TECHNICAL SPECIFICATIONS

NEW 2-STORY CLASSROOM BUILDING

AT

WILL ROGERS MIDDLE SCHOOL

4110 West 154th Street
Lawndale, CA 90260

LAWNDALE ELEMENTARY SCHOOL DISTRICT
4161 West 147th Street
Lawndale, CA 90260
(310) 973-1300



westbergwhite
architecture

WW Project No. 22029.01

October 7, 2024

Contact: Ricardo Bermudez, Project Manager
WESTBERG+WHITE, Inc.
7700 Irvine Center Drive, Suite 100
Irvine, CA 92618
Tel. (714) 508-1780, ext. 370

TECHNICAL SPECIFICATIONS

NEW 2-STORY CLASSROOM BUILDING

AT

WILL ROGERS MIDDLE SCHOOL

4110 West 154th Street
Lawndale, CA 90260

LAWNDALE ELEMENTARY SCHOOL DISTRICT

4161 West 147th Street
Lawndale, CA 90260
(310) 973-1300

DSA Application No. 03-123867

WW Project No. 22029.01

August 08, 2024

IDENTIFICATION STAMP
DIV. OF THE STATE ARCHITECT
APP: 03-123867 INC:
REVIEWED FOR
SS ☑ FLS ☑ ACS ☑
DATE: 10/24/2024

ARCHITECT
Paul D. Westberg, AIA
WESTBERG+WHITE, INC.
7700 Irvine Center Drive, Suite 100
Irvine, CA 92618
Tel. 714.508.1780

STRUCTURAL ENGINEER
Young Nam, S.E.
VCA ENGINEERS, INC.
2151 Michelson Drive, Suite 240
Irvine, CA 92612
(949) 679-0870

MECHANICAL ENGINEER
Matthew M. Pezeshki, PE
PEZESHKI ENGINEERING, INC.
1920 E. Warner Avenue, Suite 3-H
Santa Ana, CA 92705
Tel. 714.884.3803

ELECTRICAL ENGINEER
Nestor C. Ignacio, Jr., P.E.
IMEG CORPORATION
901 Via Piemonte, Suite 400
Ontario, CA 91764
(909) 942-5544

TABLE OF CONTENTS

DIVISION 01 GENERAL REQUIREMENTS

01 1100 Summary of Work
01 2610 Construction Document Modification Procedures
01 2976 Progress Payment Procedures
01 3113 Project Coordination
01 3119 Project Meetings
01 3300 Submittal Procedures
01 4100 Regulatory Requirements
01 4200 References
01 4500 Quality Control
01 4525 Concrete Moisture Testing
01 5000 Temporary Facilities and Controls
01 5713 Temporary Erosion and Sediment Controls
01 6000 Product Requirements
Substitution Request Form
01 7123 Field Engineering
01 7329 Cutting and Patching
01 7419 Construction Waste Management and Disposal
01 7423 Cleaning
01 7700 Closeout Procedures
01 7839 Project Record Documents

DIVISION 02 EXISTING CONDITIONS

02 4113 Selective Site Demolition
02 4116 Building Demolition

DIVISION 03 CONCRETE

03 3000 Cast-in-Place Concrete

DIVISION 04 MASONRY

04 2200 Concrete Unit Masonry

DIVISION 05 METALS

05 0513 Shop-Applied Coatings for Metal
05 1200 Structural Steel Framing
05 3000 Metal Decking
05 4000 Cold-Formed Metal Framing
05 5000 Metal Fabrications

DIVISION 06 WOOD, PLASTICS, AND COMPOSITES

06 1053 Miscellaneous Carpentry
06 4000 Architectural Woodwork

DIVISION 07 THERMAL AND MOISTURE PROTECTION

07 1416 Cold Fluid-Applied Waterproofing
07 1616 Crystalline Waterproofing
07 1813 Pedestrian Traffic Coatings
07 2100 Building Insulation

DIVISION 07 THERMAL AND MOISTURE PROTECTION ***(Continued)***

07 2726 Fluid Applied Air and Water Barrier Membrane
07 5416 Thermoplastic Polyolefin (TPO) Membrane Roofing
07 6200 Sheet Metal Flashing and Trim
07 7233 Roof Hatches
07 9200 Joint Sealants

DIVISION 08 OPENINGS

08 1113 Hollow Metal Doors and Frames
08 1400 Wood Doors
08 3100 Access Doors and Panels
08 5115 Aluminum Windows
08 7100 Door Hardware
08 8000 Glazing

DIVISION 09 FINISHES

09 0562 Moisture Vapor Emission Control System
09 2216 Non-Structural Metal Framing
09 2513 Portland Cement Plaster
09 2900 Gypsum Board
09 3000 Tile
09 5100 Acoustical Ceilings
09 6500 Resilient Flooring
09 7200 Wall Coverings
09 9100 Painting
09 9600 High Performance Coatings

DIVISION 10 SPECIALTIES

10 1100 Visual Display Units
10 1400 Signage
10 2117 Solid Phenolic Toilet Compartments
10 2813 Toilet Accessories
10 4400 Fire Protection Specialties

DIVISION 11 EQUIPMENT

11 5223 Audio-Visual Equipment Supports

DIVISION 12 FURNISHINGS

12 2413 Roller Shades

DIVISION 14 CONVEYING EQUIPMENT

14 2423 Hydraulic Passenger Elevators

DIVISION 21 FIRE SUPPRESSION

21 1300 Automatic Fire Sprinklers

DIVISION 22 PLUMBING

22 0500 Common Work Results for Plumbing
22 0503 Earthwork for Plumbing Systems
22 0511 Supplementary Plumbing Requirements
22 0512 Plumbing Products Substitution
22 0515 Access Doors and Panels
22 0519 Meters and Gages
22 0523 General Duty Valves for Plumbing Piping
22 0529 Supports and Anchors
22 0553 Plumbing Identification
22 0700 Plumbing Insulation
22 1100 Plumbing Piping
22 1116 Water Distribution Piping (Inside Building)
22 1119 Plumbing Specialties
22 1316 Sanitary Waste and Vent Piping
22 4200 Commercial Plumbing Fixtures

DIVISION 23 HEATING, VENTILATING AND AIR-CONDITIONING (HVAC)

23 0500 Common Work Results for HVAC
23 0511 Supplementary HVAC Requirements
23 0512 HVAC Products Substitutions
23 0513 Common Motor Requirements for HVAC Equipment
23 0515 Access Doors and Panels
23 0529 Supports and Anchors
23 0548 Vibration Controls for HVAC
23 0553 HVAC Identification
23 0593 Testing, Adjusting, and Balancing
23 0700 HVAC Insulation
23 2300 Refrigerant Piping
23 3113 Metal Ductwork
23 3300 Ductwork Accessories
23 3423 Power and Gravity Ventilators
23 3713 Air Outlets and Inlets
23 8119 Rooftop Packaged Heat Pump
23 8126 Split Air Conditioner System

DIVISION 26 ELECTRICAL

26 0500 Basic Electrical Requirements
26 0513 Wire and Cable
26 0526 Grounding and Bonding
26 0527 Supporting Devices
26 0533 Conduit and Boxes
26 0548 Seismic Requirements for Equipment and Supports
26 0553 Electrical Identification
26 0933 Lighting Control Systems
26 2200 Dry Type Transformers
26 2416 Panelboards
26 2716 Cabinets and Enclosures
26 2726 Wiring Devices

DIVISION 26 ELECTRICAL *(Continued)*

26 2729 Electric Vehicle Charging Station
26 2813 Fuses
26 2816 Disconnect Switches
26 3100 Solar Photovoltaic Systems
26 4300 Surge Protection Devices
26 5119 LED Lighting

DIVISION 27 COMMUNICATIONS

27 0500 Basic Communications Systems Requirements
27 0526 Communications Bonding
27 0528 Interior Communication Pathways
27 0543 Exterior Communication Pathways
27 0553 Identification and Administration
27 1100 Communication Equipment Rooms (CER)
27 1300 Backbone Cabling Requirements
27 1500 Horizontal Cabling Requirements
27 1710 Testing
27 1720 Structured Cabling System Warranty
27 5113 Paging Systems
27 5126 Assistive Listening System

DIVISION 28 ELECTRONIC SAFETY AND SECURITY

28 0500 Basic Electronic Safety And Security System Requirements
28 1300 Electronic Access Control
28 1600 Intrusion Detection System
28 2300 Video Surveillance
28 2605 Rescue Assistance Communication
28 3100 Fire Alarm and Detection Systems

DIVISION 31 EARTHWORK

31 0000 Earthwork
31 1000 Site Clearing

DIVISION 32 EXTERIOR IMPROVEMENTS

32 0523 Concrete for Exterior Improvements
32 1100 Base Course
32 1216 Asphalt Paving
32 1313 Concrete Paving
32 1723 Pavement Markings
32 1726 Detectable Warning Surfaces
32 3113 Chain Link Fences and Gates
32 3313 Bicycle Racks

DIVISION 33 UTILITIES

33 1416 Site Water Utility Distribution Piping
33 3100 Sanitary Utility Sewerage Piping
33 4200 Stormwater Conveyance

END OF TABLE OF CONTENTS

SECTION 01 1100

SUMMARY OF WORK

PART 1 GENERAL

1.01 PROJECT DESCRIPTION

A. Project consists of New 2-Story, 28,157 square foot Classroom Building and Site Improvements, at Will Rogers Middle School for Lawndale Elementary School District, Lawndale. California, as shown on Contract Documents prepared by Westberg+White, Inc., Architects.

B. Work includes:
   1. Selective Site Demolition Work consisting of:
      a. Demolition and removal of existing above and below grade site improvements to accommodate construction of new facilities, including, but not necessarily limited to:
         1) Portions of existing non-compliant concrete paving.
         2) Chain link fence, including posts, footings, associated accessories.
         3) Grates and catch basins.
         4) Concrete drainage channel.
         5) Play court accessories.
   2. Building Demolition Work consisting of:
      a. Removal and disposal of 3 existing relocatable buildings.
   3. New Construction consisting of, but not necessarily limited to following:
      a. Cast-in-place concrete slab and footings.
      b. Exterior wall construction consisting of:
         1) Metal stud framing, with R-19 insulation and Portland cement plaster system.
      c. Interior wall/partition construction consisting of:
         1) Metal stud framing and gypsum board, with sound attenuation batts, where required.
      d. TPO Roofing system consisting of:
         1) Single ply roofing over glass mat roof board over metal deck with R-30 batt insulation.
         2) Including sheet metal flashing and trim.
      e. Roof access hatch for ship’s ladder.
      f. Elevator pit and parapet access ladders.
      g. Perforated metal infill panels at handrails and guardrails.
      h. Decorative laminate casework and countertops.
      i. Solar Shade Structure – 29 ft. – 4 inches x 54 ft. – 8 inches.
   4. Site Improvement Work Consisting of:
      a. New hardscape surrounding new structures including, but not necessarily limited to:
         1) Concrete paving.
         2) Asphalt paving.
         3) Parking lot striping
         4) Slurry seal over asphalt paving.
         5) Concrete curb ramps with detectable warning surfaces.
         6) Chain link fencing and gates.
         7) Planter wall.

8) Wall-mounted vertical, and ground set bike racks.

5. Underground Utilities Work Consisting of:
   a. Plumbing and Electrical Work.
   b. Site Water Utility Distribution Piping.
   c. Stormwater Conveyance:
      1) Storm Drainage System

1.02 PROCUREMENT AND CONTRACTING DOCUMENTS

A. Use Division 00 Procurement and Contracting Requirements provided by Lawndale Elementary School District for New 2-Story Classroom Building at Will Rogers Middle School.

1.03 RELATED DOCUMENTS

A. Refer to District's Division 00 Documents, including General Conditions, and other Division 01 Sections, for additional requirements.

B. Comply with requirements of these specifications and District's Division 00 documents.
   1. Where differences may occur between specifications and District 00 documents, requirements of District's 00 documents govern, unless otherwise directed.
   2. Changes to approved documents will be made by addenda or change order approved by DSA in accordance with CCR, Title 24, Part 1, Section 4-338.

C. Contract Documents are complementary and what is required by one is as binding as when required by all.
   1. Report errors, inconsistencies, or omissions discovered by Contractor promptly to Owner/Architect as request for information.

D. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.

1.04 CONSTRUCTION REQUIREMENTS

A. Construct Work conforming to requirements of California Code of Regulations (CCR), Tile 24, Part 2, California Building Code (CBC), Volumes 1 and 2.
   1. Refer to Section 01 4100 for current Code edition.
   2. Refer to Section 01 4200 for additional references.

