - d. Actual free area
 - e. Manufacturers test factor
 - f. Measured velocity
 - g. CFM, design
 - h. CFM, actual
 - i. CFM, percentage above or below design
4. Outdoor Air Data:
- a. Size and inlet
 - b. Actual free area
 - c. Manufacturers test factor
 - d. Measured velocity
 - e. Outdoor air temperature

- f. Return air temperature
- g. Mixed air temperature with averaged traverse readings

3.03 AUTOMATIC CONTROL DEVICES:

- A. Automatically operated devices that are pertinent to the adjustment of the air system shall be set and adjusted to deliver the required quantities of air. All control work shall be done in collaboration with the representative of the control device manufacturer.

3.04 PATCHING MATERIALS:

- A. Except as otherwise indicated, use the same products as used in the original installation for patching holes in insulation, ductwork and housings which have been cut or drilled for test purposes, including access for test instruments, attaching jigs, and similar purposes. In each case, patching is to be completed by original installer.

3.05 MARKINGS:

- A. Mark equipment settings, including damper control positions, valve indicators, fan speed control levers, and similar controls and devices, to show final settings at completion of testing, adjusting and balancing work. Provide markings with paint or other suitable permanent identification materials.

3.06 RECOMMENDATIONS

- A. Prepare a report of recommendations for correcting unsatisfactory mechanical performance when systems cannot be successfully balanced, including, where necessary, modifications.
- B. Retest, adjust and balance systems subsequent to significant system modifications and resubmit test results.

END OF SECTION

SECTION 23 0700

THERMAL INSULATION FOR MECHANICAL SYSTEMS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide complete HVAC system insulation work for equipment, piping, ductwork and other items where shown on the drawings.
- B. Insulation work shall comply with the requirements of the California Energy Commission.
- C. All insulation that is exposed to weather shall be protected with weather covers of stainless steel or aluminum jacketing. PVC jacketing may be used for this project but shall be subject to approval.
- D. Insulate all piping and ductwork where the fluid or air being transported is 60 degrees or below in temperature and where the fluid or air being transported is 100 degrees or above in temperature. Insulate all hot surfaces above 120 degrees in temperature to prevent personnel burns. Insulate all condensate pans serving HVAC equipment. Insulate all piping, equipment, ducting, valves, etc., which require insulation but come uninsulated from the manufacturer.
- E. All work of this section shall comply with Section 23 00 00 GENERAL REQUIREMENTS - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

PART 2 - PRODUCTS

2.01 GENERAL

- A. The type of insulation and its installation shall be in accordance with this Specification for each service and the application technique shall be as recommended by the manufacturer.
- B. Fire Rating of all insulation shall have a composite (insulation, jacket or facing and adhesive used to adhere facing or jacket to insulation) fire and smoke hazard, as tested by ASTM E84, NFPA 255, and U.L. 723, not to exceed a flame spread of 25 and smoke developed by 50.
 - 1. Accessories such as adhesives, mastics, tapes, and cements shall have the same component ratings as listed.
 - 2. Products shall have integral factory labeling indicating that flame spread and smoke developed ratings do not exceed the above requirements.

2.02 DUCT AND PLENUM INSULATION

A. Linings:

1. Duct linings shall be flexible, coated, fiberglass, 1 inch minimum thickness (2 inch minimum thickness for outdoor ducts), minimum density of 1.5 pounds per cubic foot, maximum thermal conductivity of 0.26 BTUH per sq. ft. degree F/in. at 75 degrees, and minimum noise reduction coefficient of 0.60 for 1 inch thickness.
2. Plenum linings shall be rigid, neoprene coated fiberglass board, 2 inch thickness, minimum density of 3.0 pounds per cubic foot, maximum thermal conductivity of 0.23 btu/h per sq. ft. degree F/in. at 75 degrees, and minimum noise reduction coefficient of 0.90 for 2 inch thickness.
3. Comply with SMACNA Duct Liner Application Standard and manufacturers recommendations and the following:
 - a. Surface adjacent to air flow, including at joints, to be uniformly flat.
 - b. Seal butt joint edges of liner to prevent erosion. Provide sheetmetal end caps to cover liner edges at entering and leaving edges of lined duct sections.
 - c. Meet requirements of Vibration and Seismic Control Specification Section.

B. Duct wrap with Vapor Barrier:

1. Insulation shall be flexible fiberglass wrap with a minimum density of 1 pound per cubic foot, maximum thermal conductivity of 0.27 btu/h per sq. ft. degree F/in. at 75 degrees, 1-1/2" thick minimum thickness, vapor permeance of 0.02 perm and a glass fiber blanket factory laminated to a reinforced foil/draft (FRK) vapor barrier facing with 2" stapling and taping flange on one edge.
2. Comply with manufacturer's recommendations and the following:
 - a. Secure with 4" strips of adhesive, 8" on center.
 - b. Staple edges at 6" on center/
 - c. For rectangular ducts 20" and wider secure to bottom of duct with mechanical fasteners, 12" on center.

C. Rigid Board with Vapor Barrier:

1. Insulation shall be fiberglass board with a minimum density of 6.0 pounds per cubic foot and a maximum conductivity of 0.23 btu/h per sq. ft. degree F/in. at 75 degrees, 1 inch thick minimum thickness.
2. Jacketing shall be factory applied, paint-able, white Kraft outer surface bonded to aluminum foil and reinforced with fiberglass yarn with maximum vapor

permeance of 0.02 perms and a maximum beach puncture of 50 units, or approved equal.

3. Comply with manufacturer's recommendations and the following:
 - a. Apply to exterior of duct impaled on weld pins or Tuft-Weld nylon pins on maximum 12" centers with minimum of two rows per side of duct or approved equal.
 - b. Where used at exterior locations paint with two coats of paint to provide UV protections. Color selection by Owner.

2.03 PIPE INSULATION METAL JACKETING

- A. Provide 0.016 inch thick factory made pipe insulation waterproof aluminum jacketing for all insulated pipe install outside, exposed to weather. Metal jacketing shall include Z-joints at longitudinal seams arranged to prevent water from entering, and use factory applied stainless steel butt straps at transverse joints.
- B. All insulation ends, longitudinal seams, and transverse joints shall be sealed with tape sealant to prevent rainwater from entering the insulating system. At valves, gauges and other hydronic specialties requiring periodic access provide outdoor type removable and re-sealable weatherproof jackets.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

- A. Install insulation products in accordance with the manufacturer's written instruction, Commercial and Industrial Standards, and recognized industry practices to ensure that the insulation serves the intended purpose. Surfaces shall be thoroughly cleaned with all testing successfully completed prior to insulating.
- B. In addition to where specified provide insulation by type and locations as indicated on the Drawings.
- C. After the installation of insulation protect the insulation from moisture and weather damage.
- D. Provide complete weather protection for all outdoor piping insulation.

3.02 INSULATION LOCATIONS

- A. Apply insulation by type and location as follows:
 1. Refrigerant Piping
 - a. Insulate suction lines continuously from outlet of evaporator coil to the suction valve at the compressor
 1. Insulation thickness shall be 1 inch, minimum.

2. Ductwork
 - a. Linings:
 1. Supply and return ducts at the following locations:
 - a) Outside
 - b) Additionally at ducts and plenums as indicated.
 - b. Duct wrap with vapor barrier:
 1. Concealed supply and return ducts and plenums, except that lined ducts need not be wrapped - unless where indicated otherwise.
 - c. Rigid board with vapor barrier:
 1. Exposed supply and return ducts and plenums that are not lined, but only where indicated on the drawings.

3.03 DUCTWORK APPLICATION

- A. After ductwork testing has been completed insulate ductwork as specified. On ducts over 18 inches wide apply weld clips or stick clips to bottom of duct, space 18 inches on center each way, maximum. Seal all longitudinal and transverse seams and all punctures caused by weld clips or stick clips with 2" wide SMACNA labeled, and manufacturer approved, duct tape and mastic.
- B. Provide staples, bands, wires, tape, anchors, corner angles, cements, adhesives, coatings, sealers, protective finishes, and similar compounds as recommended by the insulation manufacturer to the applications indicated.
- C. Insulate all air distribution (grilles, register and diffusers) not factory insulated with fiberglass ductwrap where located in ceilings or spaces not used as return air plenums.
- D. Install insulation materials with smooth, even surfaces.
- E. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.
- F. Extend duct-wrap insulation without interruption through walls, floors, and similar ductwork penetrations, except where otherwise indicated.

3.04 AFTER INSTALLATION CHECK

- A. Visually inspect the complete installation and repair or replace any improperly sealed joints.
- B. Where there is evidence of vapor barrier failure or wet insulation after installation the damaged insulation shall be removed, the surfaces shall be cleaned and dried and the new insulation shall be installed.

END OF SECTION

SECTION 23 2300
REFRIGERANT PIPING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide complete piping, specialties, installation and tests in conformity with applicable codes and authorities having jurisdiction for the Work as required by this Section for HVAC equipment indicated on the Contract Drawings and contained herein.
- B. All work of this section shall comply with;
 - 1. ASME B31.5 Refrigeration Piping and Heat Transfer Components

PART 2 - PRODUCTS

2.01 PIPE

- A. All: Type K seamless copper or Nitrogenized ACR meeting ASTM B68, B75 B88 or ASTM B280.
- B. Fittings: Copper solder joint with silver brazed joints containing no lead.
- C. Supports: B-Line B-3175 clamps or approved equal.

2.02 SIGHT GLASS

- A. Sporlan "See-All" type or approved equal.

2.03 THERMAL EXPANSION VALVES

- A. Sporlan balanced port Q-valve with equalizer and remote bulb sensor or approved equal.

2.04 LIQUID LINE SOLENOID VALVES

- A. Sporlan Series A3, hermetic, direct acting type or approved equal.

2.05 FILTER DRIERS

- A. Sporlan Catch-All sealed drier with molded porous core or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install refrigerant piping and refrigerant containing parts in accordance with ASHRAE Standard 15 and ANSI B31.5. Refrigerant piping shall be brazed with 15 percent silver solder in accordance with AWS A5.8.

1. Install piping as short as possible, with a minimum number of joints, elbow and fittings. Elbows shall be long-radius.
 2. Install piping with adequate clearance between pipe and adjacent walls and hangers to allow for service and inspection. Space piping, including insulation, to provide one inch minimum clearance between adjacent piping or other surfaces. Use pipe sleeves through walls, floors, and ceilings, sized to permit installation of pipes with full thickness insulation. Pipe sleeves to be minimum Schedule 40 PVC and conform to all Division 3 requirements for through-concrete penetrations.
 3. Locate and orient specialties to permit proper operation and access for maintenance of packing, seat and disc. Generally locate valve stems in overhead piping in horizontal position. Provide a union adjacent to one end of all threaded end valves. Control valves usually require reducers to connect to pipe sizes shown on the drawing. Do not support piping from valve or connection.
 4. Use copper tubing in protective conduit when installed below ground. Conduit to be Schedule 40 PVC.
 5. Swab fittings and valves with manufacturer's recommended cleaning fluid to remove oil and other compounds prior to installation.
 6. Install hangers and supports per Specifications and the refrigerant piping manufacturer's recommendations. Hang piping with clamps bolted to 24 gauge sheet metal straps.
- B. Protect refrigerant system during construction against entrance of foreign matter, dirt and moisture; have open ends of piping and connections to compressors, condensers, evaporators and other equipment tightly capped until assembly.
- C. Pass nitrogen gas through the pipe or tubing to prevent oxidation as each joint is brazed. Cap the system with a reusable plug after each brazing operation to retain the nitrogen and prevent entrance of air and moisture.
- D. Long line applications: Follow manufacturers printed instructions for long line applications. Adjust refrigerant charge accordingly as per manufacturer's recommendations. Provide inverted traps at evaporator coils. Provide manufacturer recommended components and accessories for long line applications.

3.02 REFRIGERATION SYSTEM PRESSURE TESTING PROCEDURES

- A. General: After completion of piping installation and prior to initial operation, conduct test on piping system according to ASME B31.5. Furnish materials and equipment required for tests. Perform tests in the presence of Owner. If the test fails, correct defects and perform the test again until it is satisfactorily done and all joints are proved tight. Test shall conform to the following parameters;
1. Every refrigerant-containing parts of the system that is erected on the premises, except compressors, condensers, evaporators, safety devices, pressure gages,

control mechanisms and systems that are factory tested, shall be tested and proved tight after complete installation, and before operation.

2. The high and low side of each system shall be tested and proved tight at not less than the lower of the design pressure or the setting of the pressure relief device protecting the high or low side of the system, respectively, except systems erected on the premises using non-toxic and non-flammable Group A1 refrigerants with copper tubing not exceeding 0.62 in O.D. This may be tested by means of the refrigerant charged into the system at the saturated vapor pressure of the refrigerant at 68 degrees F minimum.
- B. A suitable dry gas such as nitrogen shall be used for pressure testing. The means used to build up test pressure shall have either a pressure-limiting device or pressure-reducing device with a pressure-relief device and a gauge on the outlet side. The pressure relief device shall be set above the test pressure but low enough to prevent permanent deformation of the system components.
 - C. Test pressure shall be at a minimum 110% of design pressure, not exceeding 130% of design pressure per ASME B31.5-2001. Test pressure shall be continuously maintained for 4 hours with corrections made for ambient temperature fluctuations.

3.03 LEAK TESTING

- A. After completion of pressure test in conformance with this section and ASME B31.5, test all new connections and components of system. Conduct test on piping system and components according to ASTM E515 - Standard Method of Testing for Leaks Using Bubble Emission Techniques and Article 10, section V of the ASME Boiler and Pressure Vessel Code or by methods of equal sensitivity.
- B. Furnish materials and equipment required for tests. Perform tests in the presence of Owner. If the test fails, correct defects and perform the pressure test again until it is satisfactorily done and all joints are proved tight. Contractor shall utilize Leak-Tec Thin Film 372G formula for all applicable refrigerant formulas or other approved equal testing medium of equal sensitivity.

3.04 SYSTEM TEST AND CHARGING

- A. System Test and Charging: As recommended by the equipment manufacturer.

END OF SECTION

SECTION 23 3113

METAL DUCTS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide complete materials, equipment, fabrications, installation and tests in conformity with applicable codes and authorities having jurisdiction for the following:
 - 1. Ductwork and Plenums
 - 2. Fasteners and Sealants
 - 3. Access doors
 - 4. All duct accessories

1.02 DEFINITIONS

- A. Seam: locks or weld applied longitudinally to close section of duct. Examples: longitudinal seam, spiral seam.
- B. Joint: abutting connection between duct sections for continuity of air passage. Examples: cross joint, transverse joint, coupling.
- C. Reinforcement: hardware applied to strengthen duct. Examples: girth angles, tie rods, fasteners (not connectors).
- D. Stiffening: folding, bending, cross-breaking or corrugating of sheets to achieve strength through shape. Examples: pocket lock secures joint and is transverse stiffener, with girth angle and/or fasteners applied (not connectors), joint or stiffener is reinforced.
- E. Duct Classifications:
 - 1. Velocity:
 - a. Low: to 2,000 feet per minute.
 - b. High: above 2000 feet per minute.
 - 2. Pressure classification: except as noted:
 - a. Low: to 2 inches water gauge.
 - b. Medium: above 2 inches to max. 6" water gauge.
 - c. High: above 6" water gauge.

1.03 QUALITY ASSURANCE

- A. Entire ductwork system, including materials and installation shall be installed in accordance with NFPA 90A.
- B. Ductwork and components shall be listed as U.L. 181, Class 1 air duct, flame rating not to exceed 25 and smoke rating not to exceed 50.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Duct Connection Systems: Ductmate Industries or approved equal.
- B. Flexible Connections: Ventfabrics or approved equal.
- C. Flexible Ducts: ATCO Rubber Products, Inc. or approved equal.
- D. Duct Sealants: Foster or approved equal.
- E. Flexible Duct Clamps: ATCO Rubber Products or approved equal.
- F. Duct Access Doors: Ventfabrics or approved equal.

2.02 MATERIALS

- A. Sheet Metal:
 - 1. Cold rolled soft steel sheets of lock forming grade, galvanized, meeting ASTM 526-64T.
- B. Fittings:
 - 1. Fittings shall be low loss duct fittings per SMACNA Design for Energy Efficiency and SMACNA Duct Design.
- C. Miscellaneous:
 - 1. Screws and rivets:
 - a. Same material as Sheet metal
 - b. On aluminum sheets provide cadmium plated or stainless steel
 - c. Zinc or cadmium plated permitted on galvanized sheets.
 - d. Minimum screw size shall be No. 10
 - e. Minimum rivet size shall be 4 pound.

2. Duct Sealants:
 - a. Sealing compound shall be Saftee Duct Sealant 32-17 by Foster Products Corporation or approved equal.
 - b. Exposed Ducts shall use Duct-Fas Duct Sealant 32-19 by Foster Products Corporation or approved equal.
 - c. Tape: Shall not be allowed as duct sealant.
 - d. Gaskets:
 1. Continuous, reinforced, inert self-conforming type, 1/8 inch thick, width to match angle connection. 3M Weather sealant Tape 1202.
3. Angles, tie rod and shapes for reinforcing ducts:
 - a. In accordance with SMACNA HVAC Duct Construction Standards.
4. Duct connection System:
 - a. Transverse bolted duct joints, flanges with sealant, permanent non-hardening. Ductmate Industries #25 and #35 or approved equal.

2.03 DUCT ACCESS DOORS

- A. Use insulated or uninsulated to match type of duct. Use hinged types except where sliding or removable types are required.
- B. Size shall be 14" x 14" unless otherwise required larger. Ducts less than 16 inches in longest side shall have size of 14 inches by two inches less than duct width.
- C. Provide at locations indicated on plans.

PART 3 - EXECUTION

3.01 INSTALLATION

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

3.02 DUCTWORK INSTALLATION

- A. General:
 1. Construct with gauges, joints, bracing, reinforcing, and other details per the CMC, AHSRAE, SMACNA and NFPA. Comply with most stringent requirement. Provide ducts with CMC required gauges when penetrating rated construction.
 2. Construct of Galvanized sheet metal.

3. Provide for duct rigidity by either beading at 12 inches on center, maximum, or cross-breaking outward in ducts with positive pressures and cross-breaking inward for ducts having negative pressures. The exception is for ducts exposed to weather which shall cross-break outward on top of duct.
4. Duct dimensions are net, inside, clear. This means that the ducts are to be constructed so that the inside dimensions are no less than those shown on the plans.
5. Frame, trim, caulk and seal all duct penetrations through acoustical walls and partitions.
6. Avoid penetrations of ducts. Provide airtight seals at unavoidable penetrations.
7. No exposed sharp metal shall be allowed.
 - a. All exposed pins, screws and sharp objects shall be covered with hardening silicon.
 - b. All exposed sheet metal edges shall be hemmed with exposed corners rounded smooth.
 - c. Remove all sheet metal fish hooks.
8. Flexible duct connectors:
 - a. Install at connections to fans and air handling units and where indicated on the drawings.
 - b. Install with 2 inches of slack fabric to allow a minimum movement of 1 inch in each direction.
9. Elbows:
 - a. Radius elbows shall have a centerline dimension not less than 1-1/2 duct width.
 - b. Where elbows with turning vanes are shown:
 1. Install per SMACNA HVAC Duct Construction Standards
10. Rectangular duct joints:
 - a. In medium pressure ductwork transverse joints shall be Ductmate or approved equal. In low pressure ductwork transverse joints shall be Ductmate except that slip and drive may be used at contractor's option for ducts less than 24 inches longest side.
 - b. Longitudinal seams shall be Pittsburge type or approved equal.. Snaplock shall not be allowed.
11. Joint sealing shall be by SMACNA approved duct sealant.

- a. At exposed ducts sealant shall be within joints only and not visible from exterior.
 - b. Seal all punched holes and corner cracks.
 - c. Seal all factory fabricated ducts including transverse joints on gored elbows. Seal all end caps.
 - d. Seal all longitudinal duct seams, non-bolted duct joints and connections to air outlets.
12. Horizontal supports shall be one or two piece clamp band straps or as otherwise detailed on the drawings with one support minimum per sections and additional as required to prevent sagging.
13. Vertical supports shall consist of a pedestal at base of vertical or clamp bands with knee bracing or clamp bands with extended ends supported by floor.
14. Duct hangers and supports
- a. Support horizontal ducts with hangers of size and spacing per SMACNA HVAC Duct Construction Standards with attachments to suit structure type and seismic restraints where required.
 1. See Hangers and Supports Section for attachments to structure.
 - b. Horizontal supports:
 1. Install hangers at each change in direction of duct.
 2. Strap hangers:
 - a) Install in pairs on each side of duct, in symmetry, and extend down each side with turn in on bottom of min 2 inches. Metal screw hangers to ducts on bottom, upper and lower sides and no less than 12 inches on center.
 3. Angle hangers:
 - a) Provide angle hangers formed by extended vertical bracing angles or by rods connecting to bottom angles if size or bracing angles conform to SMACNA schedules.
 4. Vertical supports:
 - a) Support vertical ducts at every floor with angles or channels riveted to ducts. Set angles or channels on floor slab or structural steel members.
15. Volume and Dampers shall be provided at locations shown on the drawings.
- a. Volume dampers shall be installed as far away from air outlets as functionally reasonable to avoid noise in the occupied spaces.

- b. Provide also in wyes and spin-ins to outlets whether shown on drawings or not, except:
 - 1. Where dampers are not shown above inaccessible ceilings.
 - 2. To sidewall outlets in exposed ducts (opposed blade dampers in outlets shall be provided).

3.03 MOUNTING AND ALIGNMENT

- A. Install all accessories to prevent air leakage. Install closed bearing ends on all damper ends that penetrate ducts to prevent air leakage. Install additional supports for duct accessories where required.

END OF SECTION

SECTION 23 3713

DIFFUSERS, REGISTERS AND GRILLES

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Provide all air outlets, inlets, grilles, registers and diffusers except where integral with manufactured piece of equipment. Outlets and inlets shall have, as a minimum, throw and noise criteria ratings for each size device as listed in manufacturers current data, rated as required by the following standards:
1. ASHRAE Standard 70 Methods of Testing for Rating the Airflow Performance of Outlets and Inlets.
 2. AMCA Standard 500 Laboratory Methods of Testing dampers for Rating.
 3. ARI 650 Air Outlets and Inlets.
 4. All work of this section shall comply with Section 23 00 00 GENERAL REQUIREMENTS - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

PART 2 - PRODUCTS

2.01 GENERAL

- A. Manufacturer shall examine and approve of application of each item of air distribution.
- B. Noise level at design capabilities: no larger than diffuser selections shown on drawings.
- C. Volume dampers:
1. Do not provide dampers built into air distribution or directly attached to air distribution unless specifically called out on drawings.
 2. Volume damper adjustable from face of diffuser on register except as noted.
 3. Opposed blade.
- D. Air distribution frame shall be suitable for the ceiling construction indicated:
1. Concealed spline type acoustical tile ceiling: flanged for surface mounting.
 2. Lay-in acoustical tile ceiling with inverted tee-bar: lay-in type frame for setting on tee-bars.
 3. Plaster ceilings: flanged for surface mounting, or plaster frames as indicated.
 4. No visible screw allowed on ceiling diffusers or frames.

- E. Outlets may be steel or aluminum unless indicated otherwise.
- F. Match finish color sample as directed by the Owner.
 - 1. Factory- baked white enamel unless otherwise specified.
 - 2. Other special materials and finished, as scheduled on Drawings.

2.02 STYLES

- A. Ceiling Diffusers:
 - 1. Face size per plans
 - 2. Architectural square panel.
 - 3. Tee-bar or sheetrock mounting frame as required for application.
 - 4. Throw pattern per plan.
 - 5. Paint interior of duct black.
- B. Duct mounted supply:
 - 1. Face size per plans
 - 2. Paint interior of duct black.
 - 3. Deflection as scheduled.
- C. Wall mounted return:
 - 1. Face size per plans
 - 2. Paint interior of duct black.
 - 3. Deflection as scheduled.
- D. Ceiling Exhausts:
 - 1. Face size per plans
 - 2. Tee-bar or sheetrock mounting frame as required for application.
 - 3. Paint interior of duct black.

2.03 SCREENED OPENINGS

- A. Mesh:
 - 1. 3/4 inch square pattern.
 - 2. No. 16 galvanized wire.

- 3. Interwoven.
- 4. Welder or secured to frame.
- B. Frames: optional:
 - 1. 1 inch by 1 inch by 1/8 inch galvanized steel angles.
 - a. Continuous around perimeter of screen

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install air distribution in accordance with manufacturers written installation instructions.
- B. Return and exhaust grilles: install with blades oriented to preven sight through outlets.
- C. Air distribution cans visible through grilles painted flat black.
- D. Transfer grilles:
 - 1. See drawings.
 - 2. Wall installations, unless otherwise indicated, provide two grilles:
 - a. One on each side of wall, except where open to return air plenums.
 - b. Connecting sheet metal collar with 18" elevation offset for light and sound attenuation.
- E. Provide duct screens at termination ducts as indicated.
- F. Verify mounting, direction and adjustments are installed per the drawings.

3.02 MOUNTING AND ALIGNMENT

- A. All air distribution shall be secured to building:
 - 1. Ceiling distribution shall be secured to prevent falling from ceiling during construction or service with minimum of two 16-gauge ceiling wires, two 22-gauge by 1 inch galvanized sheet metal strap or two #10 sheet metal screws.
 - 2. Comply with CBC.
- B. Mount directional grilles as shown on drawings.
- C. Adjust distribution throw patterns:
 - 1. As shown on drawings.

2. For double deflection grilles, adjust rear blades horizontal and front blades in 45 degree pattern at each end gradually rotating to be almost straight at blades in center of distribution.
3. Prior to test and balance.

END OF SECTION

SECTION 23 8000
DECENTRALIZED HVAC EQUIPMENT

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This Section covers the furnishing and installation of Heating, Ventilating and Air Conditioning (HVAC) equipment as indicated on the contract drawings, schedules and as specified herein.

1. HEAT PUMP
2. AIR HANDLING UNIT
3. CENTRIFUGAL EXHAUST FAN

- B. All work of this section shall comply with Section 23 00 00 GENERAL REQUIREMENTS - HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

1.02 QUALITY ASSURANCE

- A. Unit will be rated in accordance with ARI Standard 240.
- B. Unit will be certified for capacity and efficiency, and listed in the ARI directory.
- C. Unit Construction will comply with ANSI/ASHRAE and with NEC.
- D. Units will be constructed in accordance with UL standards and will carry the UL label of approval. Unit will have C-UL approval.
- E. Unit cabinet will be capable of withstanding Federal Test Method Standard No. 141 (Method 6061) 500-hr salt spray test.
- F. Air-cooled condenser coils are pressure tested and the outdoor units are leak tested.
- G. Unit constructed in ISO9001 approved facility.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Unit will be shipped as single package only and is stored and handled per unit manufacturer's recommendations.

PART 2 - PRODUCTS

2.01 HEAT PUMP

- B. Factory assembled, single piece, air-cooled heat pump unit. Contained within the unit enclosure is all factory wiring, piping, controls, compressor, refrigerant charge R-410A, and special features required to prior field start-up.