1.05 CONTRACTS

A. Construct Work under single fixed-price contract.

1.06 WORK SEQUENCE

A. General:
   1. Conform to construction schedule as specified.
   2. Construction Time:
      a. Starts as of date specified in initial "Notice to Proceed" from Architect to Contractor and ends with date of acceptance of Work by Owner.

B. Construction Schedule:
   1. Work will be conducted in single phase and provide least possible interference with activities of Owner's personnel and to permit orderly transfer of personnel and equipment to new facilities.

C. Liquidated Damages:
   1. Liquidated damages will be assessed under conditions provided in Agreement.

1.07 CONTRACTOR'S USE OF PREMISES

A. General:
   1. During construction period, limit use of premises to immediate area required for construction operations.
   2. Use of premises is also limited by Owner's right to perform construction operations with its own forces or to employ separate contractors on portions of Project.

B. Limit use of premises for Work and for storage as directed, to allow for:
   1. Work by other Contractors.
   2. Owner occupancy.
   3. Use by Public.

C. Coordinate use of premises under direction of Architect and Owner.

D. Assume full responsibility for protection and safekeeping of products under this contract, stored on Project Site.

E. Move stored products under Contractor's control, which interfere with operations of Owner or separate contractor.

F. Obtain and pay for use of additional storage or work areas needed for operations.

1.08 WORK DURING SCHOOL SESSIONS

A. Work under this contract will be executed in part during regular sessions of School.
   1. Cooperate with School authorities in every way to minimize disturbance.

B. In entrance and exit of workers, and in bringing in, storing, and removal of equipment, cooperate with those in authority and prevent interference with functioning of School.
   1. Observe rules and regulations in force and avoid unnecessary dust, mud, or accumulated debris, or undue interference with convenience, sanitation or routine of departmental activities.

C. In connecting new utilities to existing, and similar operations, time and coordinate such operations so that there will be no interference with School activities.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION *(Not Applicable)*

END OF SECTION 01 1100

SECTION 01 2610

CONSTRUCTION DOCUMENT MODIFICATION PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for handling and processing Construction Document Modifications to Contract.

1.02 MINOR CHANGES IN WORK

A. Supplemental instructions authorizing minor changes in Work, not involving adjustment to Contract Sum or Contract Time, will be issued by Architect on *AIA form G710 - Architect's Supplemental Instructions*.

1.03 CONSTRUCTION CHANGE DOCUMENT APPROVAL REQUESTS

A. Construction Change Documents will not be allowed without Division of the State Architect (DSA) approval.

B. Owner-Initiated Change Requests:
   1. Proposed changes in Work that will require adjustment to Contract Sum or Contract Time will be issued by Architect, with detailed description of proposed change and supplemental or revised Drawings and Specifications, when necessary.
   2. Change requests issued by Architect are for information only.
      a. Do not consider them an instruction either to stop Work in progress, or to execute proposed change.
   3. Unless otherwise indicated in change request, within ten days of receipt of change request, submit to Architect for Owner's review, estimate of cost necessary to execute proposed change.
      a. When no estimate of cost is submitted within 10 days it will be assumed to be “no cost change”.
      b. Include list of quantities of products to be purchased and unit costs, along with total amount of purchases to be made.
      c. Provide breakdown of labor cost involved with the proposed change.
         1) Where requested, furnish survey data to substantiate quantities.
      d. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
      e. Include statement indicating effect proposed change in Work will have on Contract Time.

C. Contractor-Initiated Change Requests:
   1. When latent or other unforeseen conditions require modifications to Contract, Contractor may propose changes by submitting request for change to Architect.
      a. Notify Owner within ten days of occurrence leading to such request or request will be denied and Contractor will not be entitled to additional compensation.

2. Include statement outlining reasons for change and effect of change on Work.
   a. Provide complete description of proposed change.
   b. Indicate effect of the proposed change on Contract Sum and Contract Time.
3. Include list of quantities of products to be purchased and unit costs along with total amount of purchases to be made. .
   a. Provide breakdown of labor cost involved with proposed change.
   b. Where requested, furnish survey data to substantiate quantities.
4. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
5. Comply with requirements in Section 01 6000, when proposed change in Work requires substitution of one product or system for product or system specified.
6. All substitution affecting DSA regulated items shall be a CCD or Addenda.

D. Construction Change Document:
   1. *DSA Form 140 – Application for Approval of Construction Change Document – CCD Category A*.
   2. Form will be prepared by Architect for approval by DSA.
   3. Form must be signed by each of following:
      a. A/E of Record.
      b. Structural Engineer, when applicable.
      c. Delegated professional engineer, when applicable.

E. Construction Change Directive:
   1. When Owner and Contractor are not in total agreement on terms of Change Order Proposal Request, Architect may issue Construction Change Directive on *AIA Form G714*, instructing Contractor to proceed with change in Work, for subsequent inclusion in Contract.
   2. Construction Change Directive will contain complete Construction Change Document and designate method to be followed to determine change in Contract Sum or Contract Time.

F. Documentation:
   1. Maintain detailed records on time and material basis of work required by Construction Change Directive.
   2. After completion of change, submit itemized account and supporting data necessary to substantiate cost and time adjustments to Contract.

1.04 CONTRACT CHANGE ORDER PROCEDURES

A. Upon DSA approval of Construction Change Document DSA Form 140, Architect will issue Construction Change Documents for signatures of Owner and Contractor on proper approved form, as provided in General Conditions of the Contract.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION *(Not Applicable)*

END OF SECTION 01 2610

SECTION 01 2976

PROGRESS PAYMENT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements governing Contractor's applications for payment.

B. Related Sections:
   1. Section 01 2610: Construction Document Modification Procedures
   2. Section 01 7700: Closeout Procedures
   3. Section 01 7839: Project Record Documents

C. Related Requirements:
   1. Refer to District’s Division 00 Documents, including General Conditions, for requirements related to Contractor's Construction Schedule, Submittal Schedule, and Progress Payments Procedures.

1.02 SCHEDULE OF VALUES

A. Coordinate preparation of Schedule of Values with preparation of Contractor's construction schedule.
   1. Correlate line items in Schedule of Values with other required administrative schedules and forms, including:
      a. Contractor's Construction Schedule.
      b. Application for Payment form.
      c. List of Subcontractors.
      d. Schedule of Alternates.
      e. List of products.
      f. List of principal suppliers and fabricators.
      g. Schedule of Submittals.
   2. Submit Schedule of Values to Architect at earliest feasible date, but in no case later than fourteen days before date scheduled for submittal of initial application for payment.
   3. Sub-Schedules: Where Work is separated into phases that require separately phased payments, provide sub-schedules showing values correlated with each phase of payment.

B. Format and Content:
   1. Include following project identification on Schedule of Values:
      a. Project name and location.
      b. Name of Architect.
      c. Project number.
      d. Contractor's name and address.
      e. Date of submittal.

2. Arrange Schedule of Values in tabular form with separate columns to indicate following for each item listed:
   a. Generic name.
   b. Related specification section.
   c. Name of subcontractor.
   d. Name of manufacturer or fabricator.
   e. Name of supplier.
   f. Change Orders (numbers) that have affected value.
   g. Dollar value.
   h. Percentage of Contract sum to nearest one-hundredth percent, adjusted to total 100 percent.
3. Provide breakdown of Contract Sum in sufficient detail to facilitate continued evaluation of applications for payment and progress reports.
   a. Break principal subcontract amounts down into several line items.
4. Round amounts off to nearest whole dollar, with total equal to Contract Sum.
5. For each part of Work where application for payment may include materials or equipment, purchased or fabricated and stored, but not yet installed, provide separate line items on Schedule of Values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of Work.
6. Margins of Cost:
   a. Show line items for indirect costs, and margins on actual costs, only to extent that such items will be listed individually in applications for payment.
   b. Complete each item in Schedule of Values and applications for payment including its total cost and proportionate share of general overhead and profit margin.
   c. At Contractor's option, temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown as separate line items in Schedule of Values or distributed as general overhead expense.
7. Schedule Updating:
   a. Update and resubmit Schedule of Values when Change Orders or Construction Change Directives result in change in Contract Sum.
   b. Submit along with updated construction schedule prior to monthly progress payment submittal

1.03 APPLICATIONS FOR PAYMENT

A. Ensure that each application for payment is consistent with previous applications and payments as certified by Architect and paid for by Owner.
   1. Initial application for payment, application for payment at time of Substantial Completion, and final application for payment involve additional requirements.

B. Payment Application Times:
   1. Date for each progress payment is 5th day of each month,
   2. Period of construction Work covered by each application for payment is period ending fifteen days prior to date for each progress payment and starting day following end of preceding period.

C. Payment Application Forms:
   1. Use *AIA Document G702 –Application and Certification For Payment* as form for application for payment or approved equal.

D. Application Preparation:
   1. Complete every entry on form, including notarization and execution by person authorized to sign legal documents on behalf of Owner.
      a. Incomplete applications will be returned without action.
   2. Ensure entries match data on Schedule of Values and Contractor's construction schedule.
      a. Use updated schedules when revisions have been made.
   3. Include amounts of approved Change Orders issued prior to last day of construction period covered by application.

E. Transmittal:
   1. Submit five executed copies of each application for payment to Architect by means ensuring receipt within twenty-four hours.
      a. Transmit one completed copy, including waivers of lien and similar attachments, when required.
      b. Transmit each copy with transmittal form listing attachments, and recording appropriate information related to application in manner acceptable to Architect.

F. Waivers of Mechanics Lien:
   1. When requested by Architect or Owner, with each application for payment, submit waivers of mechanics lien from every entity who may lawfully be entitled to file mechanics lien arising out of Contract, and related to Work covered by payment.

G. Initial Application for Payment:
   1. Administrative actions and submittals that must precede or coincide with submittal of first application for payment include following:
      a. List of subcontractors.
      b. List of principal suppliers and fabricators.
      c. Schedule of Values.
      d. Contractor's Construction Schedule (preliminary if not final).
      e. Submittal Schedule (preliminary if not final).
      f. Certificates of insurance and insurance policies.
      g. Performance and Payment Bonds

H. Application for Payment at Substantial Completion:
   1. Following issuance of Certificate of Substantial Completion, submit application for payment.
   2. Submit Application reflecting Certificates of Partial Substantial Completion issued previously for Owner occupancy of designated portions of Work.

I. Administrative actions and submittals that precede or coincide with application include:
   1. Occupancy permits and similar approvals.
   2. Warranties/guarantees and maintenance agreements.
   3. Test/adjust/balance records.
   4. Maintenance instructions.
   5. Meter readings.

6. Start-up performance reports.
7. Changeover information related to Owner's occupancy, use, operation and maintenance.
8. Final cleaning.
9. Application for reduction of retainage, and consent of surety.
10. Advice on shifting insurance coverage.
11. Record Drawings and Specifications.
12. Final progress photographs.
13. List of incomplete Work, recognized as exceptions to Architect’s Certificate of Substantial Completion.

J. Final Payment Application:
   1. Administrative actions and submittals that must precede or coincide with submittal of final payment application for payment include following:
      a. Completion of project closeout requirements.
      b. Completion of items specified for completion after Substantial Completion.
      c. Assurance that unsettled claims will be settled.
      d. Assurance that Work not complete and accepted will be completed without undue delay.
      e. Transmittal of required project construction records to Owner.
      f. Proof that taxes, fees and similar obligations have been paid.
      g. Removal of temporary facilities, controls, and services.
      h. Removal of surplus materials, rubbish and similar elements.
      i. Change of door locks to Owner's access.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION *(Not Applicable)*

END OF SECTION 01 2976

SECTION 01 3113

PROJECT COORDINATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Administrative and supervisory requirements necessary for Project coordination including, but not necessarily limited to:
      a. Coordination.
      b. Administrative and supervisory personnel.
      c. General installation provisions.
      d. Cleaning and protection.

B. Related Sections:
   1. Section 01 3300: Submittal Procedures; product and material submittals.
   2. Section 01 7423: Cleaning; general project cleaning

C. Related Requirements:
   1. Refer to District's Division 00 Documents, including General Conditions, for requirements related to Contractor's Construction Schedule and Submittal Schedule.

1.02 COORDINATION

A. Coordination:
   1. Coordinate construction activities included under various Sections of these Specifications to assure efficient and orderly installation of each part of Work.

B. Coordinate construction operations included under different Sections of Specifications that are dependent upon each other for proper installation, connection, and operation.
   1. Where installation of one part of Work is dependent on installation of other components, either before or after its own installation, schedule construction activities in sequence required to obtain best results.
   2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

C. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination.
   1. Include such items as required notices, reports, and attendance at meetings.
   2. Prepare similar memoranda for Owner and separate Contractors where coordination of their Work is required.

D. Administrative Procedures:
   1. Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of Work.
   2. Such administrative activities include, but are not necessarily limited to, following:
      a. Preparation of schedules.
      b. Installation and removal of temporary facilities.
      c. Delivery and processing of submittals.
      d. Progress meetings.
      e. Project Close-out activities.

E. Conservation:
   1. Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water and materials.
   2. Salvage materials and equipment involved in performance of, but not actually incorporated in, Work.
   3. Refer to other sections for disposition of salvaged materials that are designated as Owner's property.

1.03 SUBMITTALS

A. Staff Names:
   1. Within fifteen days of Notice to Proceed, submit list of Contractor's principal staff assignments, including Superintendent and other personnel in attendance at Project Site
   2. Identify individuals, their duties and responsibilities
      a. List their addresses and telephone numbers.
   3. Post copies of list in Project meeting room, temporary field office and each temporary telephone.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION

3.01 GENERAL INSTALLATION PROVISIONS

A. Inspection of Conditions:
   1. Require installer of each major component to inspect both substrate and conditions under which Work is to be performed.
   2. Do not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

B. Manufacturer's Instructions:
   1. Comply with manufacturer's installation instructions and recommendations, to extent that those instructions and recommendations are more explicit or stringent than requirements contained in Contract Documents.

C. Inspect materials or equipment immediately upon delivery and again prior to installation.
   1. Reject damaged and defective items.

D. Provide attachment and connection devices and methods necessary for securing Work.
   1. Secure Work true to line and level.
   2. Allow for expansion and building movement.

E. Visual Effects:
   1. Provide uniform joint widths in exposed Work.
   2. Arrange joints in exposed Work to obtain best visual effect.
   3. Refer questionable choices to Architect for final decision.

F. Recheck measurements and dimensions before starting each installation.

G. Install each component during weather conditions and Project status that will ensure best possible results.
   1. Isolate each part of completed construction from incompatible material as necessary to prevent deterioration.

H. Coordinate temporary enclosures with required inspections and tests, to minimize necessity of uncovering completed construction for that purpose.

I. Mounting Heights:
   1. Where mounting heights are not indicated, install individual components at standard mounting heights recognized within industry for particular application indicated.
   2. Comply with requirements of Chapter 11B of CBC for accessible mounting heights of toilet accessories and like items.
   3. Refer questionable mounting height decisions to Architect for final decision.

3.02 CLEANING AND PROTECTION

A. Comply with requirements of Section 01 7423.

B. During handling and installation, clean and protect construction in progress and adjoining materials in place.
   1. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

C. Clean and maintain completed construction as frequently as necessary through remainder of construction period.
   1. Adjust and lubricate operable components to ensure operability without damaging effects.

D. Limiting Exposures:

   1. Supervise construction activities to ensure that no part of construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during construction period.

END OF SECTION 01 3113

SECTION 01 3119

PROJECT MEETINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for project meetings including but not limited to:
      a. Pre-Construction Conference
      b. Progress Meetings
      c. Scheduling Conference

B. Related Sections:
   1. Section 01 3113: Project Coordination
   2. Section 01 3300: Submittals

C. Related Requirements:
   1. Refer to various Sections for pre-construction and pre-installation meeting requirements
   2. Refer to District's Division 00 Documents, including General Conditions, for requirements related to Contractor's Construction Schedule.
   3. Requirements for Contractor's Construction Schedule are included in Section 01 3300.

1.02 PRE-CONSTRUCTION CONFERENCE

A. Schedule pre-construction conference and organizational meeting at Project Site or other convenient location no later than 15 days after execution of Agreement and prior to commencement of construction activities.
   1. Conduct meeting to review responsibilities and personnel assignments.

B. Attendees:
   1. Owner, Architect and their consultants.
   2. Contractor and his superintendent.
   3. Major subcontractors, manufacturers, suppliers.
   4. Other concerned parties.
   5. Persons representing each party in attendance must be familiar with and authorized to conclude matters relating to Work.

C. Agenda:
   1. Discuss items of significance that could affect progress including such topics as:
      a. Tentative construction schedule.
      b. Critical Work sequencing.
      c. Designation of responsible personnel.
      d. Procedures for processing field decisions and Change Orders.
      e. Procedures for processing Applications for Payment.
      f. Procedures for processing Requests for Information (RFI).
      g. Distribution of Contract Documents.

h. Submittal of Shop Drawings, Product Data and Samples.
i. Preparation of Record Documents.
j. Access to Project Site and use of premises.
k. Office, Work and storage areas.
l. Equipment deliveries and priorities.
m. Safety procedures.
n. First aid.
o. Security.
p. Working hours.

1.03 PROGRESS MEETINGS

A. Conduct weekly progress meetings at Project Site.
1. Coordinate dates of meetings with preparation of payment request.

B. Attendees:
1. Representatives of
a. Owner and Architect,
b. Representatives of each subcontractor, supplier, or other entity concerned with current progress or involved in planning, coordination, or performance of future activities.
c. Persons representing each party in attendance at these meetings must be familiar with and authorized to conclude matters relating to progress.

C. Agenda:
1. Review and correct or approve minutes of previous progress meeting.
2. Review other items of significance that could affect progress.
3. Include topics for discussion as appropriate to current status of Project.
4. Contractor's Construction Schedule:
a. Review progress since last meeting.
b. Determine where each activity is in relation to Contractor's Construction Schedule, whether on time or ahead or behind schedule.
c. Determine how construction behind schedule will be expedited
1) Secure commitments from parties involved to do so.
d. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within Contract Time.
5. Review present and future needs of each entity present, including such items as:
a. Interface requirements.
b. Time.
c. Sequences
d. Cordination of Work.
e. Deliveries.
f. Off-site fabrication problems.
g. Access.
h. Site utilization.
i. Temporary facilities and services.
j. Hours of Work.
k. Hazards and risks.
l. Housekeeping.
m. Quality and Work standards.
n. Construction progress
o. Progress Schedule and Submittals.

p. Change Orders.
q. Documentation of information for payment requests.

D. Meeting Records:
1. Recording of minutes of each meeting will be by Contractor.
a. Furnish copies within reasonable time to Owner, Architect, and other attendees.
b. Unless written objections to contents of meeting minutes are received by Contractor within five days of distribution of meeting minutes, it is understood and agreed upon that minutes are true and complete record of meeting.
c. Schedule Updating:
1) Revise construction schedule after each progress meeting where revisions to schedule have been made or recognized.
2) Issue revised schedule within seven calendar days of meeting.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION *(Not Applicable)*

END OF SECTION 01 3119

SECTION 01 3300

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Procedural requirements for non-administrative submittals for work-related submittals required for performance of Work and by Contract Documents, including, but not necessarily limited to:
      a. Submittal Schedule.
      b. Product Data.
      c. Shop Drawings.
      d. Samples
      e. Verified Reports
      f. Deferred Approvals

B. Related Sections:
   1. Section 01 3113: Project Coordination
   2. Section 01 4100: Regulatory Requirements; submittals to regulatory agencies.
   3. Section 01 4200: References; submittals to regulatory agencies.
   4. Section 01 4500: Quality Control: inspection and testing submittals
   5. Section 01 6000: Products Requirements; request for substitution submittals.

C. Related Requirements:
   1. Refer to District's Division 00 Documents, including General Conditions, and other Division 01 Sections, for specifications for administrative submittals and additional requirements.
      a. Administrative Submittals include, but are not necessarily limited to:
         1) Permits.
         2) Applications for Payment.
         3) Performance and Payment Bonds.
         4) Insurance Certificates.
         5) Inspection and Test Reports.
         6) Schedule of Values.
         7) Progress Schedule.
         8) Listing or designation of subcontractors.
         9) Record Drawings.
         10) Commissioning Requirements
   2. Refer to Division 02 through 33 Sections where more specific Submittal Requirements are indicated

D. Substitutions:
   1. Contractor's submittal and Architect's acceptance of Product Data, Shop Drawings, or Samples that relate to construction activities not complying with Contract Documents does not constitute acceptable or valid request for substitution, nor does it constitute approval.

2. Product Data, Shop Drawing and Sample Submittals containing substitutions for specified items will be rejected and returned as not in compliance with Contract Documents.
3. Refer to Section 01 6000 for required procedures for submitting substitution requests.

E. LEED Submittals:
1. Indicate design review, submittal review, commissioning coordination, system verification/start-up checklists, field inspection, and functional testing as part of overall Project timeline.
2. Make LEED submittals separate from shop drawing submittals.

F. Commissioning Milestone Reports:
1. Reports by parties that participate in design review, product submittal review, installation, start-up, test and balance, training, and closeout phases.
2. Coordinate submittals of documentation pertaining to these functions and communicate with Commissioning Authority via Contractor.

1.02 SUBMITTAL PROCEDURES AND REQUIREMENTS

A. Coordination:
1. Coordinate preparation and processing of submittals with performance of construction activities.
2. Designate in Progress Schedule, or in separate coordinated schedule, dates for submission and dates reviewed shop drawings, product data and samples will be needed for each product.
   a. Identify items requiring long lead times.
      1) Make submittals for such items as soon as possible, but not later than fifteen days after Notice of Award of Contract.

B. Timing of Submittals:
1. Make submittals promptly in accordance with approved schedule, sufficiently in advance of performance of related construction activities, and in such sequence as to not cause delay in Work or in Work of other contractors.
2. Schedule submissions at least 21 working days before dates reviewed submittals will be needed.

C. Number of Submittals Required:
1. Number stated in each specification section, or as follows:
   a. Product Data and Shop Drawings:
      1) One electronic copy as specified under “Electronic Submittals”.
   b. Samples:
      1) Number stated in each specification section or, when not stated, minimum of four.
   c. Warranties, Maintenance Agreements, Industry Standards, and Operation/Maintenance Manuals:
      1) Two copies.

D. Submittal Preparation:
1. Place permanent label or title block on each submittal for identification.
2. Indicate name of entity that prepared each submittal on label or title block.
3. Include following information on label for processing and recording action taken:

a. Project name.
b. Date.
c. Submittal reference number assigned by Contractor; this number should not be specification section number.
d. Specification section number to which submittal applies.
    1) Do not reference drawing/detail numbers unless accompanied by specification section number.

4. Accompany submittals with transmittal form containing:
    a. Date.
    b. Project title and number.
    c. Name and addresss of:
        1) Architect.
        2) Contractor.
        3) Subcontractor.
        4) Supplier
        5) Manufacturer.
        6) Separate detailer, when pertinent.
    d. Number of each shop drawing, product data and sample submitted.
    e. Notification of deviations from Contract Documents.
    f. Other pertinent data.
        1) Interactive Submittal Transmittal Form will be provided to Contractor at Pre-Construction Meeting.

E. Include following on Submittals:
1. Data and revision dates:
2. Project title and number.
3. Identification of product or material.
4. Relation to adjacent structure or materials.
5. Field dimensions, clearly identified as such.
6. Specification section number.
7. Applicable standards, such as ASTM number or Federal Specification.
8. Blank space, 8 inches x 3 inches, for Contractor and Architect stamps.
9. Identification of deviations from Contract Documents.
10. Contractor’s stamp, initialed or signed, certifying review of submittal, verification of field measurements, and compliance with Contract Documents.
    a. Submittals without Contractor’s stamp and signature will be returned by Architect without review.

F. Processing:
1. Allow sufficient review time so that installation will not be delayed as result of time required to process submittals, including time for resubmittals.
2. Allow minimum of 21 days from date of receipt of complete submittal for Architect’s initial review and return of submittals.
3. Allow additional time if processing must be delayed to permit coordination with subsequent submittals.
4. Architect reserves right to withhold action on submittal requiring coordination with other submittals until related submittals are received.
5. Architect will promptly advise Contractor when submittal being processed must be delayed for coordination.
6. No extension of Contract Time will be authorized because of failure to transmit submittals to Architect sufficiently in advance of Work to permit processing.

G. Electronic Submittals:
   1. Make electronic submittals consisting of one color PDF of each document, Product Data Sheet, or Shop Drawing.
   2. Should full size hard copies of Submittals be required by District, Contractor, or Consultant, Architect will provide one marked-up color copy of PDF to Owner, Contractor, or Consultant for their use in printing additional copies.
   3. Architect will review and return marked-up PDFs to Contractor.
   4. Mark-up one copy of each PDF and maintain as “Record Document".