- C. Unit cabinet will be constructed of galvanized steel, bonderized, and coated with powder coat paint.
- D. Condenser fan will be direct-drive propeller type, forward step blade, discharging air upward.
- E. Condenser fan motors will be electronic ECM motors that provide multi-speed operation with enhanced low-speed efficiencies and sound levels.
- F. Shafts will be corrosion resistant.
- G. Forward swept fan blades will be statically and dynamically balanced.
- H. Condenser fan openings will be equipped with coated steel wire safety guards.
- I. Compressor will be hermetically sealed. Compressor will be mounted on rubber vibration isolators. Compressor will be covered with a sound absorbing blanket.
- J. Condenser coil will be air cooled. Coil will be constructed of aluminum fins mechanically bonded to copper tubes which are then cleaned, dehydrated and sealed.
- K. Refrigeration circuit components will include liquid-line back-seating shutoff valve with sweat connections, system charge of R410A refrigerant, POE compressor oil, accumulator, and reversing valve. Unit will be equipped with high pressure switch, loss of charge switch, and filter drier for refrigerant.
- L. Refer to section of this literature identifying accessories and descriptions for specific features and available enhancements.

2.02 FAN COIL

- A. Units shall be factory assembled, direct expansion coil type tested before shipment to the job site. Capacities shall be as indicated on the Contract Drawings and shall be constructed for heating and cooling.
- B. Unit cabinets shall be constructed of 22 gauge galvanized steel and furnished with an epoxy high heat, baked enamel coating. The unit casing shall have 1" thick foil faced R-4.2 high density insulation to minimize heat loss.
- C. The coil shall be of the direct expansion type with internally grooved copper tubes and exterior lanced sine wave aluminum fins. The coil shall be prepped for installation of a thermal expansion valve (TXV).
- D. For the blower panel a switch shall be provided to shut down unit power whenever the panel is opened.
- E. Unit shall contain a centrifugal blower, balanced statically and dynamically, for the indicated capacities as shown in the Schedules. The blower compartment shall have 1/2" thick acoustical insulation for quiet operation.

- F. Unit shall have integral filter rack with insulated filter door. Unit shall not be run without a 30% filter in place and at completion of job, the construction filter shall be replaced with a new 30% filter.
- G. Fan motor shall have internal overload protection, be totally enclosed and provided with vibration isolation.
- H. A factory installed junction box shall be provided for all power connections. A 24-volt control transformer, high limit and fan time run delay relay shall be provided. The fan time delay shall delay fan stop to allow removal of residual heat from the DX coil.
- I. Unit shall be provided with auxiliary two-stage electric resistance heat strips of capacities as scheduled on the drawings.
- J. Unit shall be the same manufacturer as the associated heat pump and shall be intended and designed to be paired together.

2.03 CENTRIFUGAL EXHAUST FAN

- A. Unit shall be factory assembled, consisting of a single centrifugal direct drive exhaust fan. Contained within the unit shall be all factory wiring, components and special options, where scheduled.
- B. The fan housing shall be constructed of heavy gauge galvanized steel. The housing interior shall be lined with ½" thick acoustical insulation. The outlet duct collar shall include a spring loaded aluminum backdraft damper. Outlet shall be adaptable for horizontal or vertical discharge.
 - 1. Inlet grille shall be constructed of aluminum with a white enamel finish.
- C. The access for wiring shall be external. The motor disconnect shall be internal and of the plug in type. The motor shall be matched to the fan load and shall be furnished at the specified voltage and phase. Unit power shall enter the casing at one point and consist of a final single point connection.
- D. The motor shall be mounted on vibration isolators. The fan wheel(s) shall be of the forward curved centrifugal type and shall be dynamically balanced.
- E. All fan units shall bear the AMCA Certified Ratings Seal for sound and air performance and shall be U.L. Listed.
- F. Each fan shall bear a permanently affixed manufacturer's engraved metal nameplate containing the model number and individual serial number for future identification.

PART 3 – EXECUTION

3.01 GENERAL INSTALLATION

- A. Coordinate equipment installation with work at walls, ceilings and various trades as necessary for proper interfacing and installation.

- B. Ensure that all equipment is wired properly, with correct motor rotation and positive electrical grounding.
- C. Verify that adequate clearance around equipment and adjacent walls, windows and surfaces is available to permit proper maintenance and repairs.
- D. Equipment shall be installed in strict accordance with manufacturer's printed literature.

END OF SECTION

DIVISION 26
ELECTRICAL

**SECTION 260500
COMMON WORK RESULTS FOR ELECTRICAL**

PART 1 - GENERAL**1.1 SCOPE OF WORK**

- A. Work includes, but is not limited to the following:
1. Electrical and telephone services provisions and coordination.
 2. Distribution feeders, branch circuit wiring, wiring devices and connections to all equipment requiring electrical service.
 3. Telephone/Data provisions.
 4. Security system provisions.
 5. Coordination with Vendor's associated with the construction of the project.
 6. All necessary incidental work not specifically mentioned herein or shown on the drawings shall be provided for complete and functioning systems.
- B. Work specified in Division 26, 27, 28:
1. Section 260519: Low Voltage Electrical Power Conductors and Cables
 2. Section 260526: Grounding and Bonding for Electrical Systems
 3. Section 260533: Raceway and Boxes
 4. Section 260553: Identification for Electrical Systems
 5. Section 262413: Switchboards
 6. Section 262416: 600-Volt Rated Panelboards & Circuit Breakers
 7. Section 262726: Wiring Devices
 8. Section 265000: Lighting
 9. Section 271343: Telecommunication Infrastructure
- C. Work specified in other divisions:
1. Section 337173: Electric Utility Services
 2. Division 9 Section "Finishes"
 3. Division 11 Section "Equipment".

1.2 INCORPORATED DOCUMENTS

- A. Provide equipment and materials which conform to, and perform the installation thereof in accordance with the following codes and industry standards.
1. National Electrical Code (NEC).
 2. Uniform Building Code (UBC)
 3. Underwriters' Laboratories, Inc. (UL).
 4. NFPA 101, Life Safety Code.

5. Titles 8, 19 and 24 of the California Code of Regulations (CCR).
6. American National Standards Institute (ANSI).
7. California State Fire Marshal (CSFM).
8. National Electrical Manufacturers' Association (NEMA).
9. Institute of Electrical and Electronics Engineers (IEEE).
 - a. National Electrical Safety Code (NESC).
 - i. Electrical Safety Orders.
 - ii. Other applicable local codes and ordinances.
10. All local, State and Municipal Codes and Ordinances.

- B. Where the authority-having-jurisdiction makes an interpretation or decision, as is their prerogative in accordance with the Code, such direction shall be considered a part of these Contract Documents as if contained herein. With respect to completing the intent of the Contract Documents, comply with any and all requirements of the authority-having-jurisdiction and utility company field inspectors, at no additional cost.

1.3 CONDITIONS AT SITE

- A. Lines of other services that are damaged as a result of this work shall promptly be repaired complete to the satisfaction of the Owner at no additional expense to the Owner.

1.4 REVIEW OF CONTRACT DOCUMENTS

- A. Examine all relevant Contract Documents including Drawings, Specifications, and Shop Drawings in order to become acquainted with the Work of other installers whose activities will adjoin or be affected by the Electrical Work.

1.5 PERMITS, LICENSES, AND FEES

- A. Procure and pay for all permits, licenses and fees that are required to carry out and complete the Electrical Work.
- B. Pay for building department or utility company imposed inspection fees.
- C. Pay utility company charges for normal or after hours shutdowns, service calls, repairs, and cable locating that are directly related to the installation of the Electrical Work.

1.6 WORKING SPACE

- A. Maintain adequate work space around, and access to, electrical and mechanical equipment in strict accordance with the applicable Codes. Verify during the course of

construction that sufficient space will be available for the installation equipment, fixtures, etc.

1.7 MATERIALS

- A. Electrical materials and equipment shall bear the label of, or be listed by, the Underwriters' Laboratories (UL) wherever standards have been established and label service is regularly furnished by that agency. Comply with the installation and application requirements of UL as documented in their published directories.
- B. Maintain uniformity throughout the Project by making use of only one make or brand of material for each material used.
- C. If requested by the Owner, submit samples of materials and equipment for approval prior to installation.

1.8 ELECTRICAL SUBMITTALS

- A. Submit electrical shop drawings and manufacturer's cut sheets for equipment and materials as noted in each Division 26 specification section. Bind the submittals as complete volumes according to classification of equipment such as power, lighting, fire alarm, etc. When possible, make all electrical submittals at the same time.
- B. Arrange panelboard submittals to show bussing, circuit numbering, and branch circuit protective devices similar the schedules on the Drawings. Show elevations of switchboards, motor control centers, and distribution centers indicating the layout of devices, meters, handles, etc. Provide device ratings, circuit numbers, and nameplate descriptions in table form. Include terminal strip mounting arrangements on elevations for terminal cabinets.

1.9 DRAWINGS AND SPECIFICATIONS

- A. Because the Electrical Drawings may be distorted for clarity of representation, it may be necessary to field verify the exact location of electrical outlets, lights, switches, etc. in order to conform to the Architectural elements. The Owner reserves the right to make minor changes to the locations of equipment, devices, and wiring shown on the Drawings, at no additional cost, providing the changes are ordered before the rough-in of conduit, boxes, or related items is completed, and no extra material are required.
- B. For dimensional and locational purposes, the Architectural Drawings take precedence over the Electrical Drawings. Determine the appropriate location of lighting fixtures, outlets, wall-mounted devices, etc. by studying the reflected ceiling plans, building sections, and interior elevations. Report conflicting conditions to the Owner before rough-in for adjustments to the locations.

- C. Conduit quantities, sizes, termination points, and wiring are depicted on the Electrical Drawings. However, not all conduit bends or routing details are necessarily shown. Route conduit so as to conform to the structural conditions, avoid obstructing other trades, maintain space restrictions and keep circulation areas and access openings clear.
- D. Should the Contractor perceive that the Drawings and Specifications do not sufficiently define the intent of electrical work, contact the Owner for clarification or additional information. The absence of such contact will be considered as evidence of understanding, on the part of the Contractor, of the intended Electrical Work and the required installation thereof.

1.10 WORKMANSHIP

- A. Constantly supervise the work personally or through an authorized and competent representative. Keep the same foreman or supervisor on the project from commencement through completion.
- B. Perform the Electrical work using the highest caliber craftsman available. Workmanship shall be first class and of the best quality available to ensure a long and trouble free service life.

1.11 COOPERATION AND COORDINATION

- A. Consult with the other installers and trades in coordinating the Work so as to avoid conflicts, omissions and delays. Cooperate with other contractors, third parties, and the Owner in order to expedite the project and provide for the proper execution of the building as a whole. Work performed without regard to other trades or the overall project scheme, may necessarily be required to be moved at the Contractor's expense.

1.12 MANUFACTURER'S DIRECTIONS

- A. Adhere to the manufacturer's directions regarding the proper installation and configuration of electrical equipment where those directions cover points not included in these Drawings and Specifications.

1.13 PROTECTION AND STORAGE

- A. Use all means necessary to protect the materials of this Division before, during, and after installation and to protect the work and materials of all trades.
- B. Deliver electrical materials to the site new, and in unbroken packages. Provide for the temporary storage of such materials, equipment, and construction tools in accordance with the Contract Documents and in strict accordance with approved manufacturers'

recommendations. Protect electrical equipment and materials during transit, storage and handling to prevent damage, soiling and deterioration.

- C. During shipping storage and handling protect electrical materials from damage of any type including dust, water, over-spray, and temperature.
- D. Avoid damage during construction to the work and materials of other trades as well as the electrical work and material. Repair or replace, at the Contractor's expense, defective or damaged items such that the entire Work is completed in a condition satisfactory to the Owner.
- E. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Owner and at no additional cost to the Owner.
- F. This Contractor shall personally, or through an authorized representative, check all materials upon receipt at jobsite for conformance with approved shop drawings and/or plans and specifications.

1.14 EXCAVATION, CUTTING, PATCHING, AND REPAIR

- A. Perform excavation and backfill required for the installation of electrical sub-structures. Restore grounds, walkways, roadways, curbs, walls, and other existing underground facilities to their original condition.
- B. Cut, core-drill, and demolish existing walls, floors, ceilings and other building surfaces as required for the installation of Electrical Work. Obtain the approval of the Owner prior to performing any operation which may affect any structural elements of the building.
- C. Patch and repair wood, plaster, tile, or concrete surfaces which have been damaged by the installation of the Electrical Work so that the finished surface matches the surrounding conditions.

1.15 SEISMIC RESTRAINTS

- A. General: Provide seismic restraints per applicable code and as specified or indicated, and to meet the requirements of Seismic Zone 4. Design restraints to prevent permanent displacement in any direction caused by lateral motion, overturning, or uplift.
- B. Requirements:
 - 1. Seismic Force Criteria: 0.5 g.
 - 2. Restraint: Required for following:
 - a. Switchboard
 - b. Distribution Panels

- c. Automatic Transfer Switches
 - d. Lighting fixtures
 - e. Fire Alarm related enclosures and devices
 - f. UPS and Batteries
 - g. Engine Generator
 - h. PDU's
 - i. Transformers
 - j. Cable Tray
- C. If restraint is required, design equipment to withstand the required seismic force criteria, including its internal design, components and frame, and suitable structural elements to which restraining attachments may be fastened.
- D. Rigidly Supported Equipment: Restrain per SMACNA where applicable; where not applicable restrain similarly and as recommended by equipment manufacturer.
- E. Design:
1. Prepare designs, including arrangements, sizes and model numbers indicated or referenced in applicable standards.
 2. Where designs are neither indicated nor referenced, prepare such designs, together with supporting calculations prepared by a structural registered in State of California.
 3. For switchboards, automatic transfer switch, generator, battery racks, UPS, PDU's, cable tray, and other equipment weighing 400 pounds or greater, the Contractor shall submit seismic calculations carried out by a structural engineers registered in the State of California.

1.16 FLASHING, WATERPROOFING AND SEALING

- A. In general, install in an approved watertight manner, Electrical Work which pierces exterior walls or waterproofing membranes. Flash and counter-flash roof and wall penetrations in a manner described in other applicable sections of this Specification and as approved by the Owner.
- B. Fit conduits passing through finished walls with steel escutcheon plates of brass, chrome, or painted finish as directed by the Owner. Grout penetrations of floor slabs, concrete or masonry walls with an approved grout or silicone elastomeric caulk.

1.17 EARTHQUAKE RESISTANT INSTALLATION/FASTENING:

- A. All electrical equipment and raceways shall be anchored to withstand forces generated by earthquake motions. As a minimum, equipment and equipment frames shall be designed to withstand a force of 25% of the weight of the equipment and frame acting at its center of gravity. Anchorage of the equipment and/or frame to the structure shall be for a force of 50% gravity also acting at the center of gravity.

- B. For Main Switchboard and Cable Tray, the above values shall be doubled. Design stresses in either case may be increased 1/3 over normal allowable stresses but never beyond yield.

1.18 CLEANING, ADJUSTING, AND TOUCH-UP

- A. Remove on a daily basis electrical debris, scraps, packaging material and other rubbish. Dispose of such items off-site in an approved manner. Maintain the site free from physical hazards at all times.
- B. After installation, completely clean electrical equipment, fixtures, and materials of excess paint, over-spray, plaster, cement, insulating products, and other foreign matter. Leave the Electrical Work in a clean, finished, dry, level, like new condition.
- C. Touch-up paint scratches and scuffs on electrical equipment and lighting fixtures with paint recommended by the manufacturer and matching the original item finish.
- D. Make setting, adjustments, and programming in accordance with the manufactures' operating and installation instructions. Settings and program variables will be issued by the Owner prior to commissioning of the electrical system.

1.19 AS-BUILT DRAWINGS

- A. Show on the record drawings deviations from the Electrical Drawings, locations of underground conduits and pull-boxes, and concealed equipment which is not readily apparent. Dimension the record drawings using permanent, readily identified benchmarks such as column or wall lines.

1.20 SCHEDULING/SEQUENCING

- A. Place orders for all equipment in time to prevent any delay in construction schedule or completion of project. If any materials or equipment are not ordered in time, additional charges made by equipment manufacturers to complete their equipment in time to meet the construction schedule, together with any special handling charges, shall be borne by this Contractor.

1.21 INSPECTIONS AND TESTING

- A. Perform tests of the electrical system during the course of the project and at project completion to ensure safe and proper function in accordance with the Contract Documents, manufacturers' recommendations, and applicable codes. Provide complete documentation of all test results to the Owner prior to project completion. Testing shall include, but not necessarily be limited to, the following:

1. Test for short circuits, open circuits, neutral leakage, and improper grounds on feeders and branch circuits. Perform this test with mains in disconnect from feeders, branch circuits closed, fixtures and devices permanently connected, lamps removed from sockets and wall switches closed.
 2. Provide insulation resistance tests of all phase and neutral circuit conductors using a 500 Volt Megger for circuits of 240 Volt rating and below, and a 1000 Volt Megger for circuits of 277 volts and above. Minimum acceptable insulation resistance is one (1) megohm.
 3. Perform a ground resistance test per grounding specification.
 4. Test for proper phase-to-phase and phase-to-neutral operating voltage on the main service and on each separately derived system. Perform this test at full load and at no load. With all circuits at full operating conditions, test the phase and neutral load currents using a clamp-on ammeter.
 5. When series rated circuit breakers are used, provide a letter from the manufacturer of the equipment confirming that U.L. series rating exists for all protective devices. State the available fault current from the Utility Company and indicate that the overcurrent devices exceed the available fault current at the respective point of protection.
 6. Seismic restraint calculations for equipment, by a registered structural, per Paragraph 1.15 of this Section.
 7. Tests as required by other sections of these Specifications.
 8. Tests as prescribed by individual equipment manufacturers whether or not described in these Specifications.
- B. At project completion, demonstrate to the Owner that the entire installation is complete, in proper operation condition and that the Contract has been properly and fully executed. Activate all circuits, lights, devices, and controls under full load and normal operating conditions. Identify faulty items and immediately replace or repair defective equipment, workmanship, and materials to like new condition and retest in the presence of the Owner.
- C. At the completion of the Project, demonstrate to the Owner that the entire electrical system is free from short circuits and improper grounds, or upon request of the Owner anytime, make necessary tests under the observation of the Owner which will ensure that electrical equipment, materials and installation methods are as specified.

1.22 IDENTIFICATION

- A. Each branch circuit of panelboards to have a permanently fixed number with one word directory, mounted under celluloid on inside of cabinet door, showing circuit numbers and typewritten description of equipment supplied by breakers, including location.
- B. Provide label on all motors: "Caution. Automatic equipment .May start at any time."
- C. Provide identification of all pull boxes, junction boxes, and conduit stub-ups on the project as outlined below:

1. For Power Feeders:
 - a. Stencil cover with identifying circuit number.
 - b. Lettering 1" high.
 - c. Color of lettering black.
 - d. Place lettering on cover in neat manner; run parallel to long sides of box.

2. For branch circuits, grounding, communication, signal, and control systems boxes and blank conduit stub-outs. Paint inside back of each j-box, front of each cover, and ends of each blank conduit stub-out with identifying system color as listed below:

<u>System</u>	<u>Color</u>
120/208 volt	Blue
Telephone/Data	Grey
Ground system	Green
Clock	Brown
Fire Alarm	Red
Audio/Visual	Yellow
Security	White
Low voltage lighting control	Orange/White

1.23 PERMITS AND INSPECTIONS

- A. This Contractor shall obtain and pay for all required permits and arrange for all inspections required.

- B. Do not allow or cause any of the work to be covered or enclosed until it has been tested and/or inspected.

END OF SECTION

**SECTION 260519
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 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.

1.4 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. 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. Wire and Cable (600V)
 - a. American Wire Company
 - b. Belden
 - c. General Wire and Cable Corporation
 - d. Okonite Company

- e. Rome Cable Corporation
 - f. Cerrowire
 - g. American Insulated Wire
 - h. AFC Cable Systems
 - i. Essex
 - j. Simplex Wire and Cable Company
 - k. Or approved equal
2. Solderless Lugs and Grounding Connections
- a. Burndy Engineering Company, Inc.
 - b. O.Z. Gedney Company, Inc.
 - c. Penn Union Electric Corporation
 - d. Thomas and Betts Company, Inc.
 - e. Or approved equal

2.2 CONDUCTORS AND CABLES

- A. Copper Conductors: Comply with NEMA WC 70.
- B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN and XHHW.

2.3 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.
 - 3. O-Z/Gedney; EGS Electrical Group LLC.
 - 4. 3M; Electrical Products Division.
 - 5. Tyco Electronics Corp.
 - 6. Or 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: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- C. 600-volt class, insulation color coded, minimum No. 12 AWG for branch circuits, No. 14 AWG for control circuits.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN-THWN, single conductors in raceway.
- B. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- C. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.
- D. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- E. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.
- F. Class 1 Control Circuits: Type THHN-THWN, in raceway.
- G. Class 2 Control Circuits: Type THHN-THWN, in raceway.
- H. Insulation type:
 - 1. Standard locations: #12 to #1 AWG: THWN for wet locations and THHN for dry locations. #1/0 through #4/0 AWG: XHHW (55 Mils). 250MCM and larger: XHHW (65 Mils). All wire sizes used shall be based on a 75 degree insulation rating, unless specifically used with 90 degree rated breakers and devices.
 - 2. High temperature and non-standard locations: Provide wire type and insulation category suitable for area of use as defined in NEC table 310-13.

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. Support cables according to NEC requirements.
- E. 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.
- F. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- G. Install all wiring (low voltage and line voltage) in conduit unless noted otherwise in the drawings, but do not pull into conduit until plastering and taping have been completed and conduits and outlets have been thoroughly cleaned and swabbed as necessary to remove water and debris.
- H. Approximately balance branch circuits about the neutral conductors in panels.
- I. Connections to devices from "thru-feed" branch circuit conductors to be made with pigtails, with no interruption of the branch circuit conductors.
- J. Neutral conductor identified by white outer braid, with different tracers of "EZ" numbering tags used where more than one neutral conductor is contained in a single raceway.
- K. Neatly arrange and "marlin" wires in panels and distribution panelboards with "T and B Ty-rap" or approved equal plastic type strapping.
- L. All wire and cable shall bear the Underwriters' Label, brought to the job in unbroken packages; wire color-coded as follows:

Voltage	Phasing	A	B	C	N
120/208	3PH-4W	Black	Red	Blue	White
208	3PH-3W	Black	Red	Blue	--
277/480	3PH-4W	Brown	Orange	Yellow	White
480	3PH-3W	Brown	Orange	Yellow	--
120/240	3PH-4W	Black	Red	Blue	White
240	3PH-3W	Black	Red	Blue	--

- M. The equipment grounding conductor shall be insulated copper; where it is insulated, the insulation shall be colored green.
- N. Label each wire of each electrical system in each pull box, junction box, outlet box, terminal cabinet, and panelboard in which it appears with "EZ" numbering tags indicating the connected circuit numbers.

- O. Properly identify the "high leg" of 4-wire delta connected systems (in each accessible location) as required by NEC 215-8 and 230-56.

3.4 INSTALLATION OF DISCONNECTS, CONNECTORS, AND LUGS

- A. Equipment Disconnects: All disconnects shall be located to allow proper code required clearance in each area. Locations shown on drawings are diagrammatic only. The contractor shall coordinate exact locations in the field (with other trades) prior to rough-in to ensure proper clearances.
 - 1. Motor Disconnect Switches and Safety Switches: General Electric Company Heavy Duty Type "THD", cover interlocked with operating handle so that cover cannot be opened with switch in closed position and switch cannot be closed with cover in open position. 240V or 480V rating, single or multi-pole as required or as noted on drawings, in Nema 1 enclosure indoors or Nema 3R enclosure outdoors unless otherwise noted. Provide dual element motor circuit fuses sized as recommended by equipment manufacturer (for final equipment actually installed).
 - 2. Code required disconnects: Provide a local disconnect in addition to the branch circuit protection device for all equipment as required by code (whether shown or not). Disconnects shall consist of a motor rated switch (or disconnect) for all motor loads less than 3/4HP or other suitable disconnect sized to match branch circuit conductors and load current of equipment, with number of poles as required.
- B. Lugs and Connectors: Thomas and Betts "lock-tite" or approved equal, for No. 4 and larger wire; "Scotchlock" or approved equal fixed spring type with insulator for No. 6 and smaller wire.
 - 1. All splices made up with wire nut connectors shall be solidly twisted together with electricians pliers before connector is installed to ensure a proper connection in the event of wire nut failure. No exceptions.
 - 2. Connectors listed or labeled for "no wire twisting required" are not an acceptable substitute for actual wire twisting.
 - 3. Utilize porcelain type connectors in all high temperature environments (above 105 degrees Celsius).
- C. Splice Insulation: "Scotch" or approved equal electrical tape with vinyl plastic backing or rubber tape with protective friction tape for interior work.
 - 1. Provide watertight cast splices for all conductors in site pull boxes or wet locations.

3.5 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies.

3.6 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly.
- B. Fire stopping: 3M Fire Protection Products or approved equal.
 - 1. Fire-rated and smoke barrier construction: Maintain barrier and structural floor fire and smoke resistance ratings including resistance to cold smoke at all penetrations, connections with other surfaces or types of construction, at separations required to permit building movement and sound vibration absorption, and at other construction gaps.
 - 2. Systems or devices listed in the UL Fire Resistance Directory under categories XHCR and XHEZ may be used, providing that it conforms to the construction type, penetration type, annular space requirements and fire rating involved in each separate instance, and that the system be symmetrical for wall penetrations. Systems or devices must be asbestos free.

3.7 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
- 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.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- C. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

**SECTION 260526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Grounding systems and equipment.

1.2 ACTION SUBMITTALS

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

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

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 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.
 - 3. Tinned Conductors: ASTM B 33.
 - 4. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG conductor, 1/4 inch in diameter.
 - 5. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 6. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

7. Tinned Bonding Jumper: Tinned-copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.2 CONNECTORS

- A. Listed and labeled by an NRTL 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, 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.

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, No. 4/0 AWG minimum. Bury at least 24 inches below grade.
- C. Isolated Grounding Conductors: Green-colored insulation with continuous yellow stripe. 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. Feeders and branch circuits.
 2. Lighting circuits.
 3. Receptacle circuits.
 4. Single-phase motor and appliance branch circuits.
 5. Three-phase motor and appliance branch circuits.
 6. Flexible raceway runs.
 7. Armored and metal-clad cable runs.
 8. Busway Supply Circuits: Install insulated equipment grounding conductor from grounding bus in the switchgear, switchboard, or distribution panel to equipment grounding bar terminal on busway.
 9. 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. Signal and Communication Equipment: In addition to grounding and bonding required by NFPA 70, provide a separate grounding system complying with requirements in TIA/ATIS J-STD-607-A.
1. For telephone, alarm, voice and data, and other communication equipment, provide No. 4 AWG minimum insulated grounding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location.
 2. Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-4-by-12-inch grounding bus.
 3. Terminal Cabinets: Terminate grounding conductor on cabinet grounding terminal.

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. Install ground wires in rigid conduit.
- C. All grounding electrode conductor connections "thermite" or "cad-weld" welded.
- D. Use approved pressure type solderless connector or use fusion welding for all connections to and bonding of grounding electrode system. All connections shall be visible, readily accessible for testing purposes. Grounding electrode conductor between the grounding electrode and service equipment.
- E. Terminate grounding conduits at equipment with ground bushing, with ground wire connected through grounding lug on bushing.
- F. Provide No. 12 stranded (green) THHN conductor from outlet box to ground screw of every receptacle.