H. Material Safety Data Sheets/Safety Data Sheets (MSDS/SDS):
   1. Do not include MSDS/SDS in submittals to Architect.
      a. MSDS/SDS sheets will not be reviewed by Architect and will not be returned.
   2. Include MSDS/SDS sheets in submittals to Contractor only, and when required with LEED Submittals.

1.03 PRODUCT DATA

A. Collect Product Data into single submittal for each element of construction or system.

B. Product Data includes standard printed information on manufactured products that has not been specially prepared for this Project, including, but not necessarily limited to following items:
   1. Manufacturer’s product specifications and installation instructions.
   2. Catalog cuts.
   3. Standard color charts.
   4. Roughing-in diagrams and templates.
   5. Standard wiring diagrams.
   6. Printed performance curves.
   7. Operational range diagrams.
   8. Mill reports.
   9. Standard product operating and maintenance manuals.

C. Modify standard data sheets and drawings to delete information which is not applicable to Project.
   1. Where Product Data must be specially prepared because standard printed data is not suitable for use, submit as shop drawings.
      a. Mark each copy to show applicable choices and options.
      b. Where printed Product Data includes information on several products, some of which are not required, mark copies to indicate applicable information.
      c. Include following information:
         1) Manufacturer's printed recommendations.
         2) Compliance with recognized trade association standards.
         3) Compliance with recognized testing agency standards.
         4) Application of testing agency labels and seals.
         5) Notation of dimensions and clearances required and as verified by Field measurement.
         6) Notation of coordination requirements.

D. Supplement standard information to provide additional information specifically applicable to Project:

1. Clearly mark each copy to show applicable choices and options and identify pertinent materials, products, or models.
2. Show dimensions and clearances required.
3. Show performance characteristics and capacities.
4. Show wiring or piping diagrams and controls.

E. Do not submit Product Data until compliance with requirements of Contract Documents has been confirmed.
   1. Unless noncompliance with Contract Document provisions is observed, submittal may serve as final submittal.

F. Submittals:
   1. Make electronic submittals as specified in “General Submittal Procedures and Requirements” Article.

G. Distribution:
   1. Furnish copies of final submittal to installers, subcontractors, suppliers, manufacturers, fabricators, and others required for performance of construction activities.
      a. Show distribution on transmittal forms.
   2. Do not proceed with installation until applicable copy of Product Data is in installer’s possession.

H. Do not permit use of unmarked copies of Product Data in connection with construction.

1.04 SHOP DRAWINGS

A. Shop drawings are technical drawings and data that have been specially prepared for Project, including but not necessarily limited to following items:
   1. Prepared information, drawn to accurate scale.
   2. Fabrication and installation drawings.
   3. Shopwork manufacturing instructions.
   4. Setting diagrams.
   5. Templates.
   6. Patterns.
   7. Coordination drawings (for use on Project Site).
   8. Schedules.
   9. Design mix formulas.
   10. Contractor's engineering calculations.

B. Include following information:
   1. Dimensions.
   2. Identification of products and materials included.
   3. Compliance with specified standards.
   4. Notation of coordination requirements.
   5. Notation of dimensions established by field measurement.
   6. Sheet Size:
      a. Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8-1/2 inch by 11 inch but no larger than 30 inch by 42 inch.

C. Highlight, encircle, or otherwise indicate deviations from Contract Documents.

D. Standard information prepared without specific reference to Project is not considered Shop Drawings.

E. Submittals:
   1. Make electronic submittals as specified in “General Submittal Procedures” Article.

F. Do not use Shop Drawings without appropriate final stamp indicating action taken in connection with construction.

G. Do not reproduce Contract Documents or copy standard information as basis of Shop Drawings.

1.05 SAMPLES

A. Samples are physical examples of Work, including, but not limited to, following items:
   1. Partial sections of manufactured or fabricated work
   2. Small cuts or containers of materials.
   3. Complete units of repetitively- used materials.
   4. Swatches showing color, texture and pattern.
   5. Color Range Sets.
   6. Units of Work to be used for independent inspection and testing.

B. Office Samples:
   1. Sufficient size and quantity to clearly illustrate:
      a. Functional characteristics of product or material, with integrally related parts and attachment devices.
      b. Full range of color, texture and pattern.
   2. Where size and quantity are not specified, provide minimum of four samples, 12 inches by 12 inches, minimum size, where samples are required

C. Field Samples and Mock-Ups:
   1. Erect at Project Site in location acceptable to Architect.
   2. Construct each sample or mock-up complete, including Work of trades required in finished Work.
   3. Size of area as specified in respective specification section.
   4. Remove mock-ups at conclusion of Work or when acceptable to Architect.

1.06 VERIFIED REPORTS

A. Submit Verified Reports to Division of State Architect (DSA). Comply with California Code of Regulations,Title 24, Part 1, Sections 4-336 and 4-343.

1.07 DEFERRED APPROVALS

A. Submit detailed plans, specifications, and engineering calculations for Deferred Approval items.
   1. Items requiring Deferred Approval are listed on Drawings.

B. Submit calculations and drawings of structural nature prepared and signed by registered Structural Engineer licensed in State of California.
   1. Provide cover sheet for calculations indicating following:
      a. Westberg+White Project Number

b. DSA Project Number
c. Project Name, with address and Date.
d. Provide 7 by 9 inch clear space on 8-1/2 by 11 inch calculation cover sheet.

2. Provide 7 by 9 inch clear space on upper right hand side and to left of title block on full size Drawings.

C. Submit 6 full size copies of plans and calculations on 8-1/2 by 11 inch bond paper with wet signatures in blue.
1. Prior to DSA review, Architect review.may be returned for corrections
a. Resubmit 6 sets of plans with corrections – no clouds
b. Up to 3 sets of plans and calculations will be sent to DSA by Architect for approval.
2. Should corrections be required by DSA, make corrections and submit 6 sets of plans and calculations, along with DSA checkset, to Architect.
3. After DSA approval, one electronic set will be returned to Contractor.

D. Do not start fabrication and installation of Deferred Approval items until detailed Contractor's drawings, specifications, and engineering calculations for actual systems to be installed have been accepted and signed by Architect or Structural Engineer and approved by Division of the State Architect (DSA).

1.08 MISCELLANEOUS SUBMITTALS – WORK RELATED

A. Including, but not necessarily limited to, following types of submittals:
1. Specially prepared warranties/guarantees.
2. Standard printed warranties.
3. Maintenance agreements.
4. Printed industry standards.
5. Collected and bound operating/maintenance manuals.
6. Keying schedule, keys, and other security protection safety devices.
7. Maintenance tools and spare parts.

1.09 CONTRACTOR RESPONSIBILITIES

A. As defined in Division 00 General Conditions and following:.
1. Review shops drawings, product data and samples prior to submission to Architect.
2. Determine and Verify:
a. Field measurements.
b. Field construction criteria.
c. Catalog numbers and similar data.
d. Conformance with specifications.
3. Coordinate each submittal with requirements of Work and of Contract documents.
4. Notify Architect in writing, at time of submission, of deviations in submittals from requirements of Contract Documents
5. Do not begin fabrication of Work that requires submittals until return of submittals with Architect approval.

1.10 RESUBMITTAL REQUIREMENTS

A. Shop Drawings:
   1. Revise initial drawings as required and resubmit as specified for initial submittal.
   2. Indicate on drawings changes that have been made other than those requested by Architect.

B. Product Data and Samples:
   1. New data and samples, same as required for initial submittal.

C. Multiple Resubmittals:
   1. Requirements cover initial submittal review and one resubmittal review when necessary.
   2. Architect’s and/or Consultant’s cost for evaluationg additional submittals requested by Contractor beyond first resubmittal will be paid by Owner with reimbursement from Contractor by deductive change order.

1.11 DISTRIBUTION OF SUBMITTALS AFTER REVIEW

A. Distribute reproductions of Shop Drawings and copies of Product Data which carry Architect/Engineer stamp to:
   1. Project Site file.
   2. Record Documents file.
   3. Other affected contractors.
   4. Subcontractors.
   5. Supplier or Fabricator.
   6. Owner's Project Inspector.

B. Distribute samples that carry Architect’s review stamps as directed by Architect.

1.12 ARCHITECT'S ACTION

A. Except for submittals for record, information or similar purposes, where action and return is required or requested, Architect will review each submittal, mark to indicate action taken, and return promptly.
   1. Compliance with specified characteristics is Contractor's responsibility.

B. Action Stamp:
   1. Architect will stamp each submittal with uniform, self-explanatory action stamp.
   2. Stamp will be appropriately marked, as follows, to indicate action taken:
      a. Final Unrestricted Release:
         1) Where submittals are marked "No Exception Taken”, that part of Work covered by submittal may proceed provided it complies with requirements of the Contract Documents; final acceptance will depend upon that compliance.
      b. Final-But-Restricted Release:
         1) When submittals are marked "Make Correction Noted", that part of Work covered by submittal may proceed provided it complies with notations or corrections on submittal and requirements of Contract Documents.
         2) Final acceptance will depend on that compliance.

c. Returned for Re-submittal:
   1) When submittal is marked "Revise and Resubmit", do not proceed with that part of Work covered by submittal, including purchasing, fabrication, delivery, or other activity.
   2) Revise or prepare new submittal in accordance with notations.
   3) Resubmit without delay.
   4) Repeat if necessary to obtain different action mark.
   5) Do not permit submittals marked "Rejected" or "Revise and Resubmit" to be used at Project Site, or elsewhere where Work is in progress.

d. Other Action:
   1) Where submittal is primarily for information or record purposes, special processing or other activity, submittal will be returned, marked "Action Not Required".

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION *(Not Applicable)*

END OF SECTION 01 3300

SECTION 01 4100

REGULATORY REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. General regulatory requirements pertaining to Work supplementary to other regulatory requirements mentioned or referenced elsewhere in Contract Documents.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

A. Pertaining statutes, ordinances, laws, rules, codes, regulations, standards, and lawful orders of public authorities having jurisdiction of Work are incorporated into these Contract Documents same as if repeated in full, and as such are intended where reference is made in either singular or plural to Code or Building Code unless otherwise specified including, without limitation, those in list below.
   1. Make available at Project Site such copies of listed documents applicable to Work as Architect or Owner may request including mentioned portions of California Code of Regulations (CCR).

B. Project is fully governed under State of California's Codes Section Group 1, Chapter 4, Part 1, CCR, Title 24, as it pertains to school construction:
   1. Inspector and Continuous Inspections of Work:
      a. Per Sections 4-333(b) and 4-342.
   2. Tests and Testing Laboratory:
      a. Per Section 4-335.
      b. Owner pays for testing laboratory.
   3. Special Inspections:
      a. Per Section 4-333(c).
   4. Verified Reports:
      a. Submit per Sections 4-336 and 4-343(c).
   5. Administration:
      a. Duties of Architect and Engineers:
         1) Per Sections 4-333(a) and 4-341.
      b. Duties of Contractor:
         1) Per Section 4-343.
      c. Verified Reports:
         1) Per Section 4-336.
   6. Arrange for copies of CCR, Title 24, Part 1, Part 2 Volumes 1 and 2, Part 3, and Part 9, to be made available during construction.

C. Public regulatory requirements: Statutes, ordinances, laws, rules, codes, regulations, and standards include, but are not necessarily limited to, following:
   1. California Code of Regulations (CCR):
      a. Title 19 - Public Safety, current edition.
      b. Title 24, Part 1 – 2022 California Administrative Code
      c. Title 24, Part 2 – 2022 California Building Code (CBC), Volumes 1 and 2.
      d. Title 24, Part 3 – 2022 California Electrical Code (CEC).

e. Title 24, Part 4 – 2022 California Mechanical Code (CMC)
f. Title 24, Part 5 – 2022 California Plumbing Code (CPC).
g. Title 24, Part 6 – 2022 California Energy Code
h. Title 24, Part 9 – 2022 California Fire Code (CFC).
i. Title 24, Part 10 – 2022 California Existing Building Code (CEBC):
    1) Includes Parts 8 and 12:
        a) Part 8 – California Historical Building Code (CHBC)
        b) Part 12 – California Referenced Standards Code (CRSC)
j. Title 24, Part 11 – 2022 California Green Building Standards Code (GBSC)

2. Other statutes, ordinances, laws, regulations, rules, orders, and codes specified in other Sections of Specifications or bearing on Work.

1.03 GOVERNING REGULATIONS/AUTHORITIES

A. Architect has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents
    1. Information may or may not be of significance to Contractor.
    2. Owner and Architect, at request of Contractor, are to contact authorities having jurisdiction directly for information and decisions having bearing on Work.