- G. Ground all isolated sections of metallic raceways.
- H. Provide #12 minimum stranded (green) THHN conductor sized per NEC, or as noted, connected continuously throughout branch circuit for all circuits, bonded to panel ground bus, and to all electrical devices and equipment enclosures
- I. Bonding Straps and 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 bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

3.4 LABELING

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" The label or its text shall be green.
- B. Install labels at the telecommunications bonding conductor and grounding equalizer and at the grounding electrode conductor where exposed.
 - 1. Label Text: "If this connector or cable is loose or if it must be removed for any reason, notify the facility manager."

3.5 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. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. 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. Make tests at ground rods before any conductors are connected.
 - 4. Test system using the three-point fall of potential method only. Record results and submit to Owner for approval.
- B. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and less: 10 ohms.

2. Power and Lighting Equipment or System with Capacity of 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: 3 ohms.
- C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Owner promptly and include recommendations to reduce ground resistance.

END OF SECTION

**SECTION 260533
RACEWAYS AND BOXES**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes conduit and tubing, surface and buried raceways, wireways, outlet boxes, pull boxes, junction boxes, hand holes and concrete manholes.

1.2 RELATED SECTIONS

- A. Section 260500: Common Work Results for Electrical
- B. Section 260519: Low Voltage Power Conductors and Cables
- C. Section 260526: Grounding and Bonding for Electrical Systems
- D. Section 260553: Identification for Electrical Systems

1.3 REFERENCES - CODES AND STANDARDS

- A. ANSI C80.1 Rigid Steel Conduit, Zinc Coated.
- B. ANSI C80.3 Electrical Metallic Tubing, Zinc Coated.
- C. ANSI C80.6 American National Standard for Electrical Intermediate Metal Conduit.
- D. ASTM A 48 Standard Specification for Grey Iron Castings.
- E. NECA (National Electrical Contractor's Association) - "Standard of Installation."
- F. NEMA FB 1 (National Electrical Manufacturers Association) - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.
- G. NEMA OS 1 (National Electrical Manufacturers Association) - Sheet-steel Outlet Boxes, Device Boxes, Covers, and Box Supports.
- H. NEMA OS 2 (National Electrical Manufacturers Association) - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports.
- I. NEMA RN 1 (National Electrical Manufacturers Association) - Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
- J. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit.

- K. NEMA TC 3 (National Electrical Manufacturers Association) – PVC Fittings for Use with Rigid PVC Conduit and Tubing.
- L. NEMA TC 6 - Non-Metallic Conduit.
- M. NEMA 250 (National Electrical Manufacturers Association) – Enclosures for Electrical Equipment (1,000 Volts Maximum).
- N. NFPA 70 National Electrical Code (NEC).
- O. UL 1 Flexible Metal Conduit
- P. UL 6 Rigid Metal Conduit
- Q. UL 514B Conduit, Tubing and Cable Fittings.
- R. UL 651 Rigid Non-Metallic Conduit
- S. UL 797 Electrical Metallic Tubing
- T. UL 1242 Intermediate Metal Conduit

1.4 SYSTEM DESCRIPTION

- A. Raceway, boxes and manholes located as indicated on drawings and at other locations required for splices, taps, wire pulling, equipment connections, and compliance with regulatory requirements. Raceway, boxes and manholes are shown in approximate locations unless dimensioned. Provide raceway to complete wiring system.
- B. Underground more than 5 feet (1,500 mm) outside foundation wall: Provide Schedule 40 non-metallic conduit.
- C. Underground within 5 feet from foundation wall: Provide rigid steel or Schedule 40 non-metallic conduit.
- D. In or Under Slab on Grade: Provide Schedule 40 non-metallic conduit encased in concrete. Provide Galvanized with tape wrap rigid steel factory bends greater than 22.5 degrees and for stub-ups through concrete slabs.
- E. Outdoor Locations, Above Grade: Provide rigid steel conduit. Provide cast metal outlet, pull, and junction boxes.
- F. In Slab above Grade: Provide galvanized rigid steel conduit. Provide cast or concrete-tight sheet metal boxes.
- G. Exposed Dry Locations: Provide galvanized rigid steel conduit. Provide cast boxes.

- H. Concealed Dry Locations: Provide electrical metallic tubing for sizes less than 2-inches. Provide galvanized rigid steel or intermediate steel conduit in sizes 2-inches or larger. Provide cast or sheet metal boxes.
- I. Locations subject to Corrosive Atmosphere: Provide PVC coated, galvanized rigid steel or intermediate steel conduit. Provide PVC coated cast or sheet metal boxes.
- J. Hazardous Locations (Per NEC Article 500): Galvanized rigid steel conduit. Cast iron boxes with threaded hubs for conduit entry. Conduit seals.

1.5 DESIGN REQUIREMENTS

- A. Minimum Raceway Size: 3/4 inch (19 mm) indoor and 1-inch outdoor unless otherwise specified.

1.6 SUBMITTALS

- A. Submit detailed conduit routing plan, for review and approval, prior to installation as follows:
 - 1. Exposed and/or concealed in building walls for conduits larger than 2-inch outside diameter.
 - 2. All underground conduits (3/4-inch and larger) in duct bank; concealed in floor slabs, equipment pads and concrete slabs.
- B. Product Data: Submit for the following:
 - 1. Rigid Steel Conduit.
 - 2. PVC Coated galvanized rigid steel conduit.
 - 3. Intermediate steel conduit.
 - 4. Electrical Metallic Tubing (EMT).
 - 5. Flexible metal conduit.
 - 6. Liquid tight flexible metal conduit.
 - 7. Nonmetallic conduit.
 - 8. Raceway fittings.
 - 9. Conduit bodies.
 - 10. Surface raceway.
 - 11. Pull boxes, junction boxes and manholes.
- C. Manufacturer's Installation Instructions:
 - 1. Submit application conditions and limitations of use stipulated by product testing agency specified under Regulatory Requirements.
 - 2. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.7 CLOSEOUT SUBMITTALS

- A. Project Electrical (CAD) Record Documents:
 - 1. Record actual routing of conduits.
 - 2. Record actual locations and mounting heights of outlet, pull boxes, junction boxes and manholes.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- B. Protect PVC and PVC-coated metallic conduit from sunlight.

PART 2 - PRODUCTS

2.1 CONDUIT

- A. Galvanized Rigid Steel Conduit (GRSC or RGS), couplings and elbows shall be hot-dip galvanized, rigid mild steel in accordance with ANSI C80.1 and UL 6. The conduit interior and exterior surfaces shall have a continuous zinc coating with a transparent overcoat of enamel, lacquer, or zinc chromate. Conduit shall be formed with continuous welded seams with a uniform wall thickness, in minimum 10-foot lengths, with threaded ends.
- B. Intermediate Metal Conduit (IMC). Raceway shall be hot-dipped galvanized mild steel in accordance with ANSI C80.6 and UL 1242 and shall bear the UL label. Conduit shall have same characteristics of rigid steel except for thinner wall.
- C. Polyvinyl Chloride (PVC) coated galvanized rigid steel conduit and intermediate metal conduit shall be in accordance with NEMA RN 1. Coating shall be applied under controlled factory conditions. Prior to coating, conduit shall meet requirements of ANSI C80.1 and UL 6 or ANSI C80.6 and UL 1242 as appropriate. PVC coated conduits shall have ultra-violet (UV) inhibitor in the coating material.
- D. Electrical Metallic Tubing (EMT). Electrical metallic tubing, including elbows and bends, shall be zinc coated, mild steel in accordance with the requirements of ANSI C80.3 and UL 797. The interior and exterior surfaces of the tubing shall have a continuous zinc coating. Conduit shall be formed with a continuous welded seam, with a uniform wall thickness, in minimum 10-foot lengths.
- E. Flexible Metal Conduit shall be galvanized steel meeting the requirements of UL 1. Flexible aluminum conduit is not permitted.

- F. Liquid-Tight Flexible Metal Conduit shall be plastic-jacketed, galvanized steel, "Sealtite" or approved equal Type EF for general service areas or Type HC for high-temperature when used under raised floor or in air plenums. Conduit shall be UL listed.
- G. Non-Metallic Conduit shall be as follows:
 - 1. Schedule 40: 90 degree Celsius, polyvinyl chloride in conformance with NEMA TC-2 and UL 651 requirements.
 - 2. Spacers used in duct bank installations shall be high impact plastic, interlocking bases, and intermediate type spacers. Place spacers between 6 and 10 feet apart.
- H. Rigid aluminum conduits and flexible aluminum or non-metallic conduits are not permitted on this project.

2.2 RACEWAY FITTINGS

- A. Couplings and Thread Protectors. Each length of threaded conduit shall be provided complete from the manufacturer with a coupling on one end and a thread protector on the other. The thread protector shall have sufficient mechanical strength to protect the threads during normal handling and storage.
- B. Metal Conduit Fittings shall conform to the requirements of UL 514B where this standard applies. Galvanized steel fittings shall be used with steel conduit. Threaded fittings shall engage a minimum of five threads made up wrench-tight and be compatible with conduit. EMT fittings shall be compression type, UL approved for rain tight applications and setscrew type with insulated throat for indoor applications.
- C. Liquid-Tight Flexible Conduit Fittings shall be galvanized steel, T&B 53XX series or Approved Equal insulated throat, and shall bear the UL label. Die-cast malleable fittings are not acceptable.
- D. Liquid-Tight Flexible Metal Conduit Fittings shall be galvanized steel similar to T&B "Tite-Bite" or Approved Equal.
- E. Non-Metallic Conduit Fittings shall be of same material and strength characteristics as the conduit and shall be solvent welded as recommended by manufacturer. End bells shall be plastic, high impact, tapered to fit. Where conduit transition from non-metallic to metallic is required, provide non-metallic female "terminal" adapter. Non-metallic "male" adapters are not acceptable.
- F. Special Fittings. Conduit sealing, explosion proof, dust proof, and other types of special fittings shall be provided as required and shall be consistent with the area and equipment with which they are associated. Fittings installed outdoors or in damp locations shall be sealed and gasketed. Outdoor fittings shall be of heavy cast construction. Hazardous area fittings and conduit sealing shall conform to NEC requirements for the area classification.

- G. Bushings shall be provided for the termination of all conduits not terminated in hubs, couplings or insulated throat connectors. Grounding type insulated bushings with insulating inserts in metal housings shall be provided for conduit 1-1/4 inches and larger. Standard bushings shall be galvanized steel or malleable iron in all sizes.
- H. Locknuts. One interior and one exterior locknut shall be provided for all conduit terminations not provided with threaded hubs and couplings. Locknuts shall be designed to securely bond with the conduit to the box when tightened. Locknuts shall be so constructed that they will not be loosened by vibration.
- I. Unions. Watertight conduit unions shall be Appleton or Crouse-Hinds Type UNF or UNY, or Approved Equal.
- J. Raintight Conduit terminating hubs, where indicated on the drawings or required by these specifications, shall be Meyer's rigid conduit hubs, or Approved Equal.

2.3 CONDUIT BODIES

- A. Aluminum conduit bodies shall be die-cast copper-free aluminum alloy A360. Aluminum conduit bodies shall be finished with powder-coated paint. Cover shall be die-cast or stamped aluminum or steel.
- B. Malleable iron conduit bodies shall be cast malleable iron with tensile strength meeting ASTM A 48, Class 30A requirements. Malleable conduit bodies shall be finished with an epoxy powder coating. Cover shall be malleable iron with captive screws.
- C. All conduit bodies' entrances shall be machined NPT threads with a smooth, rounded, internal conduit stop bushing.
- D. All conduit bodies shall be equipped with a sealed and gasketed cover. Cover shall be secured using stainless steel machine screws.

2.4 CONDUIT SUPPORTS

- A. Conduit supports shall be furnished and installed in accordance with other section of these specifications. Conduits shall be supported so that fittings are accessible. Support systems shall be limited to electrical conduits only.
- B. Hanger rods shall be 3/8-inch diameter galvanized threaded steel rods, minimum. Conduit racks over 18-inch wide, over one level, or supporting 2-inch RSC or larger, shall be 1/2-inch diameter rod minimum.
- C. Conduit Clamps. Conduits in single runs or groups of two shall be supported by steel clamps and clamp backs. They shall be galvanized malleable iron or approved equal cast ferrous metal for steel conduit or tubing.

- D. Support Channels. Supports for banks of three or more conduits shall be constructed of formed steel support channels (Unistrut, Kindorf, Superstrut, B-Line or Approved Equal) with associated conduit or tubing clips. Support channels shall be steel, hot-dip galvanized after fabrication with galvanized steel clips for steel conduit or tubing.
- E. Wall Penetrations. All conduits, raceways, cables and sleeve penetrations through fire rated and hazardous location walls, shafts, floor, ceilings, etc., shall be sealed with a UL-approved fire stopping system.

2.5 OUTLET BOXES AND SWITCH BOXES

- A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1, galvanized flat rolled sheet steel outlet wiring boxes of types, shapes and sizes, including box depths, to suit each respective location and installation; construct with stamped knockouts in back and sides, and with threaded screw holes with corrosion-resistant screws for securing box covers and wiring devices.
- B. Outlet boxes used in wet outdoor locations, surface mounted shall be cast metal (FS or FD type) with mounting lugs and gasketed covers.
- C. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported, per NEC requirements.
- D. Outlet Box Accessories: Provide outlet box accessories as required for each installation, including mounting brackets, wallboard hangers, extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used and meeting requirements of individual wiring situations.

2.6 PULL BOXES, JUNCTION BOXES, HANDHOLES AND MANHOLES

- A. Sheet Metal Boxes shall be NEMA OS 1, NEMA rating as indicated on drawings. Minimum 16 gauge galvanized steel construction with stainless steel hinged cover and neoprene gasket. Cover shall be secured to the body with a continuous, full length, piano type hinge and stainless steel pin on one side and captive screw on the other side. Door shall be equipped with padlock hasp with sealing hole provisions.
 - 1. Provide #10-32 tapped hole provisions for optional ground lug kit.
 - 2. Provide 0.375-16 collar studs for mounting optional panel.
 - 3. Provide external mounting feet for secure wall mounting.
 - 4. Finish: Wash and phosphate undercoat with ANSI 61 gray polyester powder finish.
- B. Surface-Mounted Cast Metal Box: NEMA 250, NEMA Type 3R or 4 as indicated, flat-flanged, surface-mounted junction box:
 - 1. Material: Cast Iron.

2. Cover: Furnish with ground flange, neoprene gasket, and stainless steel cover screws.
- C. Concrete pull boxes, vaults and hand holes for power, lighting, controls and telecommunications shall be pre-cast concrete boxes, sized as indicated on the drawing or per NEC requirements. Pull boxes shall be equipped with a concrete cover for non traffic rated locations OR cast-in frame, galvanized steel, adjustable, high impact traffic cover (H-20 load rated), sump, lifting lugs, and conduit knock-outs. Knockout location and sizes shall be coordinated with the duct bank for each location. Cover shall be engraved with the words - - "POWER", "LIGHTING", "CONTROLS", "COMM/DATA", "TELEPHONE" or similar as applicable.
- D. Concrete manholes and/or pull boxes for buried power (MH-P-xx) and control (MH-C-xx) conduits shall be either cast-in-place or pre-cast concrete vault.
1. Size, as indicated on the drawings or per NEC requirements.
 2. Pull boxes, Vaults and Manholes shall be equipped with:
 - a. Galvanized steel covers for non-traffic rated locations and cast-in frame, galvanized steel, adjustable, high impact traffic cover (H-20 load rated) for traffic rated locations.
 - b. Sump, lifting lugs, conduit knock-outs, pick holes, bolt down holes in cover plate, and pull irons. Knockout location and sizes shall be coordinated with the duct bank for each location. HDG cable racks shall be provided as required to support the cables in the pull box. Cover shall be engraved with the words "POWER", "LIGHTING", or "CONTROLS" as applicable.

2.7 CLOSURE FOAM

- A. All conduit, raceways, cables and sleeves penetrations through fire rated and hazardous location walls, shafts, floor, ceilings, etc., shall be sealed by closure foam as in Dow Corning #3-6548 silicone RTV, GE RTV 850 silicone foam, or Approved Equal.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify outlet locations and routing and termination locations of raceway prior to rough in.

3.2 INSTALLATION OF RACEWAYS

- A. Routing
1. Install raceway and boxes in accordance with NECA "Standard of Installation."

2. Conduit routing shown on drawings is diagrammatic only. Contractor shall field route conduit and raceways between equipment and devices as required to obtain a complete wiring system.
3. Conduit shall not be exposed unless specifically mentioned on the drawings or accepted by the Owner.
4. All exposed conduits shall be installed parallel or perpendicular to dominant surfaces with right-angle turns made of symmetrical bends or fittings.
5. Conduit shall not be installed on the outside face of exposed columns, but shall be routed on the web or on the inside of a flange of the column.
6. Except where prevented by the location of other work, a single conduit or a conduit group shall be centered on structural members.
7. Conduit shall be located at least 6 inches from hot water or steam pipes and from other hot surfaces

B. Moisture Pockets

1. Moisture pockets shall be eliminated from conduits. If water cannot drain to the natural opening in the conduit system, a hole shall be drilled in the bottom of a pull box or a "C-type" conduit fitting provided in the low point of the conduit run.

C. Couplings and Unions

1. Metal conduit shall be joined by threaded conduit couplings, with the conduit ends butted.
2. The use of running threads, Erickson type couplings, split couplings or similar unions are not permitted.

D. Conduit Bodies

1. Conduit bends shall meet the requirements of NEC, minimum bend radius of the cable installed or as indicated on the drawings, whichever is greater.
2. Conduits or tubing deformed or crushed in any way shall be removed from the job site.

E. Bends and Offsets

1. Changes in direction of conduits shall be made with fittings or bends.
2. Conduit bends shall meet the requirements of NEC, minimum bend radius of the cable installed or as indicated on the drawings, whichever is greater.
3. Bends shall be made using appropriate tools or mechanical equipment. The use of a pipe tee or vise for bending conduit or tubing will not be permitted.
4. For non-metallic conduit or plastic coated steel, approved factory bends and offsets shall be used.
5. Conduits or tubing deformed or crushed in any way shall be removed from the job site.
6. Install no more than the equivalent of three 90 degree bends between boxes or outlets

F. Cutting and Threading

1. The plane of all conduit ends shall be square with the centerline.
2. Where threads are required, they shall be cut and cleaned prior to conduit reaming.
3. The ends of all conduit and tubing shall be reamed to remove all rough edges and burrs.
4. Cutting oil shall be used in threading operations; the dies shall be kept sharp, and provisions shall be made for chip clearance.
5. Threads on conduits and fittings shall be lubricated with conducting and sealing compound.
6. All steel conduits shall be coated after threading with cold-galvanized zinc coating. The Contractor shall supply this protective material and shall apply it in the field prior to installing conduit or fittings.

G. All steel conduit, exposed to weather or in contact with earth, shall be re-galvanized after threading with "Galvanizing Powder M-321" as manufactured by the American Solder and Flux Company of Philadelphia, Pennsylvania; "Zincilate 810" as manufactured by Industrial Metal Protectives, Inc., of Dayton, Ohio; "Zinc Rich" coating as manufactured by ZRC Chemical Products Company, Quincy, Massachusetts; or Approved Equal. The Contractor shall supply this protective material and shall apply it in the field.

H. Connections to Boxes and Cabinets

1. Conduit shall be securely fastened to all boxes and cabinets.
2. Threads on metallic conduit shall project through the wall of the box to allow the bushing to butt against the end of the conduit.
3. The locknuts, both inside and outside, shall then be tightened sufficiently to bond the conduit securely to the box.
4. Locknuts on connectors shall be tightened securely to bond the connectors.

I. All conduits entering enclosures outdoors or in wet areas shall enter through Meyer's hubs, or Approved Equal, or threaded openings.

J. Cleaning

1. Precautions shall be taken to prevent the accumulation of water, dirt, or concrete in the conduit.
2. Conduit in which water or other foreign materials have been permitted to accumulate shall be thoroughly cleaned or, where such accumulation cannot be removed by methods acceptable to the Owner, the conduit shall be replaced.
3. For conduits sizes 3 inches and larger, draw a flexible testing mandrel approximately 12 inches long with a diameter less than the inside diameter of the conduit through the conduit. After which, draw a stiff bristle brush through until conduit is clear of particles of foreign materials. For conduits less than 3 inches, draw a stiff bristle brush through until conduit is clear of particles and foreign material.

K. Empty Conduit

1. All conduits installed for future use shall have a polypropylene pull line with a minimum tensile strength of 200 lbs., Jet Line, Cat. No. 232, polyolefin, or Approved Equal. Pull line shall be secured at both ends to ensure future accessibility.

L. Rooftop Conduits

1. Provide redwood sleepers on waterproof mastic base for all conduit runs exposed on roofs.

M. Identification

1. All conduits shall be identified in accordance with other section of these specifications.

N. Grounding

1. All conduits shall be grounded in accordance with specification Section 260526 – Grounding and Bonding for Electrical Systems.
2. A solid or stranded bare copper or green insulated copper solid or stranded ground wire shall be provided in all conduits and raceways.

O. Galvanized Rigid Steel Conduit

1. Galvanized rigid steel conduit shall be installed in areas exposed to weather, vehicle traffic, in hazardous classified areas, for penetrations through foundations, and 10 feet before transition from below grade to 8 feet above grade, unless otherwise noted on the drawings.
2. Steel conduit in contact with earth shall be protected by "Scotchwrap" or Approved Equal 10 mil tape applied in double thickness using 50 percent lap turns to 6 inches above grade and 6 inches beyond transition.
3. Expansion joints shall be used where required.

P. Intermediate Steel Conduit

1. Intermediate steel conduit may be installed in lieu of galvanized rigid steel conduit in all above ground areas where rigid steel conduit is permitted, except for wires over 600- volts, unless otherwise specified.

Q. Polyvinyl Chloride (PVC) Coated Galvanized Rigid Steel Conduits and Intermediate Steel Conduit

1. PVC -coated, steel conduit and fittings shall be installed where highly corrosive conditions exist, indoors or outdoors.
2. The Contractor shall patch any damaged coating according to the manufacturer's instructions.

R. Electrical Metallic Tubing

1. Electrical metallic tubing shall be installed for all circuits, indoors above concrete slab, where not subject to conditions outlined for rigid galvanized steel conduits.

S. Rigid Aluminum Conduit

1. Not acceptable on this project.

T. Flexible Metal Conduit, Steel or Aluminum

1. Flexible conduit inserts not greater than 30 inches in length, shall be installed in all conduit runs, which are supported by both building steel and by structures subject to vibration or thermal expansion. This shall include locations where conduit supported by building steel enters or becomes supported by isolated structures on separate foundations.
2. Flexible conduit shall be installed in conduit runs, which cross expansion joints.
3. Special areas, such as plant office control rooms in which external noise is to be minimized, shall have flexible conduit in conduit runs where the runs cross from the main building framing to the control room or office framing.
4. Flexible conduit shall be installed adjacent to all equipment and devices, which move in relation to the supply conduit due to vibration, normal operation of the mechanism, or thermal expansion.
5. Conduit shall be connected to pressure switches, thermocouples, solenoids, and similar devices with flexible conduit. Flexible conduit shall be installed adjacent to the motor terminal housing for motors requiring 4-inch and smaller conduit.
6. Flexible metal conduit inserts not greater than 6 feet in length shall be installed for light fixture tap conductors.

U. Liquid-Tight Flexible Metal Conduit

1. Liquid-tight flexible metal conduit shall be used in place of regular flexible conduit for connections to motors and transformers, in areas exposed to weather, moisture or oil, and under raised floors.
2. Liquid-tight flexible metal conduit may be used in place of flexible metal conduit where not otherwise required.

V. Non-Metallic Conduit

1. Schedule 40 shall be used for all power, signal feeders and branch circuits, in earth or enclosed in concrete, unless otherwise noted on the drawings. Conduits must be buried in earth in accordance with the NEC.

W. Conduit Support

1. Fasten conduit supports to building structures and surfaces in accordance with NEC requirements.

2. Support raceway using coated steel or malleable iron straps, lay-in adjustable hangers, clevis hangers, and split hangers.
3. Do not use wire, ceiling support wires or perforated pipe straps to support conduit. Remove any temporary installation support wire.

X. Spacing of Supports

1. All conduit runs shall be rigidly supported, except where buried in concrete,.
2. Each conduit shall be supported within one (1) foot of junction boxes and fittings.
3. Spacers used in duct bank installations shall be placed no more than 6 to 10 feet apart.
4. Support spacing along conduit runs shall be as follows.

Conduit Size	Maximum Distance Between Supports
½ inch through 1-1/4 inch	5 feet
1-1/2 inch and larger	8 feet

- Y. Ground and bond raceway and boxes in accordance with Section 260526 – Grounding and Bonding for Electrical Systems.

3.3 CABINET AND BOX INSTALLATION

- A. Install electrical boxes as shown on drawings, and as required for splices, taps, wire pulling, equipment connections and compliance with regulatory requirements.
- B. Locate boxes and conduit bodies so as to ensure ready accessibility of electrical wiring, maintain headroom and to present neat mechanical appearance.
- C. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only. In inaccessible ceiling areas, install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.
- D. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices with each other.
- E. Use flush mounting outlet boxes in finished areas.
 1. Do not install flush mounting boxes back-to-back in walls.
 2. Provide minimum 6-inch separation between adjacent boxes.
 3. Provide minimum 24-inch separation in acoustic rated walls.
 4. Use stamped steel bridges to fasten flush mounting outlet box between studs.
 5. Secure flush mounting box to interior wall and partition studs.
 6. Accurately position to allow for surface finish thickness.
 7. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

8. Use adjustable steel channel fasteners for hung ceiling outlet box.
- F. Support boxes independently of conduits.
 - G. Use code sized gang box where more than one device is mounted together. Do not use sectional box. Use code sized gang box with plaster ring for single device outlets.
 - H. Use cast outlet box in exterior locations where exposed to the weather and wet locations (interior or exterior).
 - I. Coordinate installation of electrical boxes and fittings with cable and raceway installation work. Provide knockout closures to cap unused knockout holes where blanks have been removed.
 - J. Avoid using round boxes where conduit must enter box through side of box, which would result in difficult and insecure connections where fastened with a locknut or bushing on rounded surface.
 - K. Fasten boxes rigidly to substrate or structural surfaces to which they are being mounted, or solidly embed electrical boxes in concrete or masonry as appropriate.
 - L. Except as prevented by the location of other work, all junction boxes and outlet boxes shall be centered on structures.
 - M. Conduit openings in boxes shall be made with a hole saw or shall be punched.
 - N. Cabinets and boxes shall be rigidly mounted.
 1. Mounting on concrete shall be secured by self-drilling anchors.
 2. Mounting on steel shall be by drilled and tapped screw holes, or by special support channels welded to the steel, or by both.
 3. Cabinets shall be leveled and fastened to the mounting surface with not less than ¼-inch air space between the enclosure and mounting surface.
 4. All mounting holes in the enclosure shall be used.
 - O. Large Pull Boxes - Boxes larger than 100 cubic inches in volume or 12 inches in any dimension.
 1. Interior Dry Locations - Use hinged enclosure.
 2. Other Locations - Use surface mounted box of appropriate location classification.

3.4 ANCHORS

- A. Where supports for raceways, boxes, and cabinets are mounted on concrete surfaces, they shall be fastened with self-drilling tubular expansion shell anchors with externally split expansion shells, single-cone expanders, and annular break-off grooved chucking cones. Anchors shall be Phillips "Red Head" or Approved Equal.

3.5 PULL BOX AND VAULT INSTALLATION

- A. Openings or “knockouts” in precast concrete vaults shall be as necessary and shall be sized sufficiently to permit passage of the largest dimension of pipe and/or flange.
- B. Upon completion of installation, all voids or openings in the vault walls around pipes shall be filled with 3,000 psi non-shrink grout.
- C. After the structure and all appurtenances are in place and approved, backfill shall be placed to the original ground line or to the limits designated on the plans.
- D. All joints between precast concrete vault sections shall be made watertight. The plastic joint sealing compound shall be installed according to the manufacturer's recommendations to provide a watertight joint which remains impermeable throughout the design life of the structure. The outside of the entire structure shall be coated with an approved water proofing material.
- E. Access doors shall be built up such that the hatch is flush with the surrounding surface unless otherwise specified on the drawings or by the Authority Having Jurisdiction. The Contractor is responsible for placing the cover at the proper elevation where paving is to be installed and shall make all necessary adjustments so that the cover meets these requirements.
- F. Ladders shall be installed using Type 316 stainless steel capsule anchors.
- G. Ladders shall be attached a minimum of 3 places to the vault wall.
- H. Ladder shall be centered under access door opening.

3.6 ADJUSTING

- A. Install knockout closures in unused openings in boxes.

3.7 CLEANING

- A. Clean interior of boxes to remove dust, debris, and other material.
- B. Clean exposed surfaces and restore manufacturer’s finish.

END OF SECTION

SECTION 260553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. The extent of the electrical systems and equipment requiring identification is shown on the drawings, and the extent of identification required is specified herein and in individual sections of work requiring identification. The types of electrical identification specified in this section include the following:
1. Exposed conduit color banding.
 2. Buried cable warnings.
 3. Cable/conductor identification.
 4. Operational instructions and warnings.
 5. Danger signs.
 6. Equipment/system identification signs.

1.2 REFERENCES - CODES AND STANDARDS

- A. ANSI Z535.1 - Safety Color Code
- B. APWA ULCC - Uniform Color Code for Buried Utilities.
- C. NFPA 70 National Electrical Code (NEC).

1.3 SYSTEM DESCRIPTION

- A. Label the following electrical equipment with nameplates which clearly identify each item, the function or use of the item, and the circuit identification of the feed to the item:
1. All transformers shall be identified by 1-inch high block letters cut in stencil and applied with yellow paint on a flat-black background. The transformer number, primary and secondary voltages, and the kVA shall be shown.
 2. All Metal-Clad Switchgear, Metal-Enclosed Switchgear, Switchboards, Distribution Panelboards, Power and Lighting Panels, Motor Control Centers, Local Control Panels, Terminal Cabinets and all electrical equipment enclosure shall be identified using laminated plastic nameplates. The equipment number, voltage rating, current rating, number of phases, connection type, short circuit interrupting rating, and circuit number shall be shown
 3. All motors, starters, disconnect switches, Time Switches, Special Function Pushbuttons and Switches, and miscellaneous control devices shall be identified by function and circuit number, with 1/4-inch high black characters on a 1/2-inch

wide white stick-on tape where installed indoors and engraved plastic nameplates where installed outdoors.

4. All underground raceway or cable shall be marked with buried warning tape along its entire length.
5. All exposed raceway longer than 10 feet in length shall be identified.
6. Panelboard Directories: Furnish all panelboards with a complete typewritten directory mounted in the inner door under a clear plastic cover set in a metal frame.

B. Branch circuits and devices:

1. Label all individual receptacle outlets and light switches at their faceplate to indicate the panelboard of origin and branch circuit number, as shown on drawings. Label modular furniture feeds at the power pole drop in a visible and consistent location. Labels shall be self adhesive, thermal machine printed type such as Brothers, Panduit, or T&B or Approved Equal and shall be clear plastic with black lettering.
2. All branch circuits in outlet boxes shall be identified with circuit number using wrap-around labels (T&B, BRADY, 3M or Approved Equal).
3. As an alternative to separate nameplates, device plates may be engraved directly with lettering filled with black enamel.

1.4 SUBMITTALS

- A. Catalog data for nameplates, labels, and markers.
- B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under regulatory requirements. Include instructions for storage, handling, protection, examination, preparation and installation of product.

1.5 REGULATORY REQUIREMENTS

- A. Conform to requirements of NFPA 70 – National Electrical Code.
- B. Furnish products listed and classified by Underwriters' Laboratories, Inc. (UL), Electrical Testing Laboratories, Inc. (ETL), or other recognized, approved testing and listing agencies as suitable for the purpose specified and shown.

PART 2 - PRODUCTS

2.1 NAMEPLATES AND LABELS

- A. Nameplates

1. Engraved three-layer laminated plastic, white letters on black background for normal power and white letters on red background for emergency power. Communications and control cabinets shall be labeled with white letters on green background.
2. Locations
 - a. Each electrical distribution and control equipment enclosure.
 - b. Communication cabinets.
 - c. Motor control centers, including each combination module.
3. Letter Size
 - a. Use 1/8-inch letters for identifying individual equipment and loads.
 - b. Use 1/4-inch letters for identifying grouped equipment, loads, panelboards, and transfer switches.
 - c. Use 1/2-inch letters for identifying the main switchboard, motor control centers, transformers and large distribution switchboards.

B. Labels

1. Embossed adhesive tape, with 3/16-inch white letters on colored background to match color scheme of plastic laminate labels in 2.1.1. Use only for identification of individual wall switches and receptacles, control device stations, and multi-outlet devices.
2. Thickness
 - a. 1/16-inch for units up to 20 square inches or 8-inch length; 1/8-inch for larger units.

2.2 WIRE MARKERS

A. Manufacturers

1. Brady
2. Thomas & Betts
3. 3-M Co.
4. Or Approved Equal

B. Description: Cloth, tape, split sleeve, or tubing type wire markers, self-adhesive.

C. Locations: Each conductor at panelboard gutters, pull boxes, outlet and junction boxes, control panels, motor controllers and starters, and each load connection.

D. Legend

1. Power and Lighting Circuits: Branch circuit or feeder feed from.
2. Control Circuits: Control wire number indicated on shop drawings.

3. Neutral Conductors: Clearly indicate the branch circuit or feeder number the neutral serves. In multi-wire circuits where the neutral is shared, mark the neutral with the circuit number of the "A" phase.

2.3 CONDUIT MARKERS

- A. Provide manufacturer's standard preprinted, flexible or semi-rigid, permanent, plastic-sheet conduit markers, minimum of 3 mils thick and 1-1/2-inch wide extending 360 degrees around conduits; designed for self-adhesive attachment to conduit. Except as otherwise indicated, provide lettering that indicates the voltage of the conductor(s) in the conduit. Provide 8-inch minimum length for 2-inch and smaller conduit, 12-inch minimum length for larger conduit.
- B. Identify conduits containing conductors above 600-volts with the following alternating markers
 1. DANGER - HIGH VOLTAGE
 2. The voltage, as applicable (i.e. - 12-kV, 4.16-kV, 480-Volts, 240-Volts, etc.)
- C. Location: Furnish markers for each conduit longer than 10 feet.
- D. Spacing: 20 feet on center.
- E. Color: Unless otherwise indicated or required by governing regulation, provide orange markers with black letters.
 1. Fire Alarm System: Red w/black letters.
 2. Telephone System: Green w/yellow letters.
 3. Data/Communication. System: White w/black letters.
 4. Emergency System: Orange w/black letters.
- F. Legend:
 1. 208 Volt System: Normal 208/120-volts.
 2. Fire Alarm System: Fire alarm.
 3. Telephone System: Telephone.
 4. Data/Communication System: Data/communications.

2.4 FASTENERS

- A. Secure all labels and nameplates with self-tapping stainless steel screws. Use contact type permanent adhesive where screws cannot or should not penetrate the substrate.

2.5 BAKED ENAMEL DANGER SIGNS

- A. Provide manufacturer's standard "DANGER" signs of baked enamel finish on 20 gage steel; of standard red, black and white graphics; 14-inch by 10-inch size except where 10-inch by 7-inch is the largest size which can be applied where needed, and except where larger size is needed for adequate vision; with recognized standard explanation wording (e.g. HIGH VOLTAGE, KEEP AWAY, BURIED CABLE, DO NOT TOUCH SWITCH).
 - 1. At each entry doors of Electrical Rooms: "DANGER HIGH VOLTAGE - KEEP OUT, AUTHORIZED PERSONNEL ONLY"

2.6 LETTERING AND GRAPHICS

- A. Coordinate names, abbreviations and other designations used in the electrical identification work, with the corresponding designations shown, specified or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of the electrical systems and equipment.

2.7 UNDERGROUND WARNING TAPE

- A. Three-inch minimum width, 5 mil thickness, foil bonded polyethylene tape, detectable type, with suitable continuous warning legend describing buried electrical lines. Tape color shall conform to APWA uniform color code using ANSI Z535.1 safety colors. Text shall be black, 2-inch minimum letters.
- B. Identify underground conduits using underground warning tape. Install one tape per trench at 3 inches below finished grade.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Degrease and clean surfaces to receive nameplates and labels.
- B. Coordination: Where identification is to be applied to surfaces that require finish, install identification after completion of painting.
- C. Regulations: Comply with governing regulations and the requests of governing authorities for the identification of electrical work.

3.2 APPLICATION

- A. Install nameplate and label parallel to equipment lines.
- B. Secure nameplate to equipment front using screws, rivets, or adhesive.
- C. Secure nameplate to outside moveable surface of door on panelboard.
- D. Conduit Identification:
 - 1. Where electrical conduit is exposed in spaces with exposed mechanical piping, which is identified by a color-coded method, apply color-coded identification on the electrical conduit in a manner similar to the piping identification. Except as otherwise indicated, use orange as the coded color for conduit.
 - 2. Paint red band or provide red tape on each fire alarm conduit longer than 10 feet, minimum 20 feet on center.
- E. Cable/Conductor Identification:
 - 1. Apply cable/conductor identification on each cable and conductor in each box/enclosure/cabinet where the wires of more than one circuit or communication/signal system are present, except where another form of identification (such as color-coded conductors) is provided.
 - 2. Match identification with marking system used in panelboards, shop drawings, contract documents, and similar previously established identification for project electrical work.
- F. Operational Identification and Warnings
 - 1. Wherever reasonably required to ensure safe and efficient operation and maintenance of the electrical systems, and electrically connected mechanical systems and general systems and equipment, including the prevention of misuse of electrical facilities by unauthorized personnel, install self-adhesive plastic signs or similar equivalent identification, instruction or warnings on switches, outlets and other controls, devices and covers of electrical enclosures. Where detailed instructions or explanations are needed, provide plasticized tags with clearly written messages adequate for the intended purposes.
- G. Danger Signs
 - 1. In addition to the installation of danger signs required by governing regulations and authorities, install appropriate danger signs at the locations indicated and at locations subsequently identified by the Installer of electrical work as constituting similar dangers for persons in or about the project.
 - 2. High Voltage

- a. Install danger signs wherever it is possible, under any circumstances, for persons to come into contact with electrical power of voltages higher than 110-120 volts.
- b. Critical Switches/Controls
- c. Install danger signs on switches and similar controls, regardless of whether concealed or locked up, where untimely or inadvertent operation (by anyone) could result in significant danger to persons, or damage to or loss of property.

H. Equipment/System Identification Signs

1. Install an engraved plastic-laminate sign on each major unit of electrical equipment in the building; including the central or master unit of each electrical system and the communication/signal systems, unless the unit is specified with its own self-explanatory identification or signal system.
 2. Except as otherwise indicated or specified, provide single line of text, 1/2-inch high lettering on 1-1/2-inch high sign (2-inch high where two lines are required), white lettering in black field.
 3. Provide text matching terminology and numbering of the contract documents and shop drawings.
 4. Provide signs for each unit of the following categories of electrical work
 - a. Major electrical switchboard
 - b. Electrical substation
 - c. Motor control center
 - d. Fire alarm control panel and annunciators.
- I. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrata with fasteners, except use adhesive where fasteners should not or cannot penetrate the substrata.

END OF SECTION

**SECTION 262413
SWITCHBOARDS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes main distribution switchboard.

1.2 RELATED SECTIONS:

- A. Section 260500: Common Work Results for Electrical
- B. Section 260553: Identification for Electrical Systems
- C. Section 262416: 600-Volt Rated Panelboards & Circuit Breakers

1.3 REFERENCES - CODES AND STANDARDS

- A. ANSI C12.1 Code for Electricity Metering.
- B. ANSI C39.1 Electrical Analog Indicating Instruments.
- C. ANSI C57.13 Instrument Transformers.
- D. IEEE C62.41 Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
- E. NEMA ICS 6 Enclosures
- F. NEMA AB 1 Molded Case Circuit Breakers.
- G. NEMA PB 2 Dead Front Distribution Switchboards.
- H. NEMA PB 2.1 Proper Handling, Installation, Operation and Maintenance of Dead front Switchboards Rated 600 Volts or less.
- I. NETA ATS Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.
- J. NFPA 70 National Electrical Code

1.4 SUBMITTALS

- A. Shop Drawings:
 - 1. Provide front and side views of enclosures, with overall dimensions shown; conduit entrance locations and requirements; nameplate legends; size and number of bus bars for each phase, neutral, and ground; and switchboard instrument details.
 - 2. Provide detailed drawings of the Utility Cable Entrance Compartment, Main Circuit Breaker Compartment, Instrument transformer and Revenue Metering compartment per EUSERC standards that meet Utility Company requirements.
 - 3. Submit Utility Cable Entrance, Instrument Transformer and Metering Compartment drawings to Utility Company for review and approval prior to release for fabrication and construction.
 - 4. Submit calculations and enclosure pad-mount anchoring method (anchor bolt size, embedment, and assembly details) to meet California Seismic Zone 4 requirements.
- B. Product Data: Submit electrical characteristics, including voltage, frame size and trip ratings, fault current withstand ratings, and time-current curves of equipment and components.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations, configurations, and ratings of switchboards and their components on single line diagrams and plan layouts.
- B. Installation, Operation and Maintenance Manuals: Submit spare parts data listing, source and current prices of replacement parts and supplies, and recommended maintenance procedures and intervals.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five (5) years experience.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver in convenient shipping splits, individually wrapped for protection and mounted on shipping skids.
- B. Accept switchboard on site. Inspect for damage.
- C. Store in clean, dry space. Maintain factory wrapping or provide additional canvas or plastic cover to protect units from dirt, water, construction debris, and traffic. Keep

equipment warm with temporary electric heaters to prevent condensation during storage.

- D. Handle in accordance with NEMA PB 2.1. Lift only with lugs provided. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.8 ENVIRONMENTAL REQUIREMENTS

- A. Conform to NEMA PB 2 service conditions during and after installation of switchboards.

1.9 FIELD MEASUREMENTS

- A. Verify field measurements prior to fabrication.

PART 2 - PRODUCTS

2.1 DISTRIBUTION OR SERVICE ENTRANCE SWITCHBOARD

A. MANUFACTURERS

1. Cutler-Hammer.
2. General Electric Co.
3. Siemens
4. Square D Co.
5. Or Approved Equal

- B. Product Description: NEMA 3R, weather protected, enclosed switchboard with electrical ratings and configurations as indicated on Drawings. Switchboard shall be designed and appropriate for use in a heavy-duty industrial area.

C. Construction

1. Outer Enclosure: The switchboard enclosure shall be weather protected, corrosion resistant, NEMA 3R construction as follows:
 - a. Steel support frame with body stiffeners for added strength and minimum 12 gauge steel panels all around.
 - b. Steel panels shall have seams that are continuously welded and ground smooth with no holes or knockouts.
 - c. The outer door shall provide two-door protection, isolation of electrical equipment and easy access to the interior section doors and devices.
 - d. Provide rolled lip around three sides of each outer door and along the top of enclosure opening to channel away liquids and contaminants.

- e. Provide oil-resistant door gasket attached with oil resistant adhesive and held in place with steel retaining strips.
 - f. Provide heavy gauge steel continuous piano hinged, 3-point latch, hasp and staple for pad-locking.
 - g. Provide continuous external support channels for floor mounting, leveling and anchoring the assembly.
 - h. Provide heavy duty removable lifting angles and/or lugs.
 - i. Provide suitable grounding stud on door and body.
 - j. Provide adequate cable entry space and conduit fittings approved for top or bottom conduit entry as indicated on the drawings
2. Inner Enclosure shall be mounted in compartmented vertical sections fabricated of steel and assembled to provide a rigid self-supporting structure.
- D. Main Bus:
1. Voltage and current rating shall be as indicated on the drawings.
 2. Material: Insulated Copper with tin plating, standard size. Provide minimum 1,000 ampere per square inch copper bus density.
 3. Connections: Bolted, accessible from front only for maintenance.
- E. Neutral Bus: Extend length of switchboard. Current rating shall be minimum 50 percent of the main bus rating.
- F. Ground Bus: Extend length of switchboard. Current rating shall be minimum 50 percent of the main bus rating.
- G. Pull Section: Top or Bottom feed, integral with metering section, as indicated on Drawings, and in accordance with Utility requirements.
- H. Line and Load Terminations: Accessible from front only of switchboard, suitable for conductor materials and sizes as indicated on Drawings.
- I. Utility Metering Compartment: Furnish metering transformer compartment for Utility Company's use, in accordance with EUSERC requirements. Provide 7 or 13 jaw meter sockets as required by the Utility Co.
- J. Future Provisions: Fully equipped spaces for future devices with bussing and bus connections insulated and braced for short circuit currents.
- K. Align sections at front and rear.
- L. Finish for NEMA 3R Construction: Manufacturer's standard light gray enamel over external surfaces. Coat internal surfaces with a minimum of one coat of corrosion-resistant paint, or plate with cadmium or zinc.

2.2 MOLDED CASE CIRCUIT BREAKER

- A. Description: Molded-case circuit breaker shall be as specified in Section 262416 - 600-volt Rated Panelboards and Circuit Breakers. Circuit breaker shall be rated for use as service equipment as described in NFPA 70.
- B. Provide Handle Lock and provisions for padlocking the circuit breaker in open position.

2.3 SOURCE QUALITY CONTROL

- A. Furnish shop inspection and testing in accordance with NEMA PB 2.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Verify that surface is suitable for switchboard installation.

3.2 INSTALLATION

- A. Install in accordance with NEMA PB 2.1.
- B. Tighten accessible bus connections and mechanical fasteners after placing switchboard.
- C. Install engraved plastic nameplates in accordance with Section 260553.
- D. Install breaker circuit directory.
- E. Ground and bond switchboards in accordance with Section 260526.

3.3 FIELD QUALITY CONTROL

- A. Perform inspections and tests listed in NETA ATS Section 7.1 for Switchgear and Switchboard Assemblies, as follows:
 - 1. Visual and mechanical inspection
 - a. Compare equipment nameplate data with drawings and specifications.
 - b. Inspect physical, electrical, and mechanical condition.
 - c. Confirm correct application of manufacturer's recommended lubricants.
 - d. Verify appropriate anchorage, required area clearances, physical damage, and correct alignment.
 - e. Inspect all door panels, and sections for paint, dents, scratches, fit, and missing hardware.

- f. Verify that fuses and/or circuit breaker sizes and types correspond to drawings.
 - g. Verify that current and voltage (potential) transformer ratios correspond to drawings.
 - h. Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 10.12.
 - i. Confirm correct operation and sequencing of electrical and mechanical interlock systems.
 - 1) Attempt closure on locked-open devices. Attempt to open locked-closed devices.
 - j. Clean Switchgear.
 - k. Inspect insulators for evidence of physical damage or contaminated surfaces.
 - l. Exercise all active components.
 - m. Verify that filters are in place and /or vents are clear
2. Electrical Tests
- a. Perform ground-resistance testing accordance with NETA ATS Section 7-13.
 - b. Perform resistance tests through all bus joints with a low-resistance ohmmeter. Any joints that cannot be directly measured due to permanently installed insulation wrap shall be indirectly measured from closest accessible connection.
3. Test Values
- a. Compare bus connection resistance to values of similar connections.
 - b. Bolt-torque levels shall be in accordance with NETA ATS Table 10.12 unless otherwise specified by manufacturer.
- B. Check phase rotation of all connected loads prior to removal of existing equipment and after new equipment is installed.

3.4 ADJUSTING

- A. Tighten bolted bus connections.

3.5 CLEANING

- A. Touch up scratched or marred surfaces to match original finish.

END OF SECTION

**SECTION 262416
600-VOLT RATED PANELBOARDS & CBREAKERS**

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes distribution and branch circuit panelboards and circuit breakers.

1.2 RELATED SECTIONS

- A. Section 260500: Common Work Results for Electrical
- B. Section 260526: Grounding and Bonding for Electrical Systems
- C. Section 260553: Identification for Electrical Systems

1.3 REFERENCES - CODES AND STANDARDS

- A. ANSI C2 National Electrical Safety Code.
- B. NECA Standard of Installation
- C. NEMA AB 1 Molded Case Circuit Breakers.
- D. NEMA ICS 6 Enclosures
- E. NEMA PB 1 Panelboards.
- F. NEMA PB 1.1 Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- G. NETA ATS (National Electrical Testing Association) - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems
- H. NFPA 70 National Electrical Code

1.4 SUBMITTALS

- A. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.
- B. Product Data: Submit catalog data showing specified features of standard products.
- C. Test Report:
 - 1. Factory Tests:

- a. Certified factory test reports shall be submitted for manufacturer performed routine factory tests, including tests required by standards listed in paragraph "References". Results of factory tests performed shall be certified by the manufacturer, or an approved testing laboratory, and submitted within 7 days following successful completion of the tests. The manufacturer's pass-fail criteria for tests specified in paragraph "Field Testing" shall be included.

1.5 CLOSEOUT SUBMITTALS

- A. Project Record Documents: Record actual locations of panelboards and record actual circuiting arrangements.
- B. Installation, Operation and Maintenance Manuals: Submit spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.6 QUALIFICATIONS

- A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum five (5) years experience.

1.7 MAINTENANCE MATERIALS

- A. Furnish two (2) of each panel board key. Panelboards keyed alike to Owner's current keying system.

PART 2 - PRODUCTS

2.1 DISTRIBUTION AND BRANCH CIRCUIT PANELBOARDS

- A. Manufacturers:
 - 1. Allen Bradley
 - 2. Cutler Hammer
 - 3. General Electric Co.
 - 4. Siemens.
 - 5. Square D Co.
 - 6. Or Approved Equal.
- B. Product Description
 - 1. NEMA PB 1, circuit breaker type distribution, lighting and appliance branch circuit panelboard.
- C. Service Conditions:
 - 1. Temperature: 104 degrees F (40 degrees C) ambient

2. Altitude: 100 feet (35 m) above sea level.

D. Panelboard Bus

1. Silver plated copper current carrying components, ratings as indicated on drawings.
2. Main bus ampacity shall be equal to the main circuit breaker frame size rating.
3. Furnish copper ground bus in each panelboard.

E. Minimum integrated short circuit rating

1. Panelboards rated 240-Volts - 10,000 amperes RMS symmetrical
2. Panelboards rated 480-Volts - 42,000 amperes RMS symmetrical
3. Circuit Breaker rating shall match or exceed the panel interrupting rating
4. Series rated circuit breakers are not acceptable

F. Enclosure:

1. Indoor Installation:

- a. NEMA PB 1, Type 1, gasketed, steel construction, minimum 6 inches (153 mm) deep, 20 (503 mm) inches wide suitable for flush or surface mounting as indicated on drawings.
- b. Flush or surface cabinet front with concealed trim clamps, concealed hinge, metal directory frame, and flush lock keyed alike. Finish in manufacturer's standard gray enamel.
- c. Fully hinged door with flush lock and metal directory frame.
- d. Finished in manufacturer's standard gray enamel (ANSI 61).

2. Outdoor Installation:

- a. Panel shall be housed inside an outer weatherproof, corrosion resistant, NEMA 4X, 316 stainless steel enclosure constructed as follows:
- b. Steel support frame with body stiffeners for added strength and minimum 12 gauge 316 stainless steel panels all around.
- c. Steel panels shall have seams that are continuously welded and ground smooth with no holes or knockouts.
- d. The outer door shall provide two-door protection, isolation of electrical equipment and easy access to the interior section doors and devices.
- e. Provide rolled lip around three sides of each outer door and along the top of enclosure opening to channel away liquids and contaminants.
- f. Provide oil-resistant door gasket attached with oil resistant adhesive and held in place with steel retaining strips.
- g. Provide heavy gauge steel continuous piano hinged, 3-point latch, hasp and staple for pad-locking.
- h. Provide continuous external support channels for floor mounting, leveling and anchoring the assembly.
- i. Provide heavy duty removable lifting angles and/or lugs.
- j. Provide suitable grounding stud on door and body.
- k. Provide adequate cable entry space and conduit fittings approved for NEMA Type 4X enclosure for top or bottom conduit entry as indicated on the drawings.
- l. Provide space heaters with thermostat control in each section to prevent condensation.

2.2 MOLDED CASE CIRCUIT BREAKERS

- A. NEMA AB 1, bolt-on type thermal magnetic and instantaneous magnetic trip circuit breaker. Circuit breaker thermal elements shall be of the bimetallic type and shall be capable of withstanding sustained overload and short-circuit currents without injury and without affecting the calibration of the bimetallic element. The thermal element shall have inverse time characteristics. The instantaneous elements shall trip the circuit breaker at the minimum standard trip setting.
- B. Provide common trip handle for multiple pole circuit breakers.
- C. Provide type SWD for lighting circuits and type HACR circuit breakers for air conditioning equipment circuits.
- D. Provide Class A ground fault interrupter circuit breakers as indicated on drawings.
- E. Trip rating shall be as indicated on drawings.
- F. Minimum integrated short circuit rating
 - 1. Circuit Breakers rated 240-Volts - 10,000 amperes RMS symmetrical
 - 2. Circuit Breakers rated 480-Volts - 42,000 amperes RMS symmetrical
 - 3. Circuit Breaker rating shall match or exceed the panel interrupting rating
 - 4. Series rated breakers are not acceptable

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install panelboards in accordance with NEMA PB 1.1 and NECA "Standard of Installation", NFPA 70 and IEEE C2.
- B. Install panelboards plumb.
- C. Install recessed panelboards flush with wall finishes.
- D. Provide handle ties or combined circuit breaker on all circuits sharing a neutral per NEC.
- E. Mounting height: 6 feet (1,800 mm) to top of panelboard. Install panelboards taller than 6 feet (1,800 mm) with bottom no more than 4 inches (100 mm) above floor.
- F. Install filler plates for unused spaces in panelboards.
- G. Provide typed circuit directory for each panelboard. Revise directory to reflect circuiting changes to balance phase loads.
- H. Install engraved plastic nameplates in accordance with Section 260553.
- I. Ground and bond panelboard enclosure according to Section 260526. Connect equipment ground bars of panels in accordance with NEC.