1.04 SUBMITTALS

A. Permits, Licenses, and Certificates:
    1. Submit for Owner's records, copies of following, including but not necessarily limited to:
    2. Permits
    3. Licenses
    4. Certifications
    5. Inspection reports
    6. Releases
    7. Jurisdictional settlements
    8. Notices
    9. Receipts for fee payments
    10. Judgments, and similar documents
    11. Correspondence, and records established in conjunction with compliance with standards and regulations bearing upon performance of Work.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION *(Not Applicable)*

END OF SECTION 01 4100

SECTION 01 4200

REFERENCES

PART 1 GENERAL

1.01 DEFINITIONS

A. Basic contract definitions are included in Division 00 General Conditions.

B. Indicated:
   1. Refers to graphic representations, notes or schedules on Drawings, or other paragraphs or schedules in Specifications, and similar requirements in Contract Documents.
   2. Where terms such as "shown", "noted", "scheduled", and "specified" are used, it is to help locate the reference
      a. No limitation of location is intended except as specifically noted.

C. Directed:
   1. Terms such as "directed", "requested", "authorized," "selected", "approved", "required", and "permitted" mean "directed by Architect", "requested by Architect", and similar phrases.
   2. No implied meaning is to be interpreted to extend Architect's responsibility into Contractor's area of construction supervision.

D. Approved:
   1. Where used in conjunction with Architect's action on Contractor's submittals, applications, and requests, is limited to Architect's duties and responsibilities as stated in General Conditions.

E. Regulations:
   1. Includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within construction industry that control performance of Work.

F. Furnish:
   1. Means supply and deliver to Project Site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. Install:
   1. Describes operations at Project Site including actual unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimensions, finishing, curing, protecting, cleaning, and similar operations.

H. Provide:
   1. Means furnish and install, complete and ready for intended use.

I. Installer:
   1. Contractor or entity engaged by Contractor, either as employee, subcontractor, or sub-subcontractor, for performance of particular construction activity, including installation, erection, application, and similar operations.
   2. Installers are required to be experienced in operations they are engaged to perform.

J. Project Site:
   1. Space available to Contractor for performance of construction activities, either exclusively or in conjunction with others performing other construction activities as part of Project.
   2. Extent of Project Site is shown on Drawings and may or may not be identical with description of land upon which Project is to be built.

K. Testing Laboratories:
   1. Independent entity engaged to perform specific inspections or tests, either at Project Site or elsewhere, and to report on and, when required, to interpret results of those inspections or tests.

1.02 INDUSTRY STANDARDS

A. Applicability of Standards:
   1. Except where Contract Documents include more stringent requirements, applicable construction industry standards have same force and effect as if bound or copied directly into Contract Documents.
      a. Such standards are made part of Contract Documents by reference.
   2. Individual Sections indicate which codes and standards Contractor must make available at Project Site for reference.

B. Publication Dates:
   1. Comply with standard in effect as of date of Contract Documents.

C. Copies of Standards:
   1. Each entity engaged in construction on Project is required to be familiar with industry standards.
   2. Applicable standards are not bound with Contract Documents.
   3. Where copies of standards are required by individual specification sections or are needed for performance of required construction activity, obtain copies directly from publication source.

D. Conflicting Requirements:
   1. Where compliance with two or more standards is specified, and standards establish different or conflicting requirements for minimum quantities or quality levels, refer requirements that are different, but apparently equal, and uncertainties to Architect for decision before proceeding.

1.03 GOVERNING REGULATIONS/AUTHORITIES

A. Architect has contacted authorities having jurisdiction where necessary to obtain information necessary for preparation of Contract Documents
   1. That information may or may not be of significance to Contractor.
   2. Owner and Architect, at request of Contractor, are to contact authorities having jurisdiction directly for information and decisions having bearing on Work.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION *(Not Applicable)*

END OF SECTION 01 4200

SECTION 01 4500

QUALITY CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for quality control services.
   2. Quality control services include inspections, tests, and related actions, including reports performed by Contractor, by independent agencies, and by governing authorities.
      a. They do not include contract enforcement activities performed by Architect.
   3. Inspection and testing services are required to verify compliance with requirements specified or indicated.
      a. These services do not relieve Contractor of responsibility for compliance with Contract Document requirements.
   4. Requirements for Contractor to provide quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this Section.

B. Related Requirements Specified Elsewhere:
   1. Inspections and testing required by laws, ordinances, rules, regulations or orders of public authorities: General Conditions.
   2. Certification of Products:
      a. Respective specification sections.
   3. Test, Adjust and Balance of Equipment:
      a. Respective specification sections.
   4. Tests and Standards:
      a. Each specification section listed.

C. Related Sections:
   1. Section 01 4525: Concrete Moisture Testing
   2. Section 01 4100: Regulatory Requirements; current Code edition.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.

B. American Concrete Institute (ACI):
   1. ACI 318 – Building Code Requirements for Structural Concrete and Commentary, current edition.

1.03 SELECTION OF TESTING AGENCY

A. Owner will select and employ consultant, testing laboratory or inspection agency to perform specified services.

B. Employment of Testing Laboratory in no way relieves Contractor of his obligation to perform Work in accord with Contract.

1.04 PROJECT INSPECTOR

A. Owner will select and employ Project Inspector, approved by DSA.

1.05 PAYMENT

A. Costs of quality control services will be initially paid for by Owner. following quality control services, chargeable to Contractor, will be reimbursed to Owner by deductive change order:
   1. Batch Plant Inspection.
   2. Taking and testing cores from concrete.
   3. Testing of reinforcing steel test specimens.

1.06 DEFICIENCIES

A. Cost of tests or inspections due to following will be reimbursed to Owner by deductive change order.
   1. Retesting because of failure of initial samples.
   2. Additional costs due to overtime work or extra shifts work because of improper scheduling of Work or of delivery of materials by Contractor.
   3. Failure to properly notify laboratory.
   4. Changes in sources, lots or suppliers of materials after original tests.
   5. Changes in methods or materials of construction requested by Contractor that require testing, inspection, or other related services in excess of that required by original design.
   6. Concrete mix designs in excess of first successful design for each concrete type.
   7. Overtime or extra shift work requiring overtime work by Owner's Inspector.

1.07 TESTS AND INSPECTION

A. Testing laboratory or Owner's Project Inspector, and not Contractor, will make selection of material required to be tested.

B. Notify Owner's Project Inspector in sufficient time in advance of manufacture of material to be supplied by him under Contract Documents, which must, by terms of Contract be tested, in order that Owner may arrange for testing of same at source of supply.

C. Do not incorporate into Project, material shipped by Contractor from source of supply prior to having satisfactorily passed such testing and inspection or prior to receipt of notice from Project Inspector that such testing and inspection will not be required.

1.08 TESTING AGENCY SERVICES

A. Cooperate with Architect and Contractor
   1. Provide qualified personnel promptly on notice.

B. Perform specified inspections, sampling and testing of materials and methods of construction:
   1. Comply with specified standards; ASTM, other recognized authorities, and as specified.
   2. Ascertain compliance with requirements of Contract Documents.

C. Attend pre-construction conference and progress meetings when requested by Architect or Owner.

D. Perform additional services as required by Owner.

E. Submittals:
   1. Promptly submit copies of reports of inspections and tests, mill analysis, concrete mix designs and certifications per applicable sections of specification.
   2. Submit one copy of test reports to:
      a. Owner.
      b. Architect.
      c. Contractor.
      d. Project Inspector.
   3. Include tests made, regardless of whether such tests indicate that material is satisfactory or unsatisfactory.
   4. Report samples taken but not tested.
   5. Report records of special sampling operations as required.
   6. Show in report that material or materials were sampled and tested in accordance with requirements of Title 24 and with approved specifications.
   7. Show specified design strength in test reports.
      a. State definitely in test reports whether or not material or materials tested comply with requirements.

F. Report Data:
   1. Written reports of each inspection, test, or similar service include, but are not limited to, following:
      a. Date of issue.
      b. Project title and number.
      c. Name, address, and telephone number of testing agency.
      d. Dates and locations of samples and tests or inspections.
      e. Names of individuals making inspection or test.
      f. Designation of Work and test method.
      g. Identification of product and Specification Section.
      h. Complete inspection or test data.
      i. Test results and interpretation of test results.
      j. Ambient conditions at time of sample taking and testing.
      k. Comments or professional opinion on whether inspected or tested Work complies with Contract Document requirements.
      l. Name and signature of laboratory inspector.
      m. Recommendations on retesting.

G. Testing Agency is not authorized to:
   1. Release, revoke, alter, or enlarge requirements of Contract Documents or approve or accept portions of Work.
   2. Perform duties of Contractor.

1.09 INSPECTION BY OWNER AND PROJECT INSPECTOR

A. Provide full access to Owner and his Project Inspector for purpose of inspection of parts of Work and to shops wherein Work is in preparation
   1. Maintain proper facilities and provide safe access for such inspection.

1.10 INSPECTION BY OWNER

A. Owner retains right to reject materials and workmanship which are defective, or to require their correction.
   1. Satisfactorily correct rejected workmanship and remove rejected materials from premises without charge to Owner.
   2. When Contractor does not correct such rejected work within reasonable time, fixed by written notice, Owner may correct same and charge expense to Contractor.

B. Should it be considered necessary or advisable by Owner at or before final acceptance of entire Work to make examination of Work already completed by removing or tearing out same, upon request, promptly furnish necessary facilities, labor, and materials.
   1. When such Work is found to be defective due to fault of Contractor or his subcontractor, defray expenses of such examinations and of satisfactory reconstruction.
   2. Should such Work be found to meet requirements of Contract, Contractor will be allowed additional cost of labor and material necessarily involved in examination and replacement.

1.11 WORK BY OWNER'S PROJECT INSPECTOR

A. Owner’s Project Inspector will perform following tests and inspections:
   1. Concrete slump tests.
   2. Concrete cylinder samples.
   3. Continuous inspection of masonry work.
   4. Mortar and grout prisms.
   5. Special Inspections for Welding.

1.12 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with agencies performing required inspections, tests, and similar services, and provide reasonable auxiliary services as requested .

B. Provide to agency, selected preliminary representative samples of materials to be tested, in required quantities or assist agency in taking samples.

C. Furnish incidental labor and facilities:
   1. To provide access to Work.
   2. To obtain and handle samples at Site.
   3. To facilitate inspections and tests.
   4. For agency's exclusive use for storage and curing of test samples.
   5. To provide security and protection of samples and test equipment at Project Site.

D. Notify testing agency sufficiently in advance of operations to permit assignment of personnel and scheduling of tests.

E. Coordination:
   1. Coordinate sequence of activities to accommodate required services with minimum of delay.
   2. Coordinate activities to avoid necessity of removing and replacing construction to accommodate inspections and tests.
   3. Contractor is responsible for scheduling times for inspections, tests, taking samples, and similar activities.

1.13 MISCELLANEOUS TESTS AND INSPECTIONS

A. Soil and Compaction Testing and Inspection:
   1. Performed by Project Geotechnical (Soils) Engineer employed and paid by Owner.

B. Special Tests:
   1. Special tests requested by Owner or Architect or DSA will be paid for by Owner, except that when such tests fail, deduct costs from Contract Price by Change Order.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION

3.01 REPAIR AND PROTECTION

A. Upon completion of inspection, testing, sample taking and similar services, repair damaged construction and restore substrates and finishes.

B. Protect construction exposed by or for quality control service activities, and protect repaired construction.

C. Repair and protection is Contractor's responsibility, regardless of assignment of responsibility for inspection, testing, or similar services.

3.02 SCHEDULE OF TESTS, INSPECTIONS, AND METHODS

A. Required Tests and Inspections:
   1. Perform required Tests and Inspections as set forth in California Building Code and ACI 318, as referenced in DSA Form 103

END OF SECTION 01 4500

SECTION 01 4525

CONCRETE MOISTURE TESTING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Calcium Chloride and Relative Humidity tests for determining moisture in concrete slabs:
      a. Calcium Chloride Test: Provide concrete moisture vapor emission and pH testing to concrete specified to be covered with floor coverings.
      b. Relative Humidity Test: Provide in-situ concrete relative humidity and surface pH testing to concrete specified to be covered with floor coverings
      c. Include concrete placed below, on and above grade.
      d. Perform testing after allowing concrete to dry for minimum of 90 days.
   2. Schedule testing not less than 1 week, nor more than 3 weeks prior to scheduled flooring installation.
   3. Always perform both tests, prior to application of moisture mitigation systems

B. Related Sections:
   1. Section 01 3300: Submittals; reports of test results.
   2. Section 03 3000: Cast-in-Place Concrete; under-slab vapor retarder and concrete floor sealers.
   3. Section 09 0562: Moisture Vapor Emission Control System
   4. Section 09 6500: Resilient Flooring

1.02 REFERENCES

A. ASTM International (ASTM):
   1. ASTM F 710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
   2. ASTM F 1869 – Standard Test Method for Measuring Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.
   3. ASTM F 2170 – Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in-situ Probes.