3.2 FIELD QUALITY CONTROL

- A. Field Inspect and testing shall be in performer under the provisions of NETA ATS 7.6 (1) (1) - Circuit Breaker, Low Voltage, Insulated Case/Molded Case, as outlined below:
1. Visual and Mechanical Inspection:
 - a. Compare equipment nameplate data with drawings and specifications.
 - b. Inspect physical and mechanical condition.
 - c. Inspect circuit breaker for correct mounting.
 - d. Operate circuit breaker to ensure smooth operation.
 - e. Inspect case for cracks or other defects.
 - f. Verify appropriate anchorage, required area clearances, physical damage, and correct alignment.
 - g. Inspect all doors, panels, and sections for corrosion, dents, scratches, fit, and missing hardware.
 - h. Verify that fuse and/or circuit breaker sizes and types correspond to drawings.
 - i. Perform circuit breaker inspections and operation test.

3.3 ADJUSTING

- A. Rearrange circuits in panelboard to balance phase loads to within 20 percent of each other.
- B. Maintain proper phasing for multi-wire branch circuits.

END OF SECTION

**SECTION 262726
WIRING DEVICES**

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Wiring devices are defined as single discrete units of electrical distribution systems that are intended to carry but not utilize electric energy. The types of general purpose wiring devices required for the project include, but are not limited to the following line voltage devices:
1. Connectors
 2. Plugs
 3. Receptacles
 4. Wall plates

1.2 RELATED SECTIONS

- A. Section 260500: Common Work Results for Electrical
- B. Section 260519: Low Voltage Power Conductors and Cables
- C. Section 260526: Grounding and Bonding for Electrical Systems
- D. Section 260553: Identification for Electrical Systems

1.3 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. IEC 529 Degrees of Protection provided by Enclosures.
- B. NEMA WD 1 General Purpose Wiring Devices
- C. NEMA WD 6 Wiring Device Configurations.

1.4 SUBMITTALS

- A. Product Information:
1. Catalog cut of each device showing Manufacturer name, catalog number, voltage and current rating and dimensions.

1.5 REGULATORY REQUIREMENTS

- A. Furnish products listed and classified by Underwriters Laboratories, Inc. (UL), Electrical Testing Laboratories, Inc. (ETL), or other recognized, acceptable testing and listing agencies as suitable for the purpose specified and shown.

PART 2 - PRODUCTS**2.1 GENERAL**

- A. Provide factory fabricated wiring devices in the type, color, electrical rating for service indicated, and/or as shown on the drawings.

2.2 MANUFACTURERS

- A. Provide products produced by one of the following, or Approved Equal:
 - 1. Appleton
 - 2. Arrow-Hart, Inc.
 - 3. Bryant Electric Co.
 - 4. Crouse-Hinds Co.
 - 5. General Electric Co.
 - 6. Hubbell Wiring Device Division
 - 7. Pass & Seymour
 - 8. Pyle National
 - 9. Russell & Stoll
 - 10. Slater
 - 11. Wiremold (multi-outlet assemblies)

2.3 RECEPTACLES

- A. Provide commercial grade, grounding type, heavy-duty receptacles with white plastic body, green hexagonal equipment ground screw terminal and grounding poles internally connected to mounting yoke; metal plaster ears; side wiring NEMA WD-6 as follows:
 - 1. Duplex Receptacle: Two pole, 3 wire, 20-ampere, 125-volt duplex receptacle, NEMA configuration 5-20R unless otherwise indicated.
 - 2. GFCI Receptacle: Two pole, 3 wire, 20-ampere, 125-volt duplex receptacle with integral ground fault circuit interrupter to meet regulatory requirements.
 - 3. Special Purpose: Two pole, 3 wire, 20-ampere, 125-volt single receptacle, twist-lock, NEMA configuration L5-20R as indicated.
 - 4. Two pole, 3 wire, 20-ampere, 250-volt single receptacle, twist-lock, NEMA configuration L6-20R as indicated.

5. Two pole, 3 wire, 20-ampere, 277-volt single receptacle, twist-lock, NEMA configuration L7-20R as indicated.
6. Two pole, 3 wire, 30-ampere, 125-volt single receptacle, twist-lock, NEMA configuration L5-30R as indicated.
7. Two pole, 3 wire, 30-ampere, 250-volt single receptacle, twist-lock, NEMA configuration L6-30R as indicated.
8. Two pole, 3 wire, 30-ampere, 277-volt single receptacle, twist-lock, NEMA configuration L7-30R as indicated.
9. Three phase, 4 wire, 20-ampere, 125/250-volt single receptacle, twist-lock, NEMA configuration L14-20R as indicated.
10. Three phase, 4 wire, 20-ampere, 250-volt single receptacle, twist-lock, NEMA configuration L15-20R as indicated.
11. Three phase, 4 wire, 20-ampere, 480-volt single receptacle, twist-lock, NEMA configuration L16-20R as indicated.
12. Three pole, 4 wire, 30-ampere, 125/250-volt single receptacle, twist-lock, NEMA configuration L14-30R as indicated.
13. Three pole, 4 wire, 30-ampere, 250-volt single receptacle, twist-lock, NEMA configuration L15-30R as indicated.
14. Special Purpose Receptacle: Type as required meeting the requirements of this Section and the equipment shown on the drawings and elsewhere specified.

2.4 PLUGS AND CONNECTORS

- A. Comply with NEMA Standards Publication No. WD-1. Provide 20 ampere, 125-volts, bakelite body connectors, 3-wire grounding, parallel blades, double wipe contact, with cord clamp.
- B. Matching Insulgrip, corrosion resistant nylon plugs, IP20, shall be provided for each twist-lock type receptacles unless indicated otherwise.

2.5 WALL PLATES

- A. Decorative Cover Plate: High impact, smooth nylon and smooth satin in finished areas. Color of nylon cover plate shall be white unless noted otherwise. Stainless steel cover plate in unfinished areas or where device is embedded in concrete.
- B. For projects where two separate power sources are provided, each power source receptacle shall have a different color cover plate such as black, gray, or brown. Emergency power source receptacles shall have a red cover plate.
- C. Weatherproof Cover Plate: Gasketed cast metal with lockable hinged gasketed device cover. Cover for duplex devices shall be designed such that each device is independently covered.

2.6 MULTI-OUTLET ASSEMBLIES

- A. Provide fixed multi-outlet assemblies consisting of #5362 grounding type, 20 ampere, 125-volt, two poles, three wire receptacles as an integral part, on 12-inch centers, unless otherwise noted.
- B. Where more than one circuit is indicated, do not connect adjacent receptacles to the same circuit. Include raceway snap-on covers with punched holes to accurately align receptacles.

2.7 HAZARDOUS RATED AREAS

- A. Switches, receptacles and other devices installed in hazardous areas shall be explosion-proof type in accordance with NFPA 70 and as shown on drawings.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Verify outlet boxes are installed at proper height.
- B. Verify wall openings are neatly cut and will be completely covered by wall plates.
- C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.
- D. Inspect each item of materials or equipment immediately prior to installation, and reject damaged and defective items.

3.2 PREPARATION

- A. Provide extension rings to bring outlet boxes flush with finished surface, if necessary.
- B. Clean debris from all boxes.

3.3 INSTALLATION

- A. Install wiring devices where indicated, in accordance with the manufacturer's written instructions, the applicable requirements of the NEC and the NECA "Standard of Installation", and in accordance with recognized industry practices to ensure that products serve the intended function.
- B. Coordinate with equipment manufacturer exact outlet type needed, prior to ordering.

- C. Comply with the manufacturer's applicable instructions and recommendations for installation, to whatever extent these are more explicit or more stringent than applicable requirements indicated in the contract documents.
1. Install devices plumb and level. Install switches with OFF position down
 2. Install vertically oriented grounded receptacles with grounding pole on top
 3. Connect wiring device grounding terminal to equipment grounding conductor.
 4. Connect isolated ground (IG) receptacle equipment (yoke) grounding terminal only at metallic box with bonding jumper
 5. Install decorative plates on switch, receptacle, and blank outlets in finished areas
 6. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets in utility areas. (Does not include multi-outlet assemblies, other similar locations.)
 7. Identify wiring devices as specified in Section 260553 - Identification for Electrical Systems.
 8. If single outlet in a duplex assembly is switched, that outlet shall be upside down in order for Owner to easily identify.

3.4 INTERFACE WITH OTHER PRODUCTS

- A. Coordinate locations of outlet boxes to obtain mounting heights compliant with ADA.
- B. Install wall switch at 42 inches to top of the maximum reach above finished floor for forward reach applications, 48 inches to top of reach for side reach applications. The lower reach shall be at or above 18 inches for forward reach and for side reach, unless otherwise noted.
- C. Install convenience receptacle 18 inches to center above finished floor, unless otherwise noted.
- D. Install convenience receptacle 6 inches to center above backsplash of counter, unless otherwise noted.
- E. Install dimmer 42 inches to center above finished floor, unless otherwise noted.
- F. Install telephone and/or data jacks 18 inches to center above finished floor, unless otherwise noted.
- G. Install telephone jack for wall telephone 42 inches to top of reach above finished floor for forward reach applications, and 48 inches above finished floor to top of reach for side reach applications to comply with the ADA. Receiver hook shall not be above 54 inches to its highest point above finished floor.
- H. Provide GFCI receptacles at all locations within 6-feet of a sink.

3.5 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Operate each wall switch with circuit energized and verify proper operation.
- C. Verify that each receptacle device is energized.
- D. Test each receptacle device for proper polarity.
- E. Test each GFCI receptacle device for proper operation.
- F. Verify that each telephone and data jack is properly connected and circuit is operational.

3.6 ADJUSTING

- A. Adjust devices and wall plates to be flush, plumb and level.

END OF SECTION

**SECTION 265000
LIGHTING**

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Lighting fixtures, lamps, ballasts, hangars, trim and diffusers.
- B. Supports, suspension systems, and blocking.
- C. Switches
- D. Occupancy sensors, and automatic control systems.

1.2 SUBMITTALS

- A. Provide submittals for the following:
 - 1. Light fixtures.
 - 2. Lamps.
 - 3. Ballasts.
 - 4. Occupancy sensors, switches, and power packs.
 - 5. Lighting Control Panels

1.3 WARRANTY

- A. Provide 5 year warranty on electronic ballast and occupancy sensors.

PART 2 - PRODUCTS

2.1 LIGHTING FIXTURES

- A. Provide lighting fixtures, lamps, ballasts and accessories complete and ready for operation. Furnish the fixtures as indicated on the Drawings and as listed in the fixture schedule. Verify in all cases, the lengths and quantity of fixtures necessary to achieve the indicated results.
- B. Provide lighting fixtures in the finishes and colors as noted on the Drawings. Where fixture finishes are noted to be "By Owner", include the available finishes when making fixture submittals, and obtain the Owners written selection of fixture finishes prior to ordering lighting fixtures.

- C. Prominently indicate in the submittals those fixture that are proposed to be provided with remote or separately mounted ballasts. Such fixtures must be specifically approved by the Owner in writing prior to ordering the fixtures.
- D. Provide the Underwriters Laboratories labels on all lighting fixtures.
- E. Equip fluorescent fixtures with CBM-ETL labeled ballasts provided with internally mounted automatic reset thermal protectors and silver plated sockets.
- F. All lighting fixtures shall have published photometric tests conducted by Electrical Testing Laboratories. Make available the test results upon request. Testing shall include candlepower distribution curves, total fixture efficiency, brightness and shielding angles in longitudinal and transverse directions.
- G. Observe the requirements of the California Building Code Section 5209 regarding plastic lighting diffusers. Fixtures and auxiliary equipment mounted against combustible material shall be approved for such installation.
- H. Make-up fixtures with Type AF or Approved Equal fixture wire. Provide an identified, approved landing lug for equipment ground wires.
- I. All light fixtures mounted in exterior or combustible locations shall be rated for that type of installation.

2.2 LENSES, REFLECTORS, AND TRIM

- A. Provide specialty lenses and frames such as Holophane™ type low glare lenses as indicated on the lighting fixture schedule. Verify that the fixture frames and trims are designed to function with the selected lens and the particular mounting conditions.
- B. Provide substantial light sealing and separation between individual lamp rows in the louver assemblies of 3-lamp recessed parabolic fluorescent fixtures. This shall be accomplished by the provisioning of ballast compartment covers between cells even if no ballasts are contained therein.

2.3 LAMPS

- A. Furnish all lamps of the same type, throughout the Project, from the same manufacturer.
- B. Fluorescent lamps:
 - 1. All fluorescent lamps shall be low mercury, Federal EPA TCLP compliant, extended life lamps.
 - 2. T-8 fluorescent lamps shall be extended performance, 3500- 4100 Kelvin, 86 CRI color rendering, long-life 24,000 hrs @ 3 hrs/start, GE Ecolux XL SPX lamps or Approved Equal.

3. T-5 fluorescent lamps shall be extended performance, 3500- 4100 Kelvin, 86 CRI color rendering, long-life 30,000 hrs @ 3 hrs/start, GE Ecolux lamps or Approved Equal.
4. Compact fluorescent lamps shall be low mercury, 3500-4100 Kelvin, 82 CRI color rendering, 10,000 hrs @ 3 hrs/start, Philips "PL-T ALTO", or Sylvania "DULUX ECOLOGIC" or Approved Equal.
5. Provide 3500-4100 Kelvin, tri-phosphor, energy saving, slim-line or high output fluorescent lamps where lamps longer than four feet long are specified.
6. All linear fluorescent lamps shall be provided with the same color temperature throughout project.

C. LED Lamps

1. All LED lamps shall have a greater than 25,000 hrs life, 85 CRI color rendering or higher, CCT greater or equal to 2700K. Phillips or Approved Equal.
2. LED fixtures shall be dimmable to a minimum of 10% if drawings identify dimming.
3. Fixtures shall be mercury free.

2.4 BALLASTS

A. Electronic Ballasts:

1. Provide fully electronic or hybrid style ballasts.
2. Power factor shall be greater than .85.
3. Ballast factor shall be greater than .87.
4. Total harmonic distortion (THD) shall not exceed:
 - a. 20% for a four foot fluorescent ballast
 - b. 32% for an eight foot fluorescent ballast.
5. Provide UL-listed ballasts that meet applicable California Energy Commission requirements.
6. Ballasts must be of the rapid-start type; instant-start is not acceptable.
7. Provide dimmable ballast as shown on drawings. Provide smooth dimming, step dimming is not acceptable.
8. Acceptable manufacturer: Magnetek, Motorola, or Approved Equal.

B. Rapid-Start Fluorescent Ballasts:

1. Energy-saving type, class P, CBM certified,
2. Ballasts shall have an "A" sound rating.
3. Acceptable manufacturers: Universal, Advance, Valmont, or Approved Equal.
4. Provide zero degree ballasts where used in exterior fixtures.

2.5 WALL SWITCHES

- A. Provide specification grade, quiet type, flush, 1-pole, 2-pole, three and four-way toggle switches, 20 ampere, 120/277-volts AC, with mounting yoke insulated from mechanism equipped with plaster ears and side wired screw terminals, white plastic body with toggle handle, NEMA WD-1.
1. Device Number: #1221, #1222, #1223, #1224
 2. Manufacturers: Hubbell, Pass & Seymour, Bryant or Approved Equal

2.6 OCCUPANCY SENSORS

- A. Provide occupancy sensing systems complete and ready for operation. Occupancy sensors, remote switches, and power packs shall be located as indicated on the Drawings. Power packs shall be located above ceiling unless noted otherwise. Observe the proper use of infrared or ultrasonic sensors as scheduled on the Drawings.
- B. All devices where a switch is present shall utilize the "manual on/automatic off" mode of operation, unless specified differently on drawings. All devices where no switch is present shall utilize the "automatic on/automatic off" mode of operation and shall fit in standard "Decora" style wall plates.
- C. Provide dual technology sensors unless specified differently on drawings.
- D. Provide occupancy sensing devices that are UL- listed and certified and listed in the Directory of Automatic Lighting Control Devices as published by the CEC.
- E. Self contained wall sensor switches shall have the following features:
1. 100-300 Volt, Coverage of 180 degrees, maximum 300 sq ft, 150 sq ft for desktop activity.
 2. Time delays: SmartSet (automatic), fixed (5,10,15,20,or 30 minutes), walk-through, test-mode.
 3. Sensitivity adjustment: SmartSet (automatic) or reduced sensitivity.
 4. 1.0 mm hard, poly IR 2 lens; 2 level lens for superior desktop detection.
 5. Advanced control logic based on RISC microcontroller with detection signature processing to eliminate false triggers and provides immunity to RFI and EMI, walk-through mode to turn lights off 3 minutes after the area is vacated, one-step light level control setup that learns desired hold-off level.
 6. Optional alerts for impending shut-off including light flash, audible, or both; LED to indicate occupancy detection.
- F. Occupancy sensors shall be Watt Stopper, or Approved Equal:
1. Wall sensor switch, 1-circuit, line voltage, dual technology.
 2. Wall sensor switch, 2-circuit, line voltage, dual technology.
 3. Ceiling sensor, line voltage, 360° coverage, dual-technology.

4. Ceiling sensor, low voltage, 360° coverage, dual-technology, for use with power-pack

2.7 TIME-SWITCHES AND PHOTO-SWITCHES

- A. Provide time-switches and photo-switches of the style and rating as indicated on the Drawings. Manufacturer shall be Tork or Approved Equal.
- B. Time-switches shall have a minimum of two circuits, a battery carry-over feature, lockable metal enclosure, and dead-front user accessible controls.

2.8 HAZARDOUS RATED AREAS

- A. Switches, fixtures and other devices installed in hazardous areas shall be explosion-proof type in accordance with NFPA 70 and as shown on drawings.

PART 3 - EXECUTION

3.1 GENERAL

- A. Install fixtures in straight, true lines and without visible gaps between fixtures and building surfaces and between fixtures in continuous rows. For linear wall mounted fixtures, ensure that the wall surface is finished flat, straight, and free of imperfections prior to mounting the fixtures. Replace or repair lighting fixture installations that are out of plumb or that have obvious gaps or misalignment.
- B. Provide fixtures and controls that can accomplish design requirements. Provide dimming, automatic sweep off, etc as shown on the drawings.
- C. Provide fixtures with the appropriate trim frames, flanges, canopies, and finish accessories to accommodate the ceiling conditions. Prior to ordering fixtures, and throughout the Project, verify the exact ceiling types, finishes, and thicknesses and coordinate the fixture installation therewith.
- D. Refer to the Drawings, particularly the Owner's elevations and reflected ceiling plans, in determining the exact mounting location and height of lighting fixtures. For wall mounted or suspended fixtures that do not have the mounting heights clearly indicated, contact the Owner for clarification prior to ordering pendants and installing the fixtures.
- E. Following installation of HID and fluorescent lighting fixtures, and prior to completion of the Project, perform a burn in test of the lights. The burn in test shall consist of operating the fixtures continuously for a minimum of forty-eight (48) hours. Replace lamps that are inoperative or that show signs of flicker or color wander. If

building power is not available for the burn in test, then provide a portable generator, fuel, and temporary connections for the stipulated period.

- F. Provide final touchup painting to repair fixture finishes which are nicked or marred during installation. Obtain the paint from the fixture manufacturer.
- G. Install recessed fixture to permit removal of lamps from below.
- H. Install recessed light fixture using accessories and firestopping materials to meet regulatory requirements for fire rating.
- I. Install clips to secure recessed grid-supported fixtures in place.
- J. Install wall-mounted luminaries at height as indicated on Drawings. Coordinate exact location in field with Owner.
- K. Install accessories furnished with each light fixture.
- L. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaries.
- M. Install lamps in each light fixture unless noted otherwise.
- N. Ground and bond interior luminaires in accordance with Section 260526 Grounding and Bonding for Electrical Systems.

3.2 AUDIBILITY

- A. Fixtures shall be free from any undesirable hum, vibration, or noise. Provide lighting equipment suitable for the intended ambient sound levels. Where necessary to meet this criteria, provide additional means of sound deadening, whether or not specifically indicated. Fixtures that are found to be unsatisfactory in the opinion of the Owner shall be removed and replaced at the Contractor's expense.

3.3 SUPPORTS AND BLOCKING

- A. Provide hangers, suspension cables, and blocking for lighting fixtures that will provide support independent of suspended ceilings, ceiling or wall surfaces, and electrical outlet boxes. Exception: Fixtures less than 12 inches in all dimensions and weighing less than six pounds may be permitted to be supported from the electrical outlet box if the box itself is independently supported by blocking or hangars.
- B. Refer to the Drawings for specific blocking details and seismic mounting details for lighting fixtures.

3.4 EXTERIOR POLE MOUNTED FIXTURES AND BOLLARDS

- A. Provide pole base footings in accordance with the Drawings. Footings shall be reinforced concrete with anchor bolts sized and located in accordance with the manufacturer's recommendations for the geographic locality. Provide reinforced concrete in accordance with the requirements as stipulated elsewhere in these Specifications. Forms for pole bases shall be placed using resin-lined Sono-tube or Approved Equal to give a smooth finished appearance. Patch and sack cracks and voids in the bases to match the surrounding surface.
- B. Verify the exact location of underground facilities in the vicinity of pole bases prior to boring holes and bring potential conflicts to the attention of the Owner. Use an anchor bolt template as provided by the manufacturer for the placement of anchor bolts and substantially brace the forms to ensure that the base remains straight and plumb. Refer to the Drawings for fixture orientation and alignment, and utilize a transit site or snap line to verify same.
- C. Exposed surfaces of concrete bases or footing shall be finished smooth without cracks, voids, or jagged edges. Chamfer and float the base after pouring concrete to achieve a finished appearance. In order to allow leveling of the pole, install the pole base-plate one inch above the top of the concrete footing. Level the pole plumb and pack the space under the base-plate with Embeco dry pack grout or Approved Equal.
- D. For fixtures with adjustable aiming or reflectors, arrange to perform a final adjustment of aiming at night under the Owner's direction.

3.5 CLEANING

- A. Remove dirt and debris from enclosures.
- B. Clean photometric control surfaces as recommended by manufacturer.
- C. Clean finishes and touch up damage.

3.6 OBSTRUCTIONS

- A. Verify throughout the Project that mounting locations and suspension systems remain free of obstructions. Suspended or pendant mounted fixtures must be free to swing 45 degrees in all directions without hitting obstructions or other fixtures. Provide seismic rated swivel ball hangars for pendant mounted lighting fixtures to achieve the proper swing.

END OF SECTION

DIVISION 27
COMMUNICATIONS

**SECTION 271000
TELECOMMUNICATIONS INFRASTRUCTURE**

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Complete local area network (LAN) structured cabling system in accordance with the following published standards, hereinafter referred to as the "Standards":
- B. ANSI/TIA/EIA 568A "Commercial Building Telecommunications Cabling Standard".
 - 1. ANSI/TIA/EIA 569 "Commercial Building Standard for Telecommunications Pathways and Spaces".
 - 2. EIA/TIA TSB-67 "Transmission Performance Specifications for Field Testing of UTP Cabling Systems".
 - 3. ANSI/TIA/EIA 606 "Administration Standard for the Telecommunications Infrastructure of Commercial Buildings".
 - 4. TIA/EIA 607 "Commercial Building Grounding and Bonding Requirements for Telecommunications".
 - 5. ANSI/TIA/EIA-A-5.
 - 6. EIA/TIA TSB-95.
 - 7. TIA/EIA 568 - Commercial Building Telecommunication Cabling Standard.
- C. The scope of the LAN infrastructure includes the following:
 - 1. Provisioning of telecommunications equipment rooms and closets including:
 - a. Main distribution facilities (MDF).
 - 2. Pathways including conduits, junction boxes, cable trays, ducts, wire-ways, cable supports, and cabling management systems.
 - 3. Freestanding floor and/or wall mounted equipment racks.
 - 4. Backbone cabling.
 - 5. Horizontal cabling.
 - 6. Telecommunication outlets and data jacks.
 - 7. Cross-connect fields, interconnect / patching equipment, patch-panels, patch cables, wiring blocks and cable terminations at the MDFs/MDFs.
 - 8. Documentation and labeling.
 - 9. Cable testing and reports.
 - 10. Terminal Backboard.
 - 11. Telecommunication Ground Bus Bar.
 - 12. Any other work as might reasonably be implied as required, even though not specifically mentioned herein or shown on the drawings.

1.2 RELATED SECTIONS:

- A. Section 260500: Common Work Results for Electrical
- B. Section 260519: Low Voltage Power Conductors and Cables
- C. Section 260526: Grounding and Bonding for Electrical Systems
- D. Section 260533: Raceway and Boxes

1.3 QUALIFICATIONS

- A. Installer: Company specializing in installing products specified in this section with minimum three years' experience.
- B. All clean up activity related to work performed will be the responsibility of the Low Voltage Contractor and must be completed daily before leaving the site.

1.4 WORK NOT INCLUDED

- A. Hubs, switches, routers, transceivers, and other active network equipment.
- B. Servers and workstation equipment.

1.5 SUBMITTALS

- A. Backbone and horizontal cabling including but not limited to the following:
 - 1. Unshielded twisted pair (UTP) cables.
- B. Connectors, splices, and terminations used for UTP cabling.
- C. Distribution equipment racks, frames, bracing, and anchors.
- D. Surface raceway, cable tray, and cable management systems.
- E. Cross-connect punch-down blocks, UTP modular patch-panels, FO management panels, and components.
- F. Telecommunication outlet jacks, boxes, bezels, modules, and cover-plates.

1.6 COORDINATION

- A. Coordinate with Owner on all new telecommunication connections. Verify exact location and existing products used.

1.7 MAINTENANCE**A. Extra Materials**

1. Cross-Connect Wire: Provide one 500-foot reel of each type for use by Owner.

PART 2 - MATERIALS**2.1 RACEWAYS, PATHWAYS, AND BOXES**

- A. Provide conduit, wireway, cable-trays, junction boxes, and outlet boxes as indicated on the Drawings. Materials shall be in accordance with Specification Section 260500 in addition to specific requirements of the Standards.
- B. Provide pull-lines in both empty and partially occupied data and telecomm raceways. Partially occupied raceways are considered to be those that are filled to less than 40 percent of the cross sectional area of the raceway. Pull-line sizes and types are as follows:
 1. Conduits 1¼" and smaller: 3/16" polyester pre-measured printed tape, Greenlee Textron #434 or Approved Equal.
 2. Conduits 1½" and larger: 1/4" Kevlar pre-measured printed tape, Greenlee Textron #39243 or Approved Equal.
- C. Provide rough-in outlet boxes for data and telecomm outlets in size 4-11/16" square by 2-1/8" deep with single gang plaster rings. Select special knockout provisions to match the conduit entries indicated on the Drawings.

2.2 TERMINAL BACKBOARDS

- A. 3/4" exterior grade plywood, finished on one side. Furnish in 4' x 8' sheets and cut to fit the available space. Finish with two coats of white fire retardant paint. Leave one label unpainted.

2.3 EQUIPMENT RACKS

- A. Fixed wall-mount rack for MDF: 19" EIA width, 24.5" height, 18" depth, four leg frame, 200 lbs. load rating. Chatsworth CPI #11960-718 or Approved Equal. Provide blocking and anchorage to the wall.

2.4 CABLE TRAY AND RACK SYSTEMS

- A. Wall mounted half-rack where shown on drawings and for cable management in IT room: Extruded aluminum construction, 3" loading depth, 9" rungs on 6" spacing, flush mounted without spacers or brackets, B-Line "HALF-RACK" #C3A1H06-09-or

Approved Equal length as shown. Provide #B594 Or Approved Equal clevis U-brackets at 32" maximum on center.

2.5 PATCH PANELS AND CROSS-CONNECTS

- A. All UTP components shall be rated to CAT-6 including cable, outlets, terminations, and patch panels.
- B. Fiber optic (FO) components:
 - 1. Fiber Optic termination panels, wall mounted: Panduit #FWME2 or Approved Equal.
 - 2. Fiber Optic interconnect drawer, rack mounted: Panduit #FMD2 or Approved Equal.
 - 3. Fiber Optic adapter panel for duplex SC connectors: Panduit #FAP3WDSC or Approved Equal. (Two required per twelve fiber cable).
 - 4. Blank Adapter panels: Panduit #FAPB or Approved Equal.
- C. Unshielded twisted pair (UTP) components:
 - 1. Cat 6 UTP termination panels, 48 port, rack-mounted: Panduit #CP48BL or Approved Equal.
 - 2. Cat 6 UTP termination modules, T568B (RJ45 type): Panduit #CJ688T3-X (color per scheme) or Approved Equal.
- D. Inter-Connect patch Cords: Four twisted-pair stranded, Category 6 Enhanced Power Sum or Approved Equal, 24 AWG copper conductors. Individual conductors PVC jacketed. Connector plug shall be polarized to prevent polarity reversal or split pairs, and shall be factory-marked to indicate top of connector. Inter-connect cord shall be UL listed.
 - 1. The Contractor shall complete data interconnects between patch panels and Owner-provided active network electronics.
 - 2. Minimum performance specifications:
 - a. The data equipment inter-connect cable must meet the impedance, attenuation and NEXT requirements for Category 6 Horizontal Cable of EIA / TIA 568 B.
- E. Cross-Connect Wire: One and Two twisted pair, 24 AWG solid copper conductors. Individual conductors PVC jacketed. One pair shall be yellow/blue color code and 2 twisted pairs shall be red/blue and red/orange coded. Must be UL listed for use as cross-connect wire.
 - 1. Contractor to assist Owner to perform all voice cross-connects.
 - 2. Minimum performance specifications:

- a. Cross-connect wire used on "voice" (telephone) cross-connects must meet the EIA/TIA 568 B impedance, attenuation and NEXT requirements for Category 3 horizontal cable.

F. Cable management components:

1. Vertical cable management, 4"x5" plastic wiring duct, front and rear: Cooper B-line #SB860 (on sides of racks) or Approved Equal.
2. Horizontal cable management, 3"x3" plastic wiring duct on front, 2"x4" plastic wiring duct on rear, 2 rack space unit: Cooper B-line #SB870 (required between patch panels and at top and bottom) or Approved Equal.
3. Cable ties: Velcro type, Panduit HLT or HLS series or Approved Equal.

G. Termination Hardware at MDF's (Voice only) See drawings for locations.

1. All cables installed for voice application shall be terminated in accordance with industry standards on 110S type wiring blocks.
2. Avaya 110A type wiring blocks with metal backboard category 6 insulation displacement style, or Approved Equal shall be installed with sufficient spacing to permit the orderly routing of jumper cables between wiring blocks, and wire management accessories shall be provided for each 110 block.
3. UTP cable terminating blocks: Compact 110-type or Approved Equal Category 6 insulation displacement terminal blocks complete with mounting hardware, connecting blocks, retainers, wire guides, designation strips, etc, UL listed.
 - a. Minimum performance specifications: Must meet EIA/TIA 568-A Section 10 requirements for Category 6.

2.6 UNSHIELDED TWISTED PAIR (UTP) CABLE

- A. Category 6 UTP cable: Unshielded, 4 twisted-pair, 24 AWG copper, Category 6, NEC Article 800 type CMR rated, non-plenum type, tested to 550MHz, Superior Essex DataGain Category 6, #66-246-xA, or Approved Equal, color per established scheme or at owners IT representatives directive.
- B. Category 6 UTP cable: Unshielded, 4 twisted-pair, 24 AWG copper, Category 6, NEC Article 800 type CMP rated, plenum type, tested to 550MHz, Superior Essex DataGain Category 6, #66-246-xA, or Approved Equal, color per established scheme or at owners IT representatives directive.
- C. Other UTP cable: As indicated on the Drawings.

2.7 TELECOMMUNICATIONS OUTLETS & DATA JACKS

- A. Where individual wall data outlets are indicated, provide 4-port, single-gang outlets with bezels, adapters, faceplates, and Category 6, RJ45 modules. The actual quantity and configuration of activations shall be as scheduled on the Drawings.

1. Faceplate bezel: Panduit #CBEIW or Approved Equal.
 2. Sloped inserts: Panduit #CHS2IW-X or Approved Equal.
 3. Blank inserts: Panduit #CHB2IW-X or Approved Equal.
 4. Modular jacks, T568B (RJ45 type): Panduit #CJ688T3-X or Approved Equal (color per scheme).
- B. Verify the color selection of data and telecommunications devices in the finished environment with the Owner prior to installation.

PART 3 - EXECUTION

3.1 CABLE AND WIRE INSTALLATION

- A. Provide and install of all data and voice cables including all supports, hangers, and hardware necessary for a complete installation. Under no circumstances shall cables be laid on the suspended ceiling or on floors when installed under raised floors. Provide and install all necessary cable support hardware to meet Category 6 requirements.
- B. At each voice/data closet cables are to be segregated by type, neatly tied together and routed to the patch panels and 110 blocks. All cables shall be tagged.
- C. Cable distances from patch panels to data outlet shall not exceed 295 feet. This contractor is responsible to ensure the distance specified is not exceeded.
- D. Care shall be exercised in routing both station and backbone/tie cables so as to avoid areas where sources of high levels of EMI (such as electric motors, transformers and fluorescent lighting fixtures) may exist. Maintain a minimum distance of 12 inches from these sources when run parallel. Cross at 90-degree angles where crossing must occur.
- E. Each station cable shall be "home run" (no splices or cross connection points) between jacks and patch panels.
- F. All openings or raceway transitions through firewalls and floors shall utilize UL listed fire-rated penetrations.
- G. Allow slack in Category 6 Cable bundles at entrances and exits of conduit sleeves and at transitions from "J" hooks to cable trays. Never pull cables tight at cable tray transitions; doing so may damage the cables by crimping them on the cable tray side of the bundles.
- H. Keep the cable evenly distributed within the cable tray. Do not allow the cables or bundles to be pulled tight against the splines or to be unevenly balanced on one side of the tray.

3.2 RACEWAYS, PATHWAYS, AND BOXES

- A. Install conduit, wireway, j-hooks, cable-trays, junction boxes, and outlet boxes as indicated on the Drawings. Installation methods shall be in accordance with Section 260533: Raceway and Boxes for Electrical Systems in addition to the specific requirements of the Standards.

B. FIRE AND SMOKE PARTITION PENETRATIONS

- 1. Conduit sleeves shall be provided as part of this contract as a means of routing cables through fire-rated walls and floors. Openings in sleeves and conduits used for system cables and those that remain (empty) spare shall be sealed with an approved fireproof, removable sagging material at completion. Sleeves, which pass vertically from floor to floor, shall be sealed in a similar manner using an approved re-enterable system. Additional penetrations through rated assemblies, necessary for passage of voice/data wiring, shall be made using an approved method and permanently sealed after installation of cables.

3.3 TERMINATIONS AND SPLICES

- A. Perform terminations and splices of backbone and horizontal cabling at each the MDF and station outlets. Splices and terminations shall be performed only by competent technicians proficient in latest standardized procedures.
- B. Category 6 UTP cabling terminations shall be performed using the insulation displacement contact (IDC) method. Take special care to observe jacket cut-back and pair twist requirements to preserve the performance of data cabling.
- C. Route, lace, and support both FO and UTP cabling in accordance with the Standards. Observe published bending radius and pulling tension limitations during installation.
- D. The entire UTP channel shall be installed, terminated, and tested to meet or exceed CAT-6 standards.
- E. Provide a minimum of 7' slack for UTP cable at each MDF, 10' slack at ceiling panels, and 1' slack at data outlets to allow for adds/moves/changes.
- F. Provide a service loop for FO cable at each MDF consisting of a minimum of 15' of cable at or above the ceiling in the vicinity of the termination rack. In addition, at the FO termination tray, provide a minimum of 36" extra strip length for the buffer tube & fan-out assembly to allow each termination to be removed from the tray for inspection and assembly without disturbing adjacent terminations.

3.4 TERMINAL BACKBOARDS AND EQUIPMENT RACKS

- A. Fasten backboards securely to the structural wall framing. Provide blocking between wall studs or metal framing prior to application of wall finishes where substantial

support cannot be obtained for the wall framing alone. Install the board with the finished side out and secure with #12 x 3" all-purpose screws spaced at not more than two feet apart.

- B. Anchor freestanding equipment racks to the building floor with 3/8" x 3" lag screws or concrete expansion wedge anchors fastened through the base plate. Provide a minimum of four (4) anchors per rack. In addition racks over 47" high shall be tied back to the building structure at the top using a brace for additional seismic support.

3.5 TELECOMMUNICATIONS OUTLETS & DATA JACKS

- A. Provide flush, large, double gang, back-boxes with single gang plaster rings for mounting of telecommunications outlets in finished walls.
- B. Where station outlets are indicated with voice and data services combined, use a different color jack for each service. The jack color assignments shall be consistent throughout the entire Project.
- C. Unless otherwise indicated, wire Category 6, UTP data jacks to the TIA 568B wiring configuration.
- D. Surface mounted devices shall only be used if shown on drawings or directed by Owner.
- E. Each outlet location shall be identified with a distinct callout and identified on each cable based on room number.

3.6 LABELING: LABELING SHALL INCLUDE, BUT NOT BE LIMITED TO:

- A. Labeling telecommunications outlet faceplates;
- B. Labeling station cables;
- C. Labeling terminal blocks;
- D. Labeling fiber optic cable sheaths;
- E. Labeling of all grounding conductors and ground bars in the Main Distribution Facility (MDF).
- F. Station Cables/FO:
 - 1. All labels shall be polyester with white color.
 - 2. Station Cables: All labels shall be at least 1.00- inches in width and 1.33-inch in length; with a 0.5-inch x 1-inch printable area;
 - 3. Labels shall have an adhesive backing.

4. Labels shall be attached to cable sheaths by wrapping around the sheath with the adhesive back self-laminating portion.
5. Labels shall be laser printed with the labeling scheme as specified.

G. Cable / outlet / jack / termination identification:

1. Each copper cable, its associated 568A jack at the outlet, and the associated C-4 connecting block on the terminal block or patch panel shall be labeled with a unique identifier consisting of the following:
 - a. The MDF room number where the station cable is terminated, ###.
 - b. The end user room number in which the 4-pair cable is terminated and the telecommunications outlet is located, ###.
 - c. A 3-digit serial number, reset to 001 for each room, which sequentially identifies each telecommunications jack / cable in a room, ###.
2. Example of MDF 101, user room 129, outlet number 1: 101-129-001

3.7 TESTING AND DOCUMENTATION

- A. Testing for UTP cable shall follow TSB-95 and shall include the following: Return Loss, PS-ELFEXT, Far-end crosstalk, Power sum far-end crosstalk, Power sum near-end crosstalk, ACR, Delay, and Delay Skew. Testing shall include both Basic Link and Level II tests. Horizontal UTP cable shall meet the performance criteria as stipulated in the table below and as amended by the Standards. Replace, re-splice, or re-terminate cables that do not meet the specified performance criteria. Retest and document the replacement cables.
1. Characteristic impedance: 100 ohms $\pm 15\%$ from 1 MHz to 100 MHz, $\pm 22\%$ from 100 MHz to 200 MHz, $\pm 25\%$ from 200 MHz to 250 MHz, $\pm 32\%$ from 250 MHz to 350 MHz.
 2. Minimum ACR: 26dB at 100 MHz and 7dB at 250 MHz.
 3. Attenuation is given as the maximum allowable attenuation in dB per 100m for the worst pair in the cable.
 4. NEXT (near end cross talk) is given as the minimum allowable NEXT loss in dB for the worst pair in the cable.
- B. Horizontal UTP cable connections shall meet the performance criteria as stipulated in the Standards. Replace, re-splice, or re-terminate cables that do not meet the specified performance criteria. Retest and document the replacement connectors.

3.8 IDENTIFICATION AND CABLING MANAGEMENT

- A. Permanently and clearly identify individual cables, fibers, and grounding conductors at outlets, terminations, and cross connects in accordance with TIA/EIA 606 standards.

- B. Clearly identify each cable at MDF and outlet location.
- C. Identify at the following locations:
 - 1. Within 12 inches of the point that the cable exits the top or bottom of the 110P-type terminal block column.
 - 2. Within 12 inches of the point that the cable enters a splice.
 - 3. At 40-foot intervals above T-Bar ceilings.
 - 4. At pull boxes
 - 5. Within 12 inches of the point that the cable enters or exits wall and floor sleeves.
- D. Cable pair identification:
 - 1. Identify all riser cable pairs in 5-pair increments on a 110 terminal block designation strip. The numbering shall be 4 digits beginning with "0001" and continuing through "0800". The Contractor shall provide white, laser printer generated designation strips.
 - 2. Identify all riser cable pairs in 5-pair increments on 25-pair connectors. The numbering shall be 4 digits beginning with "0001" and continuing through "0800".
- E. Warning Tags: At each location where fiber cable is exposed, it shall be marked with warning tags. These tags shall be yellow or orange in color, and shall contain the warning: "CAUTION FIBER OPTIC CABLE". The text shall be permanent, black, block characters, and at least 3/16 high. A warning tag shall be permanently affixed to each exposed cable or bundle of cables, at intervals of not more than (5) feet. Any section of exposed cable, which is less than five (5) feet in length, shall have at least one warning tag affixed to it.
- F. Develop a record keeping system for the Project that tracks the location, use, and status of telecommunications and LAN Infrastructure components and equipment.
- G. Prepare and submit a report that cross references the linkages between the various components and equipment.
- H. Prepare a Excel based administration system that documents the above elements. Provide three copies of the system and provide electronic copy of document in Excel format to the Owner.
- I. For facilities with a functional Telecommunications Administration System in place, prepare the required reports in a compatible format, and coordinate with Owner's IT personnel in the preparation and execution of the reports.

END OF SECTION

DIVISION 31
EARTHWORK

**SECTION 31 0000
EARTHWORK**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Excavation and/or embankment from existing ground to subgrade, for roadways, driveways, parking areas, walks, paths, or trails and any other site improvements called for on the Plans.

1.02 SECTION EXCLUDES

- A. Earthwork related to underground utility installation, see Section 31 2300.

1.03 RELATED SECTIONS

- A. Section 31 2300, Excavation and Fill.
- B. Section 33 4600, Subdrainage.

1.04 RELATED DOCUMENTS

- A. ASTM:
 - 1. D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
 - 2. D 1586, Method for Penetration Tests and Split-Barrel Sampling of Soils.
 - 3. D 2487, Classification of Soils for Engineering Purposes.
 - 4. D 3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
 - 5. D 4318, Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 - 6. E 329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
 - 7. E 548, Guide for General Criteria Used for Evaluating Laboratory Competence.
- B. California Building Code, California Code of Regulations, Title 24, Part 2, Chapter 18, Foundations, and Retaining Walls and Chapter 33, Site Work, Demolition and Construction.
- C. Caltrans Standard Specifications, latest edition:
 - 1. Section 17, Watering.
 - 2. Section 19, Earthwork.
- D. CAL/OSHA, Title 8.
- E. Sonoma County Standard Drawings for Public Improvements.

1.05 DEFINITIONS

- A. Borrow: Approved soil material imported from off-site for use as Structural Fill or Backfill.
- B. Excavation: Removal of material encountered above subgrade elevations.
 - 1. Authorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions as shown on plans or authorized by Owner.

2. Unauthorized Over-Excavation: Excavation below subgrade elevations or beyond indicated horizontal dimensions without authorization by Owner. Unauthorized excavation shall be without additional compensation.
- C. Structural Backfill: Soil materials approved by Owner and used to fill excavations resulting from removal of existing below grade facilities, including trees. See Section 31 2300 for trench backfill.
- D. Structural Fill: Soil materials approved by Owner and used to raise existing grades.
- E. Rock: Rock material in beds, ledges, unstratified masses, and conglomerate deposits and boulders of rock material $\frac{3}{4}$ -cubic yards or more in volume that when tested, according to ASTM D 1586, exceeds a standard penetration resistance of 100 blows/2-inches.
- F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man made stationary features constructed above or below grade.
- G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, base or topsoil materials.
- H. Unsuitable Material: Any soil material that is not suitable for a specific use on the Project. Owner will determine if a soil material is unsuitable.
- I. Utilities: onsite underground pipes, conduits, ducts and cables.

1.06 SUBMITTALS

- A. Samples:
 1. If required by Owner, provide 40-pound samples sealed in airtight containers, tagged with source locations and suppliers of each proposed soil material from on-site or borrow sources. Do not import materials to the Project without written approval of Owner.
 2. Provide materials from same source throughout work. Change of source requires approval of Owner.
- B. Material Test Reports: Provide, from a qualified testing agency, the following test results showing compliance with the project requirements:
 1. Classification according to ASTM D 2487 of each onsite or borrow soil material proposed for fill and backfill.
 2. Laboratory compaction curve in conformance with ASTM D 1557 for each onsite or borrow soil material proposed for fill and backfill.

1.07 QUALITY ASSURANCE

- A. Conform all work to the appropriate portion(s) of Caltrans Standard Specifications, Section 17 and 19.
- B. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.
- C. Perform excavation, filling, compaction and related earthwork under the observation of Owner. Materials placed without approval of Owner will be presumed to be defective and, at the discretion of Owner, shall be removed and replaced at no cost to Owner. Notify Owner at least 24-hours prior to commencement of earthwork and at least 48 hours prior to testing.

- D. Owner will perform observations and tests required to enable Owner to form an opinion of the acceptability of the Project earthwork. Correct earthwork that, in the opinion of Owner, does not meet the requirements of these Contract Documents.
- E. Upon completion of the construction work, certify that all compacted fills and foundations are in place at the correct locations, and have been constructed in accordance with sound construction practice. In addition, certify that the materials used are of the types, quality and quantity required by these Contract Documents. The Contractor shall be responsible for the stability of all fills and backfills constructed by his forces and shall replace portions that in the opinion of Owner have been displaced or are otherwise unsatisfactory due to the Contractor's operations.
- F. Finish subgrade tolerance at completion of grading:
 - 1. Building and paved areas: ± 0.05
 - 2. Other areas: ± 0.10 feet.

1.08 PROJECT CONDITIONS

- A. Protect open excavations, trenches, and the like with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- B. Prevent erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.
- C. Temporarily stock-pile fill material in an orderly and safe manner and in a location approved by Owner.
- D. Environmental Requirements: When unfavorable weather conditions necessitate interrupting earthwork operation, areas shall be prepared by compaction of surface and grading to avoid collection of water. Provide adequate temporary drainage to prevent erosion. After interruption, compaction specified in last layer shall be re-established before resuming work.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from on-site excavations.
- B. Obtain approval of on-site soil materials and borrow materials to be used for structural fill or structural backfill from Owner.
- C. On-Site Structural Fill and Structural Backfill: Soil or soil-rock mixture from on site excavations, free of deleterious substances. On-site structural fill and backfill shall not contain rocks or rock fragments over 6 inches in greatest dimension and not more than 15 percent shall be over 2-1/2 inches in greatest dimension and with an organic content less than 3.0 percent by weight.
- D. Imported Structural Fill and Structural Backfill: Conform to the requirements of on-site structural fill. Material shall also be a non-expansive and predominantly granular soil or soil-rock mixture with plasticity index of 15 or less in accordance with ASTM D 4318 and an R-Value of 25 or greater.

PART 3 EXECUTION**3.01 GENERAL**

- A. Conform to Section 19, Earthwork, Caltrans Standard Specifications as modified by the Contract Documents.
- B. Placement and compaction of material by flooding, ponding, or jetting will not be permitted.
- C. The use of explosives will not be permitted.

3.02 CONTROL OF WATER AND DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding the site and surrounding area. Provide dewatering equipment necessary to drain and keep excavations and site free from water.
- B. Dewater during backfilling operation so that groundwater is maintained a least one foot below level of compaction effort.
- C. Obtain Owner's approval for proposed control of water and dewatering methods.
- D. Protect subgrades from softening, undermining, washout and damage by rain or water accumulation.
- E. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations.
- F. Maintain dewatering system in place until dewatering is no longer required.

3.03 WET WEATHER CONDITIONS

- A. Do not prepare subgrade, place or compact soil materials if subgrade or materials are above optimum moisture content.

3.04 BRACING AND SHORING

- A. Conform to California and Federal OSHA requirements.
 - 1. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the facility being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.
 - 2. Be solely responsible for all bracing and shoring and, if requested by Owner, submit details and calculations to Owner. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations related to the proposed facility shall precede a response to the submittal by Owner.
 - 3. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the position or operation of the facility being constructed or adjacent utilities and facilities.

3.05 EXCAVATION

- A. Excavate earth and rock to lines and grades shown on drawings and to the neat dimensions indicated on the Plans, required herein or as required to satisfactorily compact backfill.
- B. Remove and dispose of large rocks, pieces of concrete and other obstructions encountered during excavation.
- C. Where forming is required, excavate only as much material as necessary to permit placing and removing forms.
- D. Provide supports, shoring and sheet piles required to support the sides of excavations or for protection of adjacent existing improvements.

3.06 REMOVAL OF EXISTING FILLS AND UNSUITABLE MATERIAL

- A. Over-excavate areas of existing fills and other unsuitable material encountered during mass grading as directed by Owner.
- B. Compensation for increased removal widths and depths that are not required by Owner will not be considered, except when such increase is necessary for protection of life and property as determined by and approved by Owner.
- C. Owner will provide written approval for each excavation prior to placement of fill. Allow adequate time after excavation and before filling for Owner's review and written approval and, if necessary, time for Owner to conduct as built survey prior to placing fill. Basis for calculating the quantity of material excavated or placed may be the difference between the grading shown on the Plan and an as-built survey of the grading.

3.07 GRADING

- A. Uniformly grade the Project to the elevations shown on plans
- B. Finish ditches, gutters and swales to the sections, lines and grades indicated and to permit proper surface drainage.
- C. Round tops and bottoms of slopes as indicated or to blend with existing contours.

3.08 SUBGRADE PREPARATION

- A. Install underground utilities and service connections prior to final preparation of subgrade and placement of base materials for final surface facilities. Extend services so that final surface facilities are not disturbed when service connections are made.
- B. Prepare subgrades under the structural section of paved areas, curbs, gutters, walks, structures, other surface facilities and areas to receive structural fill.
- C. Prepare subgrades for the structural section of paved areas, curbs and gutters by plowing or scarifying surface at least 6 inches below final subgrade elevations and 5-feet beyond edge of pavement unless specified otherwise by Owner. Uniformly moisture condition to obtain optimum moisture contents. Break clods and condition surface by harrowing or dry rolling. Remove boulders, hard ribs and solid rock. Prepare earth uniform for full depth and width of subgrade.

- D. Protect utilities from damage during compaction of subgrades and until placement of final pavements or other surface facilities.
- E. Obtain Owner's approval of subgrades prior to placing pavement structural section.

3.09 PLACEMENT OF STRUCTURAL FILL

- A. Obtain Owner's approval of surface to receive structural fill prior to placement of structural fill material.
- B. Place structural fill on prepared subgrade.
- C. Spread structural fill material in uniform lifts not more than 8-inches in un-compacted thickness and compact.
- D. Place structural fill material to suitable elevations above grade to provide for anticipated settlement and shrinkage.
- E. Overbuild fill slopes, as required by Owner, to obtain required compaction. Remove excess material to lines and grades indicated.
- F. Do not drop fill on structures. Do not backfill around, against or upon concrete or masonry structures until structure has attained sufficient strength to withstand loads imposed and the horizontal structural system had been installed.

3.10 KEYWAYS AND BENCHES

- A. Provide keyways as indicated for fill slopes steeper than 6 horizontal to 1 vertical. Extend keyway 5-foot minimum into competent, undisturbed soil or 3-foot minimum into competent, undisturbed rock as directed by Owner.
- B. Place subsurface drains in bottom of keyway in conformance with Section 33 4600.
- C. Bench subgrade as indicated above toe of fill.
- D. Place subsurface drains at benches every 20 vertical feet or as directed by Owner.

3.11 LOT FINISH GRADING

- A. Blade finish lots to lines and grades indicated.

3.12 COMPACTION AND TESTING

- A. Do not compact by ponding, flooding or jetting.
- B. Compact soils at optimum water content. Aerate material if it is too wet. Add water to material if it is too dry. Thoroughly mix lifts before compaction to ensure uniform moisture distribution.
- C. Perform compaction using rollers, pneumatic or vibratory compactors or other equipment and mechanical methods approved by Owner.
- D. Compaction requirements:
 - 1. Compact structural fills less than 5-feet thick to 90 percent compaction.

2. Compact structural fill 5-feet thick or greater to 95 percent compaction.
3. Compact the upper 6 inches of subgrade soils beneath pavements, curbs and gutters to 95 percent compaction. Extend compaction 5-feet beyond pavement edges unless specified otherwise by Owner.
4. Compact the upper 6-inches of subgrade soils under walks, structures and areas to receive structural fill to 90 percent compaction.

3.13 SOIL STERILIZATION

- A. Apply soil sterilant to areas indicated, such as beneath asphalt concrete pavement, brick pavement, concrete pavement and at grade concrete slabs, including sidewalks, curbs and gutters. Also where indicated apply soil sterilant below expansion and control joints and at areas where pipes, ducts or other features penetrate slabs.
- B. Apply soil sterilant uniformly and at the rates recommended by the manufacturer.
- C. Apply soil sterilant to prepared subgrade, or after installation of aggregate base as recommended by the manufacturer.

3.14 DISPOSAL

- A. Lawfully dispose of all unsuitable and excess or surplus material off-site at no cost to Owner.

END OF SECTION

**SECTION 31 1000
SITE CLEARING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Protecting existing trees and vegetation to remain.
- B. Trimming tree limbs and roots.
- C. Removing trees as designated.
- D. Clearing vegetation, debris, trash and other materials within limits indicated.
- E. Grubbing of vegetation within limits indicated.
- F. Stripping of topsoil within limits indicated.
- G. Removing above-grade site improvements within limits indicated.
- H. Disconnecting, capping or sealing, and abandoning site utilities in place.
- I. Disconnecting, capping or sealing, and removing site utilities.
- J. Disposing of objectionable material.

1.02 RELATED SECTIONS

- A. Section 31 0000, Earthwork.

1.03 RELATED DOCUMENTS

- A. Caltrans Standard Specifications, latest edition.
- B. Applicable Publications
 1. "Trees and Building Sites," official publication of the International Society of Arboriculture.
 2. "Arboriculture," the care of trees and shrubs by Dr. Richard Harris.
- C. American National Standards Institute, ANSI. A300 Pruning Standards, Tree Shrub, and other Woody Plant management, Standard Practices (Pruning), 2008.

1.04 DEFINITIONS

- A. ANSI: American National Standards Institute.
- B. CAL-OSHA: California Occupational Safety and Health Administration.
- C. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2-inches in diameter; and free of weeds, roots, and other deleterious materials.

1.05 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.

1.06 QUALITY ASSURANCE

- A. Do not remove or prune trees without first securing a permit from the appropriate agency.
- B. Prune to the standards of the International Society of Arborists and to ANSI A300.