1.03 SUBMITTALS

A. Reports:
   1. Provide test results for concrete moisture vapor emission and pH testing of concrete in chart form listing test dates, start/stop times, start/stop weight, weight gain in grams, moisture vapor emission values, and pH levels
   2. Provide test results for concrete in-situ relative humidity and pH testing in chart form listing test dates, time, depth of test well, in-situ temperature, relative humidity, and pH levels
   3. List test locations on chart and show same on 8-1/2 by 11 inch site map
      a. Make such map available to testing agency
   4. Deliver results to Owner, Owner's Project Inspector, Architect, Contractor, and flooring covering contractors.

1.04 QUALITY ASSURANCE

A. Pre-Installation Meeting:
   1. Schedule meeting with Owner, Architect, Independent Testing Agency, and Construction Manager
      a. Comply with requirements of Section 01 3119.
      b. Arrange for attendance by floor covering installers and floor covering manufacturers' technical representatives.
   2. Meeting to include, but not limited to, following:
      a. Review of calcium chloride, relative humidity, and pH test results on floor slabs.
      b. Adhesive application instruction.
      c. Scheduling and procedures for periodic field inspections by floor covering manufacturers' technical representatives.
   3. Record minutes of meeting and promptly distribute copies of minutes to attendees and other interested parties as may be necessary.
   4. Record issues resolved during meeting
      a. Include copies of Drawings and application instructions used in meeting
      b. Record changes on Drawings and application instructions made at meeting.

B. Independent Testing Agency:
   1. Calcium Chloride Testing: Certified by Test Kit Manufacturer for product use.
   2. Relative Humidity Testing: Certified by Test Apparatus Manufacturer for product use.
   3. Other agency with verifiable experience

C. Commercially Produced Moisture Vapor Emission Test Kits:
   1. Test dish including calcium chloride must be commercially packaged and delivered to test site in sealed factory wrapping
   2. Test dome from same source as dish.
   3. Test kit must comply with ASTM standards of size and weight.

D. Digital Meter and Calibrated Humidity Probes:
   1. Minimum 2-point probe calibration

E. Wide range pH paper, and distilled or de-ionized water.

PART 2 PRODUCTS

2.01 MOISTURE TESTING MATERIALS AND EQUIPMENT

A. Calcium Chloride Test as manufactured by Vaprecision, Full Spectrum Flooring, or approved equal.

B. Humidity and Temperature probe kit as manufactured by Vaisala, or approved equal.

C. Wide range pH test paper as manufactured by Micro Essential Laboratory, or approved equal.

PART 3 EXECUTION

3.01 TESTING – GENERAL

A. Maintain test site at same temperature and humidity conditions as those anticipated during normal occupancy.
   1. Maintain these temperature and humidity levels for 48 hours prior and during test period.
   2. When meeting this criteria is not possible, then minimum conditions should be 75± 10 degrees F and 50± 10 percent relative humidity.
   3. When building is not under HVAC control, place recording hygrometer or data logger to record conditions during test period.
      a. Include transcript of this information with test report.

3.02 QUANTIFICATION OF CONCRETE MOISTURE VAPOR EMISSION

A. Number of vapor emission test sites is determined by square footage of facility.
   1. Minimum number of tests to be placed is equal to 3 in first 1,000 square feet and 1 per each additional 1,000 square feet.

B. Tests sites are to be cleaned of adhesive residue, curing compounds, paints, sealers, and floor coverings, 24 hours prior to placement of test kits.

C. Weigh test dish at Project Site prior to start of test.
   1. Scale must report weight to 0.1 grams.
   2. Record weight and start time.

D. Expose Calcium Chloride and set dish on concrete surface.

E. Install test containment dome and allow test to proceed for 60 - 72 hours.

F. Retrieve test dish by carefully cutting through containment dome.
   1. Close and reseal test dish.

G. Weigh test dish on Project Site recording weight and stop time.

H. Calculate and report results as "pounds of emission per 1,000 square feet per 24 hours"

3.03 QUANTIFICATION OF RELATIVE HUMIDITY AT 40 PERCENT OF CONCRETE THICKNESS

A. Number of in-situ relative humidity test sites is determined by square footage of facility.
   1. Minimum number of tests to be placed is equal to 3 in first 1,000 square feet and 1 per each additional 1,000 square feet.

B. Determine thickness of concrete slab, typically from construction documents

C. Utilizing roto-hammer, drill test holes to depth equal to 40 percent of concrete thickness.
   1. For example – 2 inches deep for 5 inch thick slab, or 1-1/2 inches deep for 4 inch thick slab.

2. Test elevated structural slab (not poured in pans) at depth equal to 20 percent of its thickness.
3. Hole Diameter: Do not exceed outside diameter of insertable test sleeve by more than 0.04 inch.
    a. Drilling operation must be dry.

D. Vacuum concrete dust from test hole.

E. Insert hole liner or sleeve to full depth of test hole, ensuring that liner is capped or plugged at end protruding from concrete surface.

F. Permit test site to acclimate, or equilibrate, for 72 hours prior to taking relative humidity readings.

G. Remove sleeve plug and place probe into sleeve ensurring that it reaches bottom of test hole.
1. Test probe must be at temperature equilibration with concrete slab.

H. Read and record temperature and relative humidity at test site.

3.04 QUANTIFYING pH LEVEL

A. At each vapor emission test site, after removal of test containment dome, and at or near relative humidity test site, perform pH test.
1. Place several drops of water onto concrete surface to form puddle approximately 1 inch in diameter.
2. Allow water to set for approximately 60 seconds
3. Dip pH paper into water and remove immediately
    a. Compare color to chart provided by paper supplier to determine pH reading

B. Record and report results.

3.05 ADDITIONAL TESTING

A. When more complete assessment of moisture content in concrete is necessary, perform relative humidity profiling.

B. In lieu of limiting testing to single depth within slab, profiling includes testing at depths of 20 percent 40% and 60% of concrete thickness.

C. This extended testing may be limited to groupings in each 2,000 or 5,000 square feet, with single depth testing at each 1,000 square feet increment as outlined above.

3.06 CLEANING

A. Upon completion of testing, remove dust, debris, surplus materials and tools of Work from Project Site.

B. Leave installation clean and ready for succeeding finishes.

END OF SECTION 01 4525

SECTION 01 5000

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Temporary facilities required for this Work include, but are not necessarily limited to:
      a. Temporary utilities such as heat, water, electricity, and telephone.
      b. Field offices and sheds
      c. Sanitary facilities.
      d. Construction aids.
      e. Barriers.
      f. Temporary controls.
      g. Temporary tree and plant protection
      h. Project identification sign.
      i. Temporary informational signs.

B. Related Sections:
   1. Section 01 5713: Temporary Erosion and Sedimentation Controls
   2. Section 02 4113: Selective Site Demolition; additional protection requirements.
   3. Section 02 4116:Building Demolition
   4. Section 31 1000:Site Clearing

C. Related Requirements:
   1. Refer to District's Division 00 Documents, including General Conditions, and other Division 01 Sections, for additional requirements.
   2. Refer to Division 32 Sections for additional traffic control requirements.
   3. Permanent installation and hook-up of various utility lines are described in other pertinent sections.
   4. Comply with requirements of pertinent safety regulations for equipment furnished by subcontractors.

D. Work Not Part of This Section:
   1. Ladders, planks, hoists, and similar items normally furnished by individual trades in execution of their own portions of Work.

1.02 PROJECT CONDITIONS

A. Use means necessary to maintain temporary facilities in proper and safe condition throughout progress of Work.

PART 2 PRODUCTS

2.01 UTILITIES

A. Water:
   1. Provide necessary temporary water lines and water supply and upon completion of Work, remove such temporary facility.

2. Provide and pay for water needed for construction.

B. Electricity:
1. Provide necessary temporary wiring and upon completion of Work, remove such temporary facility.
2. Provide area distribution boxes so located that individual trades may furnish and use 100 foot maximum length extension cords to obtain adequate power and artificial lighting at points where needed for work, inspection, and safety.
3. Provide and pay for electricity needed for construction.

C. Heating:
1. Provide and maintain heat necessary for proper conduct of operations needed in Work.

D. Telephone:
1. Make necessary arrangements and pay costs for installation and operation of telephone service to Contractor’s office on Project Site and Owner’s Project Inspector’s office on Project Site.
2. Install telephone on separate line for each temporary office.
   a. Where office has more than one occupant, provide telephone for each additional occupant.
3. Coin operated telephones are not acceptable.

2.02 FIELD OFFICES AND SHEDS

A. Contractor’s Facilities:
1. Provide field office building and sheds adequate in size and accommodation for Contractor’s offices, supply, and storage.

B. Owner's Project Inspector's Office:
1. Provide lockable office at least 10 feet by 12 feet in dimension with lockable operable window, serviceable finishes, lighting, heating, and air conditioning, for use by Owner's Project Inspector.
2. Furnish with lockable desk, reference table, lockable 4 drawer file cabinet, plan rack, and two chairs.
3. Subject to District approval, provide space in Contractor’s Field Office for Owner’s Project Inspector, in lieu of separate office.

C. Provide and maintain on premises, where directed, watertight storage sheds for materials which might be damaged by weather, including storage facilities for concrete test samples or other material samples required for Work.

2.03 SANITARY FACILITIES

A. Sanitary facilities include temporary toilets, wash facilities, and drinking water fixtures.
1. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
2. Install where facilities will best serve Project's needs.
3. Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility.
4. Provide covered waste containers for used material.

B. Temporary Toilet Units:
   1. Provide self-contained, single-occupant toilet units of chemical, aerated recirculation, or combustion type.
   2. Provide units properly vented and fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
   3. Provide separate facilities for male and female personnel.
   4. Maintain in sanitary condition.

C. Wash Facilities:
   1. Install wash facilities supplied with potable water at convenient locations for personnel involved in handling materials that require wash-up for healthy and sanitary condition.
   2. Dispose of drainage properly.
   3. Supply cleaning compounds appropriate for each condition.
   4. Provide safety showers, eyewash fountains , and similar facilities for convenience, safety, and sanitation of personnel.

D. Drinking-Water Facilities:
   1. Provide containerized, tap-dispenser, bottled water drinking water units, including paper supply.

E. Use of Owner's toilet facilities is not permitted.

2.04 CONSTRUCTION AIDS

A. Provide construction aids and equipment required by personnel and to facilitate execution of Work
   1. Scaffolds, staging, ladders, stairs, ramps, runways, platforms, railings, hoists, cranes, chutes, and other such facilities and equipment.

B. Provide necessary facilities and means of access to structure so that Building Inspectors, Special Inspectors, Architect and Structural Engineer may inspect structure or portions of structure as necessary.
   1. Means of access includes, but is not necessarily limited to, ladders, scaffolds, and similar items.

2.05 BARRIERS

A. Temporary Fencing:
   1. Provide temporary fence around entire construction area as required for safety and protection.
   2. Construction:
      a. Provide chain link fencing not less than six feet in height, complete with metal or wood posts and required bracing, and with suitably locked truck and pedestrian gates as required.
   3. Provide opaque, fabric or plastic windscreen material, full height and run of fencing, including gates.

B. Tree and Plant Protection:
   1. Preserve and protect existing trees and plants at Project Site that are designated to remain, and those adjacent to Project Site.
   2. Provide temporary barriers around each, or around each group of trees or plants.

3. Trenching Near Trees:
    a. Where utility trenches are required near trees, excavate under or around tree roots by hand or with air spade.
    b. Do not cut main lateral tree roots or taproots.
        1) Cut only smaller roots that interfere with installation of utilities.
        2) Do not allow exposed roots to dry out before placing permanent backfill.

2.06 TEMPORARY CONTROLS

A. Contractor Responsiblility:
    1. Specific safety requirements by governmental authorities, including requirements of latest Occupational Safety and Health Act (OSHA) and Cal/OSHA.

B. Provide and maintain methods, equipment, and temporary construction, as necessary to provide controls over environmental conditions at construction site and related areas under Contractor's control.
    1. Remove physical evidence of temporary facilities at completion of Work.
    2. Comply with requirements of authorities having jurisdiction.

C. Dust Control:
    1. Provide positive methods and apply dust control materials to minimize raising dust from construction operations, and provide positive means to prevent airborne dust from dispersing into atmosphere.

D. Water Control:
    1. Provide methods to control surface water to prevent damage to Project, Site, or adjoining properties.
    2. Control fill, grading and ditching to direct surface drainage away from excavations, pits, tunnels and other construction areas and to direct drainage to proper runoff.
    3. Provide, operate and maintain hydraulic equipment of adequate capacity to control surface water.
    4. Dispose of drainage water in manner to prevent flooding, erosion, or other damage to Project Site or to adjoining areas.
    5. Comply with requirements specified in Section 01 5713.

E. Debris Control:
    1. Maintain areas under Contractor's control free of extraneous debris.
    2. Prevent accumulation of debris at construction site, storage and parking areas, or along access roads.
    3. Provide containers for deposit of debris as specified in Section 01 7419.

F. Pollution Control:
    1. Provide methods, means and facilities required to prevent contamination of soil, water and atmosphere by discharge of noxious substances from construction operations.
    2. Provide equipment and personnel to perform emergency measures required to contain spillage, and to remove contaminated soils and liquids.
    3. Take special measures to prevent harmful substances from entering public waters.

a. Prevent disposal of wastes, effluents, chemicals, and other such substances in sanitary or storm sewers.

G. Temporary Fire Protection:
1. Install and maintain temporary fire protection facilities of types needed to protect against reasonably predictable and controllable fire losses.
2. Comply with NFPA 241 .
3. Prohibit smoking in construction areas.
4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
5. Develop and supervise overall fire prevention and protection program for personnel at Project Site.
a. Review needs with local fire department and establish procedures to be followed.
b. Instruct personnel in methods and procedures.
c. Post warnings and information.

2.07 PROJECT IDENTIFICATION SIGN

A. Provide one painted sign, of not less than 32 sq. ft. area, with painted graphic content to include:
1. Title of Project.
2. Name of Owner.
3. Names and Titles of:
a. Architect.
b. Professional Consultants.
c. Prime Contractor.
4. Graphic Design, Style of Lettering, and Colors:
a. As designated by Architect.
5. Erect on Project Site at lighted location of high public visibility, adjacent to main entrance to Project Site, as approved by Architect.
a. Support on posts or framing of preservative treated wood or steel.

2.08 TEMPORARY INFORMATIONAL SIGNS

A. Provide temporary informational signs as follows:
1. As required by codes, laws and regulatory agencies and to:
a. Inform public and persons seeking entrance to Project.
b. Identify key elements of construction facilities.
c. Direct traffic.

B. Prepare temporary signs of sizes indicated.
1. Erect on Project Site as approved by Architect.
2. Support on posts or framing of preservative treated wood or steel.
3. Do not permit installation of unauthorized signs..

2.09 OWNERSHIP OF TEMPORARY FACILITIES AND CONTROLS

C. Items provided by Contractor under this Section remain property of Contractor
1. Remove such items from job site immediately upon completion of Work..

PART 3 EXECUTION

3.01 MAINTENANCE AND REMOVAL

A. Maintain temporary facilities as long as needed for safe and proper completion of Work.

B. Remove such temporary facilities as rapidly as progress of Work will permit, or as directed by Architect.

END OF SECTION 01 5000

4.

SECTION 01 5713

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Prevention of erosion due to construction activities.
2. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
3. Restoration of areas eroded due to insufficient preventive measures.
4. Performance Bond.
5. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

B. Related Sections:
1. Section 31 0000: Earthwork; temporary and permanent grade changes for erosion control.
2. Section 31 1000: Site Clearing; limits on clearing; disposition of vegetative clearing debris.

1.02 REFERENCES

A. ASTM International (ASTM):
1. ASTM D 4873 – Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.

B. United States Environmental Protection Agency (EPA):
1. National Pollutant Discharge Elimination System (NPDES):
a. Construction General Permit (CGP); current edition.

C. Public Works Standards, Inc.:
1. Standard Specifications for Public Works Construction (SSPWC):
a. The "Greenbook"; current edition.
2. Standard Plans for Public Works Construction (SPPWC); current edition.

D. California Stormwater Quality Association (CASQA):
1. Best Management Practice (BMP) Handbook, current edition.

1.03 PERFORMANCE REQUIREMENTS

A. Comply with requirements of U.S. Environmental Protection Agency (EPA) for erosion and sedimentation control, as specified for National Pollutant Discharge Elimination System (NPDES), Phases I and II, under requirements for 2017 Construction General Permit (CGP).

B. Comply with requirements of California State Construction General Permit Order 2009-0009-DWQ for erosion and sedimentation control, even though this Project is not required by law to comply.

C. Best Management Practices Standard:
   1. Federal Highway Administration Best Management Practices for Erosion and Sediment Control.

D. Develop and follow Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.

E. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained.
   1. Furnish documentation required to obtain applicable permits.

F. Provide to Owner Performance Bond covering erosion and sedimentation preventive measures only, in amount equal to 100 percent of cost of erosion and sedimentation control work.

G. Timing:
   1. Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

H. Storm Water Runoff:
   1. Control increased storm water runoff due to disturbance of surface cover due to construction activities for Project.
   2. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
   3. Anticipate runoff volume due to most extreme short term and 24-hour rainfall events that might occur in 25 years.

I. Erosion On Site:
   1. Minimize wind, water, and vehicular erosion of soil on Project Site due to construction activities for Project.
   2. Control movement of sediment and soil from temporary stockpiles of soil.
   3. Prevent development of ruts due to equipment and vehicular traffic.
   4. When erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

J. Erosion Off Site:
   1. Prevent erosion of soil and deposition of sediment on other properties caused by water leaving Project Site due to construction activities for Project.
   2. Prevent windblown soil from leaving Project Site.
   3. Prevent tracking of mud onto public roads outside Project Site.
   4. Prevent mud and sediment from flowing onto sidewalks and pavements.
   5. When erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

K. Sedimentation of Waterways On Site:

1. Prevent sedimentation of waterways on Project Site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
2. When sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
3. When sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.

L. Sedimentation of Waterways Off Site:
1. Prevent sedimentation of waterways off Project Site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
2. When sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

M. Open Water:
1. Prevent standing water that could become stagnant.

N. Maintenance:
1. Maintain temporary preventive measures until permanent measures have been established.

1.04 SUBMITTALS

A. Erosion and Sediment Control Plan [and Stormwater Pollution Prevention Plan (SWPPP)]: ~~*[Verify if SWPP is required fo Project]*~~
1. Include:
a. Site plan:
1) Identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
2) Showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
b. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
c. Schedule of temporary preventive measures, in relation to ground disturbing activities.
d. Other information required by law.
e. Format required by law is acceptable, provided additional information specified is also included.
2. Obtain approval of Plan by authorities having jurisdiction.
3. Obtain approval of Plan by Owner.

B. Certificate:
1. Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements.
a. Signed by legally authorized official of manufacturer.
b. indicate actual minimum average roll values.

2. Identify fabric by roll identification numbers.

C. Inspection Reports:
1. Report of each inspection.
2. Identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.01 MATERIALS

A. Gravel:
1. Conforming to Greenbook standard.

B. Grass Seed for Temporary Cover:
1. Select species appropriate to climate, planting season, and intended purpose.
2. When same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine Project Site and identify existing features that contribute to erosion resistance.

B. Maintain such existing features to greatest extent possible.

3.02 PREPARATION

A. Schedule Work so that soil surfaces are left exposed for minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

A. In cases, where permanent erosion resistant measures have been installed temporary preventive measures are not required.

B. Stabilized Construction Entrances:
1. Traffic-bearing aggregate surface conforming to BMP TC-1 requirements.
   a. Width:
      1) As required – 20 feet, minimum.
   b. Length:
      1) 50 feet minimum.
   c. Provide at each construction entrance from public right-of-way.
   d. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.

C. Linear Sediment Barriers:

1. Made of silt fences or gravel bags.
2. Provide linear sediment barriers as indicated on Drawings.

D. Storm Drain Curb Inlet Sediment Trap:
   1. As detailed on Drawings.

E. Storm Drain Drop Inlet Sediment Traps:
   1. As detailed on Drawings.

F. Soil Stockpiles:
1. Protect using one of following measures:
a. Cover with polyethylene film, secured by placing soil on outer edges.
b. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches of straw or hay.

3.04 INSTALLATION

A. Stabilized Construction Entrances:
1. Traffic-bearing aggregate surface conforming to BMP TC-1 requirements.
a. Excavate minimum of 6 inches.
b. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.
c. Place and compact at least 6 inches of 1.5 to 3.5 inch diameter stone.

B. Silt Fences:
1. Conforming to BMP SE-1 requirements and following:
a. Store and handle fabric in accordance with ASTM D4873.
b. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
c. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
d. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.
e. Install with top of fabric at nominal height and embedment as specified.
f. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
g. Wherever runoff will flow around end of barrier or over top, provide temporary splash pad or other outlet protection
1) At such outlets in run of barrier, make barrier not more than 12 inches high with post spacing not more than 4 feet.

C. Install gravel bags conforming to BMP SE-6 requirements.

3.05 MAINTENANCE

A. As minimum, maintain BMPs as described in reference BMP Handbook.

B. Inspect preventive measures weekly, within 24 hours after end of storm that produces 0.5 inches or more rainfall at Project Site, and daily during prolonged rainfall.

C. Repair deficiencies immediately.

D. Silt Fences:
   1. Promptly replace fabric that deteriorates unless need for fence has passed.
   2. Remove silt deposits that exceed one-third of height of fence.
   3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

E. Clean out temporary sediment control structures weekly and relocate soil on Project Site.

F. Place sediment in appropriate locations on Project Site
   1. Do not remove sediment from Project Site.

3.01 CLEANING

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Engineer.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION 01 5713

SECTION 01 5713

TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Prevention of erosion due to construction activities.
2. Prevention of sedimentation of waterways, open drainage ways, and storm and sanitary sewers due to construction activities.
3. Restoration of areas eroded due to insufficient preventive measures.
4. Performance Bond.
5. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

B. Related Sections:
1. Section 31 0000: Earthwork; temporary and permanent grade changes for erosion control.
2. Section 31 1000: Site Clearing; limits on clearing; disposition of vegetative clearing debris.

1.02 REFERENCES

A. ASTM International (ASTM):
1. ASTM D 4873 – Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.

B. United States Environmental Protection Agency (EPA):
1. National Pollutant Discharge Elimination System (NPDES):
a. Construction General Permit (CGP); current edition.

C. Public Works Standards, Inc.:
1. Standard Specifications for Public Works Construction (SSPWC):
a. The "Greenbook"; current edition.
2. Standard Plans for Public Works Construction (SPPWC); current edition.

D. California Stormwater Quality Association (CASQA):
1. Best Management Practice (BMP) Handbook, current edition.

1.03 PERFORMANCE REQUIREMENTS

A. Comply with requirements of U.S. Environmental Protection Agency (EPA) for erosion and sedimentation control, as specified for National Pollutant Discharge Elimination System (NPDES), Phases I and II, under requirements for 2017 Construction General Permit (CGP).

B. Comply with requirements of California State Construction General Permit Order 2009-0009-DWQ for erosion and sedimentation control, even though this Project is not required by law to comply.

C. Best Management Practices Standard:

1. Federal Highway Administration Best Management Practices for Erosion and Sediment Control.

D. Develop and follow Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.

E. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained.
   1. Furnish documentation required to obtain applicable permits.

F. Provide to Owner Performance Bond covering erosion and sedimentation preventive measures only, in amount equal to 100 percent of cost of erosion and sedimentation control work.

G. Timing:
   1. Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

H. Storm Water Runoff:
   1. Control increased storm water runoff due to disturbance of surface cover due to construction activities for Project.
   2. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
   3. Anticipate runoff volume due to most extreme short term and 24-hour rainfall events that might occur in 25 years.

I. Erosion On Site:
   1. Minimize wind, water, and vehicular erosion of soil on Project Site due to construction activities for Project.
   2. Control movement of sediment and soil from temporary stockpiles of soil.
   3. Prevent development of ruts due to equipment and vehicular traffic.
   4. When erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

J. Erosion Off Site:
   1. Prevent erosion of soil and deposition of sediment on other properties caused by water leaving Project Site due to construction activities for Project.
   2. Prevent windblown soil from leaving Project Site.
   3. Prevent tracking of mud onto public roads outside Project Site.
   4. Prevent mud and sediment from flowing onto sidewalks and pavements.
   5. When erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

K. Sedimentation of Waterways On Site:
   1. Prevent sedimentation of waterways on Project Site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   2. When sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
   3. When sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.