1.07 PROJECT CONDITIONS

- A. Except for materials indicated to be stockpiled or to remain the Owner's property, cleared materials are the Contractor's property. Remove cleared materials from site and dispose of in lawful manner.
- B. Salvageable Improvements: Carefully remove items indicated to be salvaged and store where indicated on plans or where designated by Owner. Avoid damaging materials designated for salvage.
- C. Unidentified Materials;
 - 1. If unidentified materials are discovered, including hazardous materials that will require additional removal other than is required by the Contract Documents, immediately report the discovery to Owner.
 - 2. If necessary, Owner will arrange for any testing or analysis of the discovered materials and will provide instructions regarding the removal and disposal of the unidentified materials.

PART 2 PRODUCTS**2.01 SOIL MATERIALS**

- A. Backfill excavations resulting from demolition operations with on-site or import materials conforming to structural backfill defined in Section 31 0000.

PART 3 EXECUTION**3.01 PREPARATION**

- A. Protect and maintain benchmarks and survey control points during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain during construction.

3.02 TREE PROTECTION

- A. Do not excavate within drip line of remaining trees, unless otherwise indicated.

- B. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation edge as possible.
- C. Cover exposed roots with burlap and water regularly.
- D. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
- E. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.

3.03 TREE REMOVAL

- A. Remove trees designated for removal prior to the construction of new improvements.
- B. Perform tree removal work in a safe and proper manner, adhering to CAL-OSHA and ANSI Standards.
- C. Remove or grind stumps to a minimum of 18-inches below finish subgrade. Remove surface roots to this depth within 24-inches of the tree trunk.

3.04 RESTORATION

- A. Restore damaged improvements to their original condition, as acceptable to Owner.
- B. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, as directed by Owner.
- C. Replace trees that cannot be repaired and restored to full-growth status, as determined by Owner.

3.05 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed or abandoned.
- B. Arrange to shut off indicated utilities with utility companies or verify that utilities have been shut off.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless authorized in writing by Owner, and then only after arranging to provide temporary utility services according to requirements indicated.
- D. Coordinate utility interruptions with utility company affected.
- E. Do not proceed with utility interruptions without the permission of Owner and utility company affected. Notify Owner and utility company affected two working days prior to utility interruptions.
- F. Excavate and remove underground utilities that are indicated to be removed.
- G. Securely close ends of abandoned piping with tight fitting plug or wall of concrete minimum 6-inches thick.

3.06 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
- B. Remove trash, debris, logs, concrete, masonry and other waste materials.
- C. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
- D. Completely remove stumps, roots, obstructions, and debris extending to a depth of 18-inches below subgrade.
- E. Use only hand methods for grubbing within drip line of remaining trees.

3.07 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
- C. Remove trash, debris, weeds, roots, and other waste materials.
- D. Stockpile topsoil materials designated to remain on site at a location approved by Owner at a location away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- E. Do not stockpile topsoil within drip line of remaining trees.

3.08 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, and gutters, as indicated. Where concrete slabs, curb, gutter and asphalt pavements are designated to be removed, remove bases and subbase to surface of underlying, undisturbed soil.
- C. Unless the existing full-depth joints coincide with line of pavement demolition, neatly saw-cut to full depth the length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
- D. Remove driveways, curbs, gutters and sidewalks by saw cutting to full depth. If saw cut falls within 30-inches of a construction joint, expansions joint, score mark or edge, remove material to joint, mark or edge.

3.09 BACKFILL

- A. Place and compact material in excavations and depressions remaining after site clearing in conformance with Section 31 0000.

3.10 DISPOSAL

- A. Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Site.

END OF SECTION

**SECTION 31 2300
EXCAVATION AND FILL**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Excavation, bedding, and backfill of underground storm drain, sanitary sewer and water piping and associated structures.

1.02 SECTION EXCLUDES

- A. Drainage fill material and placement around subdrains. See Section 33 4600.
- B. Trenching and backfill for other utilities such as underground electric, telephone, gas, cable TV, etc.

1.03 RELATED SECTIONS

- A. Section 31 0000, Earthwork.
- B. Section 33 4600, Subdrainage.

1.04 RELATED DOCUMENTS

- A. ASTM:
 - 1. C 33, Specification for Concrete Aggregates.
 - 2. C 150, Specification for Portland Cement.
 - 3. C 260, Specification for Air-Entraining Admixtures for Concrete.
 - 4. C 618, Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
 - 5. D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.
 - 6. D 2321, Practice for Underground Installation of Flexible Thermoplastic Sewer Pipe.
 - 7. D 2487, Classification of Soils for Engineering Purposes.
 - 8. D 3740, Practice for Evaluation of Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
 - 9. E 329, Specification for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
 - 10. E 548, Guide for General Criteria Used for Evaluating Laboratory Competence.
- B. California Building Code, California Code of Regulations, Title 24, Part 2 - Chapter 18, Foundations, and Retaining Walls, and Chapter 33, Site Work, Demolition and Construction.
- C. Caltrans Standard Specifications:
 - 1. Section 19, Earthwork.
 - 2. Section 26, Aggregate Bases.
 - 3. Section 68, Subsurface Drains.
 - 4. Section 88, Engineering Fabrics.
- D. CAL/OSHA, Title 8.

1.05 DEFINITIONS

- A. AC: Asphalt Concrete.
- B. ASTM: American Society for Testing and Materials.
- C. Bedding: Material from bottom of trench to bottom of pipe.
- D. CDF: Controlled Density Fill.
- E. DIP: Ductile Iron Pipe.
- F. HDPE: High Density Polyethylene pipe.
- G. Initial Backfill: Material from bottom of pipe to 12-inches above top of pipe.
- H. PCC: Portland Cement Concrete.
- I. RCP: Reinforced Concrete Pipe.
- J. Trace wire: Magnetic detectable conductor.
- K. Springline of Pipe: Imaginary line on surface of pipe at a vertical distance of $\frac{1}{2}$ the outside diameter measured from the top or bottom of the pipe.
- L. Subsequent Backfill: Material from 12-inches above top of pipe to subgrade of surface material or subgrade of surface facility or to finish grade.
- M. Trench Excavation: Removal of material encountered above subgrade elevations and within horizontal trench dimensions.
 - 1. Authorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions as shown on plans or authorized by Owner.
 - 2. Unauthorized Trench Over-Excavation: Excavation below trench subgrade elevations or beyond indicated horizontal trench dimensions without authorization by Owner. Unauthorized excavation shall be without additional compensation.
- N. Utility Structures:
 - 1. Storm drainage manholes, catch basins, drop inlets, curb inlets, vaults, etc.
 - 2. Sanitary sewer manholes, vaults, etc.
 - 3. Water vaults, etc.

1.06 SUBMITTALS

- A. Product Data:
 - 1. Grading and quality characteristics showing compliance with requirements for the Work.
 - 2. Certify that material meets requirements of the Project.
 - 3. Mix design for any Controlled Density Fill (CDF) shall meet the requirements of these Contract Documents.
- B. Samples:
 - 1. If required by Owner, provide 40-pound samples of all imported trench bedding and backfill material sealed in airtight containers, tagged with source locations and suppliers of each proposed material. Do not import materials to Project without written approval of Owner.

2. Provide materials from same source throughout work. Change of source requires approval of Owner.
- C. Material Test Reports: Provide, from a qualified testing agency, the following test results showing compliance with the project requirements:
 1. Classification according to ASTM D 2487 of each imported trench bedding and backfill material.
 2. Laboratory compaction curve in conformance with ASTM D 1557 for each imported trench bedding and backfill material.

1.07 QUALITY ASSURANCE

- A. Provide an independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Conform all work to the appropriate portion(s) of the Caltrans Standard Specifications, Section 19.
- C. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM D 1557.
- D. Owner will perform observations and tests required to enable Owner to form an opinion of the acceptability of the trench backfill. Correct the trench backfill that, in the opinion of Owner, does not meet the requirements of these Contract Documents.

1.08 PROJECT CONDITIONS

- A. Protect open, trenches, and utility structure excavations with fences, covers and railings to maintain safe pedestrian and vehicular traffic passage.
- B. Stockpile on-site and imported backfill material temporarily in an orderly and safe manner.

PART 2 PRODUCTS

2.01 PIPE BEDDING AND INITIAL BACKFILL

- A. ASTM D 2321, Class IA, IB or II.
 1. Clean and free of clay, silt or organic matter.
- B. Permeable Material: Conform to Section 68-1.025 of Caltrans Standard Specifications, Class 1, Type A or Class 2.
- C. Class 2 Aggregate Base: Conform to Section 26 of Caltrans Standard Specifications, 3/4-inch maximum.
- D. Sand: Conform to Section 19-3.025B of Caltrans Standard Specifications.

2.02 WARNING TAPE

- A. Magnetic detectable conductor, clear plastic covering, imprinted with respective utility type in large letters.

2.03 SUBSEQUENT BACKFILL

- A. Conform to on-site or imported structural backfill in Section 31 0000.

2.04 CONTROLLED DENSITY FILL (CDF) (IN TRENCHES)

- A. Provide non-structural CDF, from bottom of trench to finish subgrade of subbase or base material, that can be excavated by hand and produce unconfined compressive 28-day strengths from 50-psi to a maximum of 150-psi. Provide aggregate no larger than 3/8-inch top size. The 3/8-inch aggregate shall not comprise more than 30% of the total aggregate content.
- B. Cement: Conform to the standards as set forth in ASTM C-150, Type II Cement.
- C. Fly Ash: Conform to the standards as set forth in ASTM C-618, for Class F pozzolan. Do not inhibit the entrainment of air with the fly ash.
- D. Air Entraining Agent: Conform to the standards as set forth in ASTM C-260.
- E. Aggregates need not meet the standards as set forth in ASTM C-33. Any aggregate, producing performances characteristics described herein will be accepted for consideration. The amount of material passing a #200 sieve shall not exceed 12% and no plastic fines shall be present.
- F. Provide CDF that is a mixture of cement, Class F pozzolan, aggregate, air entraining agent and water. CDF shall be batched by a ready mixed concrete plant and delivered to the job site by means of transit mixing trucks.
- G. The Contractor shall determine the actual mix proportions of the controlled density fill to meet job site conditions, minimum and maximum strengths, and unit weight. Entrained air content shall be a minimum of 4.0%. The actual entrained air content shall be established for each job with the materials and aggregates to be used to meet the placing and unit weight requirements. Entrained air content may be as high as 20% for fluidity requirements.

2.05 CONCRETE STRUCTURE BEDDING AND BACKFILL

- A. Precast Structures: Same materials to the same heights as specified for pipe bedding and backfill, or other material approved by Owner.
- B. Poured-in-Place Structures:
 - 1. Bedding: In general, bedding is not required, pour bases against undisturbed native earth in cut areas and against engineered fill compacted to 90% relative compaction in embankment areas.
 - 2. Side Backfill: On-site or imported structural fill meeting the requirements given in Section 31 0000.

2.06 FILTER FABRIC

- A. Filter Fabric:
 - 1. Filter Fabric: Section 88-1.03 of Caltrans Standard Specifications.
 - 2. Mirifi 140N (Mirifi Inc., Charlotte, NC) (Tel. 800-438-1855) or Approved Equal.

PART 3 EXECUTION**3.01 TRENCHING AND EXCAVATION**

- A. Existing PCC or AC Areas: Cut PCC or AC to full depth at a minimum distance of 12-inches beyond the edge of the trench.
- B. Excavate by hand or machine. For gravity systems begin excavation at the outlet end and proceed upstream. Excavate sides of the trench parallel and equal distant from the centerline of the pipe. Hand trim excavation. Remove loose matter.
- C. Excavation Depth for Bedding: Minimum of 4-inches below bottom of pipe or as otherwise allowed or required by Owner, except that bedding is not required for nominal pipe diameters of 2-inches or less.
- D. Excavation Width at Springline of Pipe:
 - 1. Up to a nominal pipe diameter of 24-inches: Minimum of twice the outside pipe diameter, or as otherwise allowed or required by Owner.
- E. Over-Excavations: Backfill trenches that have been excavated below bedding design subgrade, with approved bedding material.
- F. Comply with Owner's limitations on the amount of trench that is opened or partially opened at any one time. Do not leave trenches open overnight without the approval of Owner.
- G. Where forming is required, excavate only as much material as necessary to permit placing and removal of forms.
- H. Bottoms of trenches will be subject to testing by Owner. Correct deficiencies as directed by Owner.
- I. Grade bottom of trench to provide uniform thickness of bedding material and to provide uniform bearing and support for pipe along entire length. Remove stones to avoid point bearing.

3.02 CONTROL OF WATER AND DEWATERING

- A. Be solely responsible for dewatering trenches and excavations and subsequent control of ground and surface water. Provide and maintain such pumps or other equipment as may be necessary to control ground water and seepage to the satisfaction of Owner until backfilling is completed.
- B. Dewater during backfilling operation so that groundwater is maintained a least one foot below level of compaction effort.
- C. Obtain Owner's approval for proposed control of water and dewatering methods.
- D. Reroute surface water runoff away from open trenches and excavations. Do not allow water to accumulate in trenches and excavations.
- E. Maintain dewatering system in place until dewatering is no longer required.

3.03 BRACING AND SHORING

- A. Conform to California and Federal OSHA requirements.

- B. Place and maintain such bracing and shoring as may be required to support the sides of the excavations for the proper protection of workmen; to facilitate the work; to prevent damage to the pipes and appurtenances being constructed; and to prevent damage to adjacent structures or facilities. Remove all bracing and shoring upon completion of the work.
- C. Be solely responsible for all bracing and shoring and, if requested by Owner, submit details and calculations to Owner. The Contractor's submittal shall include the basic design, assumed soils conditions and estimation of forces to be resisted, together with plans and specifications of the materials and methods to be used, and shall be prepared by a civil engineer or structural engineer registered in California. No excavations in trench section or around structures shall precede a response to the submittal by Owner.
- D. Be solely responsible for installing and extracting the sheathing in a manner which will not disturb the line, grade, or backfill compaction or operation of the utility being installed or adjacent utilities and facilities.

3.04 PIPE BEDDING

- A. Accurately shape bedding material to the line and grade called for on the Plans. Carefully place and compact bedding material to the elevation of the bottom of the pipe in layers not exceeding 8-inches in loose thickness. Compact bedding material at optimum water content to 90% relative compaction unless specified otherwise on the Plans or by Owner. Compact by pneumatic tampers or other mechanical means approved by Owner. Jetting or ponding of bedding material will not be permitted.
- B. Upon completion of bedding operations, and prior to the installation of pipe, notify Owner, who will inspect the bedding layer. Do not commence pipe laying until Owner has approved the bedding.

3.05 WARNING TAPE

- A. Install 6" above top of pipe.

3.06 BACKFILLING

- A. Bring initial backfill up simultaneously on both sides of the pipe, so as to prevent any displacement of the pipe from its true alignment. Carefully place and compact initial backfill material to an elevation of 12-inches above the top of the pipe in layers not exceeding 8-inches in loose thickness. Compact initial backfill material at optimum water content to 90% relative compaction unless specified otherwise on the Plans or by Owner. Compact by pneumatic tampers or other mechanical means approved by Owner. Jetting or ponding of initial backfill material will not be permitted.
- B. Bring subsequent backfill to subgrade or finish grade as indicated. Carefully place and compact subsequent backfill material to the proper elevation in layers not exceeding 8-inches in loose thickness. Compact subsequent backfill material at optimum water content to 90% relative compaction, except that the upper 36-inches in areas subject to vehicular traffic shall be compacted to at least 95% relative compaction, unless specified otherwise on the Plans or by Owner. Compact by pneumatic tampers or other mechanical means approved by Owner. Jetting or ponding of subsequent backfill material will not be permitted.
- C. Do not use compaction equipment or methods that produce horizontal or vertical earth pressures which may cause excessive pipe displacement or damage the pipe.

- D. Utility backfill shall be inspected and tested by Owner during placement. Backfill not compacted in accordance with these specifications shall be re-compacted or removed as necessary and replaced to meet the specified requirements, to the satisfaction of Owner prior to proceeding with the Project.

3.07 CLEANUP

- A. Upon completion of utility earthwork all lines, manholes catch basins, inlets, water meter boxes and other structures shall be thoroughly cleaned of dirt, rubbish, debris and obstructions of any kind to the satisfaction of Owner.

END OF SECTION

DIVISION 32
EXTERIOR IMPROVEMENTS

**SECTION 32 1100
BASE COURSES**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Aggregate base.

1.02 RELATED SECTIONS

- A. Section 31 0000, Earthwork.

1.03 RELATED DOCUMENTS

- A. Caltrans Standard Specifications:
 - 1. Section 19, Earthwork.
 - 2. Section 26, Aggregate Bases.
- B. ASTM:
 - 1. D 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

1.04 DEFINITIONS

- A. ASTM: American Society for Testing Materials.

1.05 SUBMITTALS

- A. Submit material certificates signed by the material producer and the Contractor, certifying that that each material item complies with, or exceeds the specified requirements.

1.06 QUALITY ASSURANCE

- A. Conform all work to the appropriate portion(s) of the Caltrans Standard Specifications, Section 19.
- B. Finish surface of the prepared subgrade to receive aggregate base shall be as specified in Section 31 0000.
- C. Do not project the finish surface of subbase above the design subgrade.
- D. Finish surface of aggregate base shall be 0 to - 0.05-feet.
- E. Percentage of compaction specified shall be the minimum acceptable. The percentage represents the ratio of the dry density of the compacted material to the maximum dry density of the material as determined by the procedure set forth in ASTM Designation D1557.

PART 2 PRODUCTS

2.01 FILL MATERIAL

- A. If fill material is required to restore the previously constructed subgrade to its proper elevation,

provide structural fill material specified in Section 31 0000.

2.02 AGGREGATE BASE

- A. Material: Caltrans Standard Specification Section 26.
 - 1. Class 2, 3/4-inch Maximum: Section 26-1.02A.

PART 3 EXECUTION

3.01 SOIL STERILANT

- A. Furnish and apply to areas indicated in accordance with Section 31 0000.

3.02 AGGREGATE BASE

- A. Watering, Spreading and Compacting: Section 26-1.035, 26-1.04 and 26-1.05 of Caltrans Standard Specifications.

END OF SECTION

**SECTION 32 1200
FLEXIBLE PAVING**

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Prime coat.
- B. Tack coat.
- C. Asphalt concrete paving.

1.02 RELATED SECTIONS

- A. Section 31 0000, Earthwork.

1.03 RELATED DOCUMENTS

- A. ASTM:
 - 1. D 979: Practice for Sampling Bituminous Paving Mixtures.
 - 2. D 1073: Specification for Fine Aggregate for Bituminous Paving Mixtures.
 - 3. D 1188: Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens.
 - 4. D 2041: Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
 - 5. D 2726: Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
 - 6. D 2950: Test Method for Density of Bituminous Concrete in Place by Nuclear Method.
 - 7. D 3549: Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
 - 8. D 3666: Specifications for Minimum Requirements for Agencies Testing and Inspecting Bituminous Paving Mixtures.
- B. Caltrans Standard Specifications.
 - 1. Section 39: Asphalt Concrete.
 - 2. Section 92: Asphalts.
 - 3. Section 93: Liquid Asphalts.
 - 4. Section 94: Asphaltic Emulsions.

1.04 DEFINITIONS

- A. ASTM: American Society for Testing Materials.

1.05 QUALITY ASSURANCE

- A. Quality Assurance shall be in accordance with Section 01450 - Quality Control.

1.06 SUBMITTALS

- A. Job-Mix Designs: Certificates signed by manufacturers certifying that each asphalt concrete mix complies with requirements.

- B. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.07 PROJECT CONDITIONS

- A. Environmental Limitations:
 - 1. Prime Coat: Minimum surface temperature of 60 deg F at application.
 - 2. Tack Coat: Minimum surface temperature of 60 deg F at application.
 - 3. Asphalt Concrete: Minimum atmospheric temperature of 50 deg F at application.

PART 2 PRODUCTS

2.01 ASPHALT CONCRETE

- A. Caltrans Standard Specifications Section 39, Type B.
- B. Asphalt Materials:
 - 1. Asphalt Binder: Performance Graded in accordance with Caltrans Standard Specification Section 92, PG64-16.
 - 2. Prime Coat: Caltrans Standard Specification Section 93, MC-70.
 - 3. Tack Coat: Caltrans Standard Specification Section 94, SS1.
- C. Aggregates: Conform to Caltrans Standard Specification Section 39-2.02.
- D. Storing, Proportioning and Mixing Materials: Caltrans Standard Specification Section 39-3.
- E. Sand: ASTM D 1073, Grade No. 2 or 3.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.
- B. Proof-roll subbase using heavy pneumatic-tired rollers to locate areas that are unstable or that require further compaction.
- C. Notify Owner in writing of any unsatisfactory conditions. Do not begin paving until these conditions have been satisfactorily corrected.

3.02 PAVEMENT GRINDING

- A. Clean existing paving surface of loose or deleterious material immediately before pavement grinding.
- B. Grind conforms as indicated on the Plans.

3.03 SOIL STERILANT

- A. Furnish and apply to areas indicated in accordance with Section 31 0000.

3.04 SURFACE PREPARATION FOR AGGREGATE BASE MATERIALS

- A. General: Immediately before placing asphalt materials remove loose and deleterious material from substrate surfaces and ensure that prepared subgrade is ready to receive paving according to the Caltrans Standard Specification Section 39-4.01.
- B. Prime Coat: Apply uniformly over surface of compacted-aggregate base according to the Caltrans Standard Specification Section 39-4.02. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure for 24 hours minimum.
 - 1. If prime coat is not entirely absorbed within 8 hours after application, spread excess prime coat with hand tools and broadcast sand over surface to blot excess asphalt. Use just enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 - 2. Protect primed substrate from damage until ready to receive paving.
- C. Tack Coat: Apply uniformly to all vertical surfaces against which asphalt concrete is to be placed, including existing surfaces of previously constructed asphalt or portland cement concrete paving and to surfaces abutting or projecting into new asphalt pavement, according to the Caltrans Standard Specification Section 39-4.02.
 - 1. Allow tack coat to cure undisturbed before paving.
 - 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3.05 ASPHALT CONCRETE SPREADING AND COMPACTING EQUIPMENT

- A. Spreading Equipment: Caltrans Standard Specification Section 39-5.01.
- B. Compaction Equipment: Caltrans Standard Specification Section 39-5.02.

3.06 ASPHALT CONCRETE PLACEMENT

- A. Place, spread and compact asphalt concrete to required grade, cross section, and thickness according to the Caltrans Standard Specification Sections 39-6.01, 39-6.02 and 39-6.03.
- B. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.07 JOINTS

- A. Construct joints to ensure continuous bond between adjoining paving sections according to the Caltrans Standard Specification Sections 39-6.01 and 39-6.02.
 - 1. Construct joints free of depressions with same texture and smoothness as other sections of asphalt course.
 - 2. Clean contact surfaces and apply tack coat.
 - 3. Offset longitudinal joints in successive courses a minimum of 6 inches.
 - 4. Offset transverse joints in successive courses a minimum of 24 inches.
 - 5. Compact joints as soon as asphalt concrete will bear roller weight without excessive displacement.

3.08 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact according to the Caltrans Standard Specification Sections 39-6.01 and 39-6.03.

- B. Compaction Requirements: Average Density to be 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.
- C. Finish Rolling: Finish roll paved surfaces to remove roller marks while asphalt is still warm.
- D. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method.
- E. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh asphalt. Compact by rolling to specified density and surface smoothness.
- F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.09 INSTALLATION TOLERANCES

- A. Asphalt Pavement:
 - 1. Course thickness and surface smoothness within the tolerances specified in Caltrans Standard Specification Sections 39-6.01, 39-6.02 and 39-6.03.
 - 2. Total Thickness: Not less than indicated.

END OF SECTION

DIVISION 33
UTILITIES

**SECTION 33 4000
STORM DRAINAGE UTILITIES**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Site storm drainage up to 5-feet of any on-site building.

1.02 RELATED SECTIONS

- A. Section 03 0000, Concrete.
- B. Section 31 2300, Excavation and Fill.

1.03 RELATED DOCUMENTS

- A. AASHTO:
 - 1. M 252: Corrugated Polyethylene Drainage Pipe.
 - 2. M 294: Corrugated Polyethylene Pipe, 12 to 48-inch Diameter.
- B. ASTM:
 - 1. A 74: Cast Iron Soil Pipe and Fittings.
 - 2. A 615/A615M: Deformed and Billet-Steel Bars for Concrete Reinforcement.
 - 3. C 443: Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
 - 4. C 1173: Flexible Transition Couplings for Underground Piping Systems.
 - 5. D 1785: Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - 6. D 2235: Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and fittings.
 - 7. D 2321: Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity Flow Applications.
 - 8. D 2564: Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
 - 9. D 2751: Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
 - 10. D 3034: Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 11. D 4101: Specifications for Propylene Injection and Extrusion Materials.
 - 12. F 477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - 13. F 656: Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
 - 14. F 679: Specification for Poly(Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.
 - 15. F-1336: Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings.
- C. AWWA:
 - 1. M41: Ductile Iron Pipe and Fittings.
- D. Caltrans Standard Specifications:
 - 1. Section 51, Concrete Structures.
 - 2. Section 52, Reinforcement.
 - 3. Section 65, Reinforced Concrete Pipe.
 - 4. Section 66, Corrugated Metal Pipe.
 - 5. Section 70, Miscellaneous Facilities.
 - 6. Section 72, Slope Protection.

7. Section 75, Miscellaneous Metal.

- E. Caltrans Standard Plans:
1. Plan D94A: Metal and Plastic Flared End Sections.
 2. Plan D94B: Concrete Flared End Sections.
 3. Plan D97A: Corrugated Metal Pipe Coupling Details No.1, Annular Coupling Band Bar and Strap and Angle Connection.
 4. Plan D97B: Corrugated Metal Pipe Coupling Details No. 2, Hat Band Coupler and Flange Details.
 5. Plan D97C: Corrugated Metal Pipe Coupling Details No. 3, Helical and Universal Couplers.
 6. Plan D97D: Corrugated Metal Pipe Coupling Details No. 4, Hugger Coupling Bands.
 7. Plan D97E: Corrugated Metal Pipe Coupling Details No. 5, Standard Joint.
 8. Plan D97F: Corrugated Metal Pipe Coupling Details No. 6, Positive Joint.
 9. Plan D97G: Corrugated Metal Pipe Coupling Details No. 7, Positive Joints and Downdrains.
 10. Plan D98A: Slotted Corrugated Steel Pipe Drain Details.
 11. Plan D98B: Slotted Corrugated Steel Pipe Drain Details.

1.04 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials.
- B. ABS: Acrylonitrile-butadiene-styrene.
- C. ASTM: American Society for Testing Materials.
- D. AWWA: American Water Works Association.
- E. CMP: Corrugated metal pipe.
- F. DIP: Ductile iron pipe.
- G. HDPE: High-density polyethylene.
- H. NPS: Nominal pipe size.
- I. PE: Polyethylene.
- J. PVC: Polyvinyl chloride.
- K. RCP: Reinforced concrete pipe.

1.05 SUBMITTALS

- A. Product Data Shop Drawings for the following:
1. Piping materials and fittings.
 2. Special pipe couplings.
 3. Polymer-concrete, channel drainage systems (trench drains).
 4. Joint sealants.
 5. Plastic area drains.
 6. Cleanout plugs or caps.
 7. Precast concrete catch basins, inlets, curb inlets, junction structures and area drains, including frames and grates.
 8. Precast clean out boxes and box covers.

9. Concrete, metal and plastic flared end sections.

B. Field Test Reports: Indicate and interpret test results for compliance with performance.

1.06 DELIVERY, STORAGE AND HANDLING

A. Do not store plastic structures, pipe and fittings in direct sunlight.

B. Protect pipe, fittings, and seals from dirt and damage.

C. Handle precast concrete pipe, manholes and other precast structures according to manufacturer's written instructions.

D. Protect imported bedding and backfill material from contamination by other materials.

PART 2 PRODUCTS

2.01 PIPING MATERIALS

A. ABS Pipe and Fittings: 4-inch through 12 inch, ASTM D 2751, SDR 35. Bell and spigot joints.

1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.

B. HDPE Pipe and Fittings: 4-inch through 10-inch, AASHTO M 252, Type S, smooth interior and corrugated exterior. Bell and spigot joints.

1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.

2. Couplings: AASHTO M 252, corrugated band type. Engage a minimum of 4 corrugations, 2 on each side of pipe joint.

C. PVC Pipe and Fittings, 4-Inch and Larger

1. Pipe:

a. 4-inch through 15-inch: ASTM D 3034, SDR 35. Bell and spigot joints.

2. Fittings:

a. 4-inch through 27-inch: ASTM F 1336.

3. Joint Gasket: Elastomeric seal, ASTM F 477.

2.02 PIPE ANCHORS

A. Portland Cement Concrete and Reinforcing: Section 03 0000.

2.03 SPECIAL PIPE COUPLINGS

A. Plastic Pipe: ASTM C 1173. Rubber or elastomeric sleeve and stainless steel band assembly fabricated to match outside diameters of pipes to be joined.

2.04 CLEANOUTS

A. Piping: Same as storm drain line if possible.

B. Top Plug or Cap: Same material as piping if possible. Plug or cap to be secure but removable, threaded or non-threaded.

C. Box Size: As required to provide access and allow easy removal and reinstallation of plug or cap.

- D. Box Types:
 1. Non-Traffic Areas: Portland cement concrete box and box cover, light duty.
 2. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover to be rated for AASHTO H20 loading.
- E. Box Cover Markings: "S.D.," unless otherwise specified.
- F. Available Manufacturers: Subject to compliance with requirements, box manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 1. Associated Concrete Products, Inc. (Santa Ana, California) (Tel. 714-557-7470).
 2. Brooks Products Inc. (El Monte, California) (Tel. 818-443-3017).
 3. Christy Concrete Products, Inc. (Fremont, California) (Tel. 800-486-7070).
 4. Or Approved Equal

2.05 CATCH BASINS, DROP INLETS, JUNCTION STRUCTURES, AREA DRAINS, ETC.

- A. General: Size, shape, configuration, depth, etc. of structure and frame, grate, or cover shall be as indicated.
- B. Portland Cement Concrete and Reinforcing: Section 03 0000.
- C. Precast Structure: Rate for AASHTO H20 loading in traffic areas.
- D. Frames, Grates and Covers: Caltrans Standard Specification Section 75-1.02, 75-1.03 and 75-1.05.
 1. Galvanize steel frames, grates and covers.
 2. Grates and covers shall be non-rocking.
 3. Rate for AASHTO H20 loading in traffic areas.

2.06 JOINT SEALANT FOR PRECAST STRUCTURES

- A. Mortar: Caltrans Standard Specification Section 51-1.135.
 1. Use to seal around pipes at connections to structures and manholes. Also use to seal joints between precast sections of structures and manholes.
- B. Gaskets: Preformed flexible rubber or plastic gasket.
 1. Rubber Gaskets: ASTM C 443.
 2. Plastic Gaskets: Federal Specification SS-S-00210 (GSA-FSS), Type I, Rope Form; or alternate standard which may exist. Acceptable material is "Ram-Nek" as manufactured by the K. T. Snyder Company (Houston TX) or Approved Equal.

2.07 POLYMER-CONCRETE TRENCH DRAINS

- A. General: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include number of units required to form total length required.
- B. Include the following components:
 1. Channel Sections: Interlocking-joint, precast modular units with end caps. Inside width as indicated with deep, rounded bottom, with built in slope or flat invert as indicated and outlets in number, sizes, and locations indicated. Include extension sections necessary for required depth.

2. Frame and Grate: Gray iron, ductile iron or galvanized steel as indicated. Where drain is located in traffic areas, rate for AASHTO H20 loading.
- C. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.
- D. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 1. "Polydrain" by ABT Inc. (Troutman, NC) (Tel 704-528-9806).
 2. "ACO Drain" by ACO Polymer Products Inc. (Chardon, OH) (Tel. 800-543-4764).
 3. Or Approved Equal.

2.08 METAL, CONCRETE OR PLASTIC FLARED END SECTIONS

- A. General: Caltrans Standard Specification Section 70-1.02C and Caltrans Standard Plan D94A and D94B.

2.09 SLOPE PROTECTION

- A. Rock Slope Protection: Caltrans Standard Specification Section 72-2.02.
 1. Class: No. 2
 2. Fabric: Caltrans Standard Specification Section 72-2.025

2.10 CONCRETE/SHOTCRETE DITCH LINING

- A. General: Caltrans Standard Specification Section 72-4.03.
 1. Bar Reinforcement: Caltrans Standard Specification Section 52-1.02A, minimum Grade 40.
 2. Welded Wire Fabric: Caltrans Standard Specification Section 52-1.02C. Use 6 x 6-W1.4 xW1.4 unless otherwise indicated.

PART 3 EXECUTION

3.01 PIPE INSTALLATION

- A. General: Install pipe, fittings, and appurtenances utilizing best practices, manufacturer's instructions, and in accordance with Section 6 and 7 of ASTM D 2321 for plastic pipe.
- B. Pipe Depth and Trench Configuration: Conform to typical trench section(s) indicated.
- C. Excavation, Bedding, Backfill, and Compaction: Section 31 2300.
- D. Handling: Carefully handle during loading, hauling, unloading and placing operations to avoid breakage or damage. Use strap type slings for lifting and placing; no chains or hooks will be permitted. Comply with manufacturer's recommendations.
- E. Laying: Before lowering pipe into the trench, remove all stakes, debris, loose rock and other hard materials from the bottom of the trench. Lay accurately in conformance with lines and grades indicated. Start laying the pipeline at the low end and proceed upstream. Lay bell and spigot pipe with the bell end facing upstream. Lay pipe on a bed prepared by handwork, dug true to grade. Furnish firm bearing for pipe throughout its entire length with bell holes provided at the ends of each pipe length of sufficient size to permit making up the particular type of joint being used. Adjust pipe to line and grade by scraping away or filling and tamping material under the body of the pipe for the entire pipe length and not by blocking or wedging. After final positioning, hold pipe

in place in trench with backfill material placed equally on both sides of the pipe at as many locations as required to hold the pipe section in place.

- F. Curved Alignment: When necessary to conform to the alignment specifically indicated, lay pipe on a curved alignment by means of asymmetrical closure of joints or bending of the pipe barrel. Use shorter lengths of pipe than the standard length if necessary to achieve curvature specified. Do not exceed the recommendations of the pipe manufacture for deflections at the joints or pipe bending.
- G. Closure: Close open ends of pipes and appurtenance openings at the end of each day's work or when work is not in progress.

3.02 INSTALLATION OF PIPE ANCHORS

- A. Install at location, configuration and details shown on the Plans.

3.03 SPECIAL PIPE COUPLINGS

- A. General: Use where required to join piping and no other appropriate method is specified. Do not use instead of specified joining methods.
- B. Installation: Manufacturer's instructions.

3.04 CLEANOUT INSTALLATION

- A. General: Install as indicated.

3.05 INSTALLATION OF CATCH BASINS, DROP INLETS, JUNCTION STRUCTURES, AREA DRAINS, ETC.

- A. Excavation, Bedding, Backfill, and Compaction: Section 31 2300.
- B. Poured in Place Structures: Install as indicated and Caltrans Standard Specification Section 51.
 - 1. Shape bottoms to convey flows as indicated.
- C. Precast Structures: Install as indicated.
 - 1. Seal all joints and pipe entrances and exits.
 - 2. Place concrete in bottom and shape to convey flows as indicated.

3.06 POLYMER-CONCRETE TRENCH DRAIN INSTALLATION

- A. Excavation, Bedding, Backfill, and Compaction: Section 31 2300.
- B. Install: As indicated and in accordance with the manufacturer's instructions.

3.07 CONCRETE OR PLASTIC FLARED END SECTION INSTALLATION

- A. Install: As indicated.

3.08 SLOPE PROTECTION PLACEMENT

- A. Rock Slope Protection: Caltrans Standard Specification Section 72-2.03 and as indicated.
 - 1. Use Method B Placement unless otherwise indicated.

3.09 CONCRETE/SHOTCRETE DITCH LINING PLACEMENT

- A. Concrete/Shotcrete Slope Protection: Caltrans Standard Specification Section 72-4.02 and 72-4.04.

END OF SECTION

**SECTION 33 4600
SUBDRAINAGE**

PART 1 GENERAL**1.01 SECTION INCLUDES**

- A. Subdrains in trenches and subdrains or prefabricated composite drainage panels at walls or foundations.

1.02 RELATED SECTIONS

- A. Section 31 2300 Excavation and Fill.
- B. Section 33 4000, Storm Drainage Utilities.

1.03 RELATED DOCUMENTS

- A. AASHTO:
 - 1. M 252: Corrugated Polyethylene Drainage Tubing.
 - 2. M 288: Geotextiles Used for Subsurface Drainage Purposes.
 - 3. M 294: Corrugated Polyethylene Pipe, 12- to 48-in. Diameter.
- B. ASTM:
 - 1. C 1173: Specifications for Flexible Transition Couplings for Underground Piping System.
 - 2. D 448: Classification for Sizes of Aggregate for Road and Bridge Construction.
 - 3. D 1621: Test Method for Compressive Properties of Rigid Cellular Plastics.
 - 4. D 1785: Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
 - 5. D 2235: Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and fittings.
 - 6. D 2321: Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
 - 7. D 2564: Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
 - 8. D 2729: Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 9. D 2751: Acrylonitrile-Butadiene-Styrene (ABS) Sewer Pipe and Fittings.
 - 10. D 3034: Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 - 11. D 4716: Test Method for Constant Head Hydraulic Transmissivity (in-Plane Flow) of Geotextiles and Geotextile Related Products.
 - 12. F 477: Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 - 13. F 656: Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.
 - 14. F-1336: Poly(Vinyl Chloride) (PVC) Gasket Sewer Fittings.
- C. Caltrans Standard Specifications:
 - 1. Section 68-Subsurface Drains
 - 2. Section 88-Engineering Fabrics.

1.04 DEFINITIONS

- A. AASHTO: American Association of State Highway and Transportation Officials.
- B. ABS: Acrylonitrile-Butadiene-Styrene.

- C. ASTM: American Society for Testing and Materials
- D. AWWA: American Water Works Association.
- E. HDPE: High-density polyethylene.
- F. PE: Polyethylene.
- G. PVC: Polyvinyl Chloride.

1.05 SUBMITTALS

- A. Product data for the following:
 - 1. Perforated pipe and fittings.
 - 2. Solid pipe and fittings.
 - 3. Prefabricated composite drainage panels.
 - 4. Geotextile fabrics.
 - 5. Cleanout plugs or caps.
 - 6. Precast clean out boxes and box covers.
- B. Samples:
 - 1. Drainage Fill.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Do not store plastic structures, pipe, and fittings in direct sunlight.
- B. Protect pipe, pipe-fittings, and seals from dirt and damage.
- C. Protect permeable material from contamination by other materials.

PART 2 PRODUCTS

2.01 PERFORATED WALL AND SOLID WALL PIPE

- A. ABS Pipe and Fittings: 4-inch through 12-inch, ASTM D 2751, SDR 35. Bell and spigot joints.
 - 1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
 - 2. Perforation Size, Location, and Spacing: ASTM D 2729.
- B. HDPE Pipe and Fittings: 4-inch through 10-inch, AASHTO M252 Type S (Solid wall.) or SP (Perforated wall.), smooth interior and corrugated exterior. Bell and spigot joints.
 - 1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
 - 2. Couplings: AASHTO M 252, corrugated band type. Engage a minimum of 4 corrugations, 2 on each side of pipe joint.
 - 3. Perforation Size, Location, and Spacing: AASHTO M 252, Class 2.
- C. HDPE Pipe and Fittings: 12-inch through 48-inch, AASHTO M 294. Type S (Solid Wall.) or Type SP (Perforated wall.), smooth interior and corrugated exterior. Bell and spigot joints.
 - 1. Bell and Spigot Joint Gasket: Elastomeric seal, ASTM F 477.
 - 2. Couplings: AASHTO M 252, corrugated band type. Engage a minimum of 4 corrugations, 2 on each side of pipe joint.
 - 3. Perforation Size, Location, and Spacing: AASHTO M 294, Class 2.

- D. PVC pipe and Fittings: Smaller than 4-inch, ASTM D1785, Schedule 40. Solvent cement joints.
 - 1. Solvent Cement: ASTM D 2564. Include primer according to ASTM F656.
 - 2. Perforation Size, Location, and Spacing: ASTM D 2729.
- E. PVC Pipe and Fittings:
 - 1. Pipe: 4-inch through 15-inch, ASTM D 3034, SDR 35. Bell and spigot joints.
 - 2. Perforation Size, Location, and Spacing: ASTM D 2729.
 - 3. Fittings: ASTM F 1336.
 - 4. Joint Gasket: Elastomeric seal, ASTM F 477.

2.02 SPECIAL PIPE COUPLINGS

- A. Description: ASTM C 1173. Rubber or elastomeric sleeve and stainless steel band assembly fabricated to match outside diameters of pipes to be joined.

2.03 CLEANOUTS

- A. Piping: Same as subdrain pipe without perforations.
- B. Top Plug or Cap: Same material as piping if possible. Plug or cap to be secure but removable, threaded or non-threaded.
- C. Size box to provide access and allow easy removal and reinstallation of plug or cap.
- D. Types:
 - 1. Non-Traffic Areas: Portland cement concrete box and box cover, light duty.
 - 2. Traffic Areas: Portland cement concrete box and box cover or steel or cast iron cover, heavy duty, both box and cover to be rated for AASHTO H20 loading.
- E. Cover Markings: "S.D.," unless otherwise specified.
- F. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Project include, but are not limited to, the following:
 - 1. Associated Concrete Products, Inc. (Santa Ana, California) (Tel. 714-557-7470).
 - 2. Brooks Products Inc. (El Monte, California) (Tel. 818-443-3017).
 - 3. Christy Concrete Products, Inc. (Fremont, California) (Tel. 800-486-7070).
 - 4. Or Approved Equal.

2.04 DRAINAGE FILL MATERIAL

- A. Caltrans Permeable Material: Conform to Section 68-1.025 of Caltrans Standard Specifications.
 - 1. Class 2.
 - 2. Or Approved Equal.
- B. Washed, evenly graded mixture of crushed stone, or crushed or uncrushed gravel, ASTM D 448, coarse aggregate, Sieve No. 57, with 100 percent passing 1-1/2-inch sieve and not more than 5 percent passing No. 8 sieve.

2.05 FILTER FABRIC

- A. When required, use filter fabric for encasing permeable material around subdrains.
 - 1. Caltrans Filter Fabric: Section 88-1.03 of Caltrans Standard Specifications.

2. Mirifi 140N (Mirifi Inc., Charlotte, NC) (Tel. 800-438-1855) or Approved Equal.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.
- B. Install only after unsatisfactory conditions have been corrected.

3.02 PIPING APPLICATIONS

- A. Refer to the Plans for location, size, and material designation for individual subdrains.

3.03 INSTALLATION OF PERFORATED PORTIONS OF SUBDRAINS

- A. Excavation: Section 6 of ASTM D 2321 and as indicated.
- B. Subdrain Bedding: Place supporting layer of drainage fill over compacted subgrade to compacted depth indicated. If drainage fill requires encasement in filter fabric, lay filter fabric in trench and overlap trench sides before installing drainage fill.
- C. Piping Installation: Install pipe in accordance with Section 7 of ASTM D 2321. Install piping beginning at low point of system, true to grades and alignment indicated, with unbroken continuity of invert. Excavate recesses for bottoms of bell ends of pipe. Lay pipe with bells facing upslope and with spigot end centered fully into adjacent bell. Bed piping with full pipe bearing in drainage fill material. Lay perforated pipe with perforations down. Install gaskets, seals, sleeves, and couplings in accordance with manufacturers written instructions. Use increasers, reducers, and couplings made for different sizes of materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- D. Initial Subdrain Backfill: After installing drainage piping, add drainage fill up to top of pipe to perform tests.
- E. Testing Subdrain: After installing drainage fill to top of pipe, test drain piping with water to ensure free flow before backfilling with drainage fill. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.
- F. Subsequent Subdrain Backfill: After satisfactory testing, cover piping with drainage fill to width and height indicated. Place drainage fill in layers not exceeding 3 inches in loose depth; compact each layer placed. If filter fabric is required complete the filter fabric encasement by bringing fabric to top and closing the encasement.
- G. Fill to Grade: Place native fill material over compacted drainage fill to thickness indicated. Place material in loose-depth layers not exceeding 6 inches. Thoroughly compact each layer. Fill to finish elevations.

3.04 INSTALLATION OF NON-PERFORATED PORTIONS OF SUBDRAINS

- A. Conform to Sections 31 2300 and 33 4000.

3.05 PREFABRICATED COMPOSITE DRAINAGE PANELS

- A. Coordinate placement with other drainage materials.
- B. Install prefabricated drainage panels in accordance with manufacturer's instructions.
- C. Place perforated drainage pipe at base of footing and attach to composite drainage panels in accordance with the manufacturer's instructions.

3.06 JOINING PIPE

- A. Join ABS and PVC pipe and fittings with elastomeric seals according to ASTM D 2321 or solvent cement.
- B. Special pipe couplings: Join piping made of different materials and dimensions with special couplings made for this application. Use couplings that are compatible with and that fit both pipe materials and dimensions.

3.07 CLEANOUT INSTALLATION

- A. Cleanout piping to be the same size as the subdrain piping to which it is attached.
- B. Install cleanouts from subdrainage piping to grade. Locate cleanouts at beginning of piping run, at changes in direction, and other locations indicated.
- C. Do not allow cleanout box to bear on cleanout riser.

3.08 CLEANING

- A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION

**SECTION 337173
ELECTRIC UTILITY SERVICES**

PART 1 - GENERAL

1.1 SUMMARY

- A. Arrange and coordinate with Utility Company for permanent electric service, payment of Utility Company charges for service, service provisions and utility metering equipment.

1.2 RELATED SECTIONS

- A. Section 260500: Common Work Results for Electrical
- B. Section 260519: Low Voltage Power Conductors and Cables
- C. Section 260526: Grounding and Bonding for Electrical Systems
- D. Section 260533: Raceway and Boxes for Electrical Systems
- E. Section 260553: Identification for Electrical Systems
- F. Section 262413: Switchboards
- G. Section 262416: 600-V Rated Panelboards & Circuit Breakers

1.3 SUBMITTALS

- A. Submit copy of switchboard, / switchgear Service entrance Compartment to Utility Company for their review and approval prior to fabrication of the equipment.

1.4 QUALITY ASSURANCE

- A. Perform Work in accordance with Utility Company written requirements.
- B. Maintain one copy of each document on site.

1.5 FIELD MEASUREMENTS

- A. Verify field measurements are as indicated.

1.6 COORDINATION

- A. Coordinate relocation of any overhead or underground lines interfering with the construction with utility company.

PART 2 - PRODUCTS

2.1 SERVICE DESCRIPTION

- A. Utility Company name and contact person or representative is indicated on the drawings.
- B. Electrical Service System Characteristics: 400 Amp, 208Y/120 Volt, 3-phase. 4-wire.
- C. Service Entrance:
 - 1. Overhead/Underground service entrance to switchboard service termination section.

2.2 UTILITY METERS

- A. Utility revenue meter will be furnished and installed by Utility Company.

2.3 UTILITY METER BASE

- A. Utility revenue meter base rated for the service size requested. Coordinate with Utility Co. prior to release of Switchboard procurement order.

2.4 ACCEPTABLE MANUFACTURERS

- A. Refer to Section 262413, Part 2 - Products
- B. List of Equipment Manufacturers:
 - 1. Main Switchboard
 - a. Westinghouse/Cutler Hammer
 - b. General Electric
 - c. Industrial Electric Manufacturing
 - d. Electrical Power Products
 - e. Square D
 - f. Or Approved Equal
 - 2. Panelboards

- a. Shall match manufacturer of main switchboard

2.5 MATERIALS

- A. Provide and install conduits for primary cables by utility company, concrete pad and grounding for utility company transformer, and conduit for secondary service to main switchboard. Comply with all Utility Co. requirements.
- B. Furnish and install telephone and cable television service conduits and pullboxes; install conduits to main backboard as shown. All work shall conform to utility company requirements and to Section 260500.
- C. Grounding:
 1. Provide and install grounding system as noted on the Drawings.
 2. Grounding electrode conductor: bare stranded copper type, #4/0 minimum.
 3. Install ground wires in rigid conduit.
 4. All grounding electrode conductor connections "thermite" or "cad-weld" welded.
 5. Use approved pressure type solderless connector or use fusion welding for all connections to and bonding of grounding electrode system. All connections shall be visible, readily accessible for testing purposes. Grounding electrode conductor between the grounding electrode and service equipment: Minimum #4/0.
 6. Furnish and install solid copper 3/4" x 10'-0" ground rod(s). Where multiple ground rods are shown, install a minimum of 20'-0" apart. Install ground rods in accessible boxes with covers. Furnish and install 2-#4/0 bare copper cables between multiple ground rods and main switchboard ground bus.
 7. Terminate grounding conduits at equipment with ground bushing, with ground wire connected through bushing.
 8. Provide No. 12 stranded (green) THHN conductor from outlet box to ground screw of every receptacle.
 9. Ground all isolated sections of metallic raceways.
 10. Provide #12 minimum stranded (green) THHN conductor sized per NEC, or as noted, connected continuously throughout branch circuit for all circuits, bonded to panel ground bus, and to all electrical devices and equipment enclosures
 11. Use approved pressure type solderless connector or use fusion welding for all connections to grounding electrode. Connection visible, readily accessible for testing purposes. Grounding electrode conductor between the grounding electrode and service equipment: Minimum #4/0.
 12. Connect grounding electrode system to metallic water service entry metallic cold water pipe (if available) with nonferrous clamp and bare copper cable (sized as required) in conduit. Connection shall be accessible for inspection.
 13. Connect grounding electrode system to building steel as noted on Drawings. Use exothermic weld, connection shall be accessible for inspection.
 14. After installation, test system using the three-point fall of potential method only. Record results and submit to Owner for approval. If resistance to ground exceeds three (3) ohms, install additional ground rods, bonded and interconnected to

grounding electrode system. Provide additional grounding until resistance is less than three (3) ohms.

2.6 MAIN SWITCHBOARD

- A. General: Switchboard shall be distribution panel type, Nema 3R metal enclosure with ground bus and insulated full capacity neutral bus.
- B. The switchboard shall be braced for a short circuit current shown on drawings. Bracing shall be per NEMA and UL standards.
- C. The switchboard shall comply with all the requirements of the Utility Company.
- D. The switchboard shall be pad-mounted, self-supporting, dead-front and rear, front-operated, front-connected, distribution type. The enclosure shall be 90 inches high, made of cold rolled steel on a structural shape, or formed, steel frame and shall be mounted on two 3-inch, 5-pound continuous channel iron sills, which shall be closed at the ends between the two channels.
- E. This contractor is responsible for the complete installation of the new switchboard within the space provided (both vertical and horizontal) and shall verify and/or coordinate all dimensions prior to ordering equipment. Proper allowances should be included to allow complete installation and erection.
- F. The switchboard shall be a minimum of 20 inches deep and shall be constructed of National Electrical Code (NEC) gauge steel.
- G. The switchboard shall be provided with a cable pull section at the top of the switchboard. Provide a minimum 12 inches of vertical clearance between the cable terminal lugs bolted to the switchboard busses and the top and bottom of the switchboard enclosure. Horizontal pull sections and gutters shall be kept free and clear of busses. Where busses cross vertical pull sections, the busses shall be insulated.
- H. All connections between bus bars shall be of a bolted type using Belleville washers. Clamps will not be accepted. All bus bars shall be accurately formed, and all holes shall be made in a manner which will permit bus bars and connections to be fitted into place without being forced.
- I. The design of all current-carrying devices or parts of the switchboard shall conform to the standard specified in the related sections of Underwriters' Laboratories, Inc. (UL) No. UL-891 and National Electric Manufacturer's Association (NEMA) Standard PB-2, except as these characteristics may be modified herein.
- J. Bus bars, connection bars and wiring on the back of the switchboard shall be arranged so that maximum accessibility is provided for cable connections from the front.

- K. Ampere ratings for rectangular bus bars shall be in accordance with the temperature rise standard of National Electric Manufacturer's Association (NEMA) and the Underwriters' Laboratories, Inc. (UL).
- L. The enclosure shall be chemically cleaned by parkerizing, bonderizing or phosphorizing as a unit after all welding has been completed. The enclosure shall then be painted with a rust-resisting primer coat of paint and shall be finished with a coat of light gray, baked enamel.
- M. Each section shall be bussed for the full connected load of that section. Extend bussing to spare circuit breaker "Spaces." Drill busses for future circuit breakers, and provide breaker connector hardware as required.
- N. Provide copper bus bars and connections with silver-plated contact surfaces.
- O. The contact surfaces and studs of all devices to which bus connections are made shall also have silver-plated surfaces.
- P. Locate ground bus, with a cross-section equal to at least 25 percent of the capacity of the main bus rating, in the back of the switchboard and extend bus throughout the length of the switchboard assembly. Ground each housing of the assembly directly to this bus.
- Q. Rigidly support all bus and connection bars and current transformers.
- R. Fit all nuts and connections with locking devices to prevent loosening.
- S. Provide load connections with solderless lugs. Factory-install all devices shown on Drawings as specified herein.
- T. Properly identify the "high leg" of 4-wire delta connected systems as required by NEC 384-3(e).
- U. Provide half-inch copper braid pigtail at side of switchboard enclosure for termination of signal system ground cables. Pigtail to be located on side of distribution section.
- V. Provide ground fault protection when indicated on the single line diagram or where otherwise noted on the plans. Protection shall consist of a current sensor, relaying device, and the appropriately sized main overcurrent protection device.
- W. Provide a bonding strap from the equipment ground bus to the neutral bus.
- X. Provide Arc Flash warning label per NEC 2014 110.16.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that service equipment is ready to be connected and energized.

3.2 INSTALLATION

- A. Install service entrance conduits from pull box to building service entrance equipment. Utility Company will provide service entrance conductors.
- B. Electric Service: Coordinate with Pacific Gas & Electric and Owner for electric service. Furnish and install all materials and labor necessary for complete installation as noted on drawings. Submit shop drawings and obtain approval from the Utility Co. prior to fabrication.
- C. Excavate and trench as necessary for the electrical installation, and when the work has been installed, inspected and approved, backfill all excavations with clean earth from excavation, or imported sandy soil in maximum 8" (eight-inch) layers, moisten and machine tamp to 95% compaction, and restore the ground and/or paving or floor surfaces to their original condition.

END OF SECTION