L. Sedimentation of Waterways Off Site:
   1. Prevent sedimentation of waterways off Project Site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   2. When sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

M. Open Water:
   1. Prevent standing water that could become stagnant.

N. Maintenance:
   1. Maintain temporary preventive measures until permanent measures have been established.

1.04 SUBMITTALS

A. Erosion and Sediment Control Plan [and Stormwater Pollution Prevention Plan (SWPPP)]:
   1. Include:
      a. Site plan:
         1) Identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
         2) Showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
      b. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
      c. Schedule of temporary preventive measures, in relation to ground disturbing activities.
      d. Other information required by law.
      e. Format required by law is acceptable, provided additional information specified is also included.
   2. Obtain approval of Plan by authorities having jurisdiction.
   3. Obtain approval of Plan by Owner.

B. Certificate:
   1. Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements.
      a. Signed by legally authorized official of manufacturer.
      b. indicate actual minimum average roll values.
   2. Identify fabric by roll identification numbers.

C. Inspection Reports:
   1. Report of each inspection.
   2. Identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.01 MATERIALS

A. Gravel:
   1. Conforming to Greenbook standard.

B. Grass Seed for Temporary Cover:
   1. Select species appropriate to climate, planting season, and intended purpose.
   2. When same area will later be planted with permanent vegetation, do not use species known to be excessively competitive or prone to volunteer in subsequent seasons.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine Project Site and identify existing features that contribute to erosion resistance.

B. Maintain such existing features to greatest extent possible.

3.02 PREPARATION

A. Schedule Work so that soil surfaces are left exposed for minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

A. In cases, where permanent erosion resistant measures have been installed temporary preventive measures are not required.

B. Stabilized Construction Entrances:
   1. Traffic-bearing aggregate surface conforming to BMP TC-1 requirements.
      a. Width:
         1) As required – 20 feet, minimum.
      b. Length:
         1) 50 feet minimum.
      c. Provide at each construction entrance from public right-of-way.
      d. Where necessary to prevent tracking of mud onto right-of-way, provide wheel washing area out of direct traffic lane, with drain into sediment trap or basin.

C. Linear Sediment Barriers:
   1. Made of silt fences or gravel bags.
   2. Provide linear sediment barriers as indicated on Drawings.

D. Storm Drain Curb Inlet Sediment Trap:
   1. As detailed on Drawings.

E. Storm Drain Drop Inlet Sediment Traps:
   1. As detailed on Drawings.

F. Soil Stockpiles:
   1. Protect using one of following measures:
      a. Cover with polyethylene film, secured by placing soil on outer edges.
      b. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches of straw or hay.

3.04 INSTALLATION

A. Stabilized Construction Entrances:
   1. Traffic-bearing aggregate surface conforming to BMP TC-1 requirements.
      a. Excavate minimum of 6 inches.
      b. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.
      c. Place and compact at least 6 inches of 1.5 to 3.5 inch diameter stone.

B. Silt Fences:
   1. Conforming to BMP SE-1 requirements and following:
      a. Store and handle fabric in accordance with ASTM D4873.
      b. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
      c. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
      d. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.
      e. Install with top of fabric at nominal height and embedment as specified.
      f. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
      g. Wherever runoff will flow around end of barrier or over top, provide temporary splash pad or other outlet protection
         1) At such outlets in run of barrier, make barrier not more than 12 inches high with post spacing not more than 4 feet.

C. Install gravel bags conforming to BMP SE-6 requirements.

3.05 MAINTENANCE

A. As minimum, maintain BMPs as described in reference BMP Handbook.

B. Inspect preventive measures weekly, within 24 hours after end of storm that produces 0.5 inches or more rainfall at Project Site, and daily during prolonged rainfall.

C. Repair deficiencies immediately.

D. Silt Fences:
   1. Promptly replace fabric that deteriorates unless need for fence has passed.
   2. Remove silt deposits that exceed one-third of height of fence.

3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.

E. Clean out temporary sediment control structures weekly and relocate soil on Project Site.

F. Place sediment in appropriate locations on Project Site
   1. Do not remove sediment from Project Site.

3.01 CLEANING

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Engineer.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION 01 5713

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Following Administrative and Procedural Requirements:
      a. Selection of products for use in Project
      b. Product delivery, storage, and handling.
      c. Manufacturers' standard warranties on products.
      d. Special warranties.
      e. Product substitutions.

B. Related Sections:
   1. Section 01 4200: References; applicable industry standards for products specified.
   2. Section 01 7700: Closeout Procedures; submittal of warranties for contract closeout.

C. Related Requirements:
   1. Refer to District’s Division 00 Documents, including General Conditions, and other Division 01 Sections, for additional requirements.
   2. Specific requirements for warranties on products and installations specified to be warranted are included in appropriate Divisions 02 through 33 Sections.

1.02 DEFINITIONS

A. Definitions used in this Article are not intended to change meaning of other terms used in Contract Documents, such as "specialties", "systems", "structure", "finishes", "accessories", and similar terms.
   1. Such terms are self-explanatory and have well recognized meanings in construction industry.

B. Products:
   1. Items purchased for incorporating into Work, whether purchased for Project or taken from previously purchased stock.
   2. Term "product" includes terms "material," "equipment," and terms of similar intent.
   3. Named Products:
      a. Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature, that is current as of date of Contract Documents.

4. New Products:
    a. Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise.
        1) Products salvaged or recycled from other projects are not considered new products.

C. Substitutions:
1. Changes in products, materials, equipment, and methods of construction required by Contract Documents and proposed by Contractor
2. Following are not considered substitutions:
    a. Substitutions requested during bidding period, and accepted by written Addendum prior to opening of bids or award of Contract.
3. Revisions to Contract Documents requested by Owner or Architect.
4. Specified options of products and construction methods included in Contract Documents.
5. Compliance with governing regulations and orders issued by governing authorities.

D. Basis-of-Design Product Specification:
1. Where specific manufacturer's product is named and accompanied by words "Basis-of-Design", including make or model number or other designation, to establish significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

E. Manufacturer's Warranty:
1. Preprinted written warranty published by individual manufacturer for particular product and specifically endorsed by manufacturer to Owner.

F. Special Warranty:
1. Written warranty required by or incorporated into Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.03 SUBMITTALS

A. Product Listing Schedule:
1. Prepare schedule showing products specified in tabular form acceptable to Architect to include:
    a. Generic names of products required.
    b. Manufacturer's name and proprietary product names for each item listed.
2. Form:
    a. Prepare Product Listing Schedule with information on each item tabulated under following column headings:
        1) Related Specification Section number.

2) Generic name used in Contract Documents.
3) Proprietary name, model number and similar designations.
4) Manufacturer's name and address.
5) Supplier's name and address.

3. Completed Schedule:
   a. Within fifteen days after date of commencement of Work submit four copies of completed Product Listing Schedule.

      1) Furnish written explanation for omissions of data, and for known variations from Contract requirements.

1.04 QUALITY ASSURANCE

A. To fullest extent possible, provide products of same kind, from single source.

1.05 REQUESTS FOR SUBSTITUTIONS

A. Requests for Substitutions received after award of Contract will be considered only in case of substantiated product unavailability, or other conditions beyond control of Contractor.

B. Substitution Requests:
   1. Submit one electronic copy (PDF) of each request for consideration.
   2. Identify product or fabrication or installation method to be replaced.
   3. Include Specification Section number and title and Drawing numbers and titles.
      a. Refer to Article 2.02, in this Section.
   4. Substitution Request Form:
      a. Use form provided by Owner.
         1) In absence of Owner furnished form, use form included at end of this Section.
      b. Other forms will not be accepted.
      c. Requests received without properly completed substitution request form will be rejected without further review.
   5. Documentation:
      a. Show compliance with specified requirements for substitutions and following, as applicable:
         1) Statement indicating why specified material or product cannot be provided.
            a) Submit statement on official letterhead of Contractor, supplier, or manufacturer, signed by an officer of the Company.
            b) Statement will be subject to independent verification by Architect.
         2) Product identification, including manufacturer's name and address.

3) Coordination information, including list of changes or modifications needed to other parts of Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
4) Detailed, side-by-side comparison of significant qualities including attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
5) Product Data, including drawings and descriptions of products and fabrication and installation procedures.
6) Structural calculations, where applicable or requested, prepared and signed by registered Structural Engineer licensed in California.
7) Samples, where applicable or requested.
8) List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
9) Material test reports from qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
10) Research/evaluation reports evidencing compliance with building code in effect for Project, from model code organization acceptable to authorities having jurisdiction.
11) Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for Work, including effect on overall Contract Time.
    a) When specified product or method of construction cannot be provided within Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
12) Cost information, including proposal of change, when occurring, in Contract Sum.
    a) When substitution request is made after award of Contract, for other than reasons stated, include in request, benefit to Owner, in form of cost reduction.
13) Designation of availability of maintenance services, sources of replacement materials.
14) Contractor's certification that proposed substitution complies with requirements in Contract Documents and is appropriate for applications indicated.
15) Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

C. Basis-of-Design Product Specification Submittal:
   1. Comply with requirements in Section 01 3300.
   2. Show compliance with requirements.

D. Multiple Resubmittals:
   1. Requests for Substitutions made after Award of Contract:
      a. Requirements cover initial Request for Substitution review and one resubmittal review when necessary.
   2. Architect's and/or Consultant's cost for evaluationg additional submittals requested by Contractor beyond first resubmittal will be paid by Owner with reimbursement from Contractor by deductive change order.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle products using means and methods that will prevent damage, deterioration and loss, including theft; comply with manufacturer's written instructions.
   1. Schedule delivery to minimize long term storage at Project Site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
   3. Deliver products to Project Site in undamaged condition in manufacturer's original sealed container, or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
   4. Inspect products on delivery to ensure compliance with Contract Documents, and to ensure products are undamaged and properly protected.
   5. Store products in manner to facilitate inspection and measurement of quantity or counting of units.
   6. Store materials in manner that will not endanger Project structure.
   7. Store products subject to damage by elements under cover in weathertight enclosure above ground, with ventilation adequate to prevent condensation.
   8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   9. Protect stored products from damage.

1.07 PRODUCT WARRANTIES

A. Warranties specified in other Sections are in addition to, and run concurrent with, other warranties required by Contract Documents.
   1. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of Contract Documents.

B. Special Warranties:
   1. Prepare written document that contains appropriate terms and identification, ready for execution.
      a. Submit draft for approval before final execution.

2. Manufacturer's Standard Form:
    a. Modified to include Project-specific information and properly executed.
3. Refer to Division 26 through 32 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time:
1. Comply with requirements in Section 01 7700 and General Conditions.

PART 2 PRODUCTS

2.01 PRODUCT SELECTION

A. General Product Requirements:
1. Provide products that comply with Contract Documents, that are undamaged and, unless otherwise indicated, unused at time of installation.
2. Provide products complete with accessories, trim, finish, safety guards and other devices and details needed for complete installation and for intended use and effect.
3. Standard Products:
    a. Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
4. Owner reserves right to limit selection to products with warranties not in conflict with requirements of Contract Documents.
5. Where products are accompanied by term "as selected", Architect will make selection.
6. Where products are accompanied by term "match sample", sample to be matched is Architect's.
7. Descriptive, performance, and reference standard requirements in Specifications establish "salient characteristics" of products.

8. Where products are specified by name and accompanied by term "or equal", or "or approved equal", or "or approved", comply with provisions in "Product Substitutions" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:
1. Procedures for product selection include following:
    a. Product:
        1) Where Specification paragraphs or subparagraphs titled "Product" name single product and manufacturer, provide product named.
        2) Substitutions may be considered, unless otherwise indicated.

b. Products:
   1) Where Specification paragraphs or subparagraphs titled "Products" introduce list of names of both products and manufacturers, provide one of products listed that complies with requirements.
   2) Products and manufacturers are listed alphabetically and do not indicate order of preference, unless otherwise indicated.
c. Manufacturer/Source:
   1) Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide product by manufacturer or from source named that complies with requirements.
   2) Substitutions may be considered, unless otherwise indicated.
d. Manufacturers:
   1) Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce list of manufacturers' names, provide product by one of manufacturers listed that complies with requirements.
   2) Where manufacturers are specified by name, accompanied by term "or equal", or "or approved equal" comply with provisions in "Product Substitutions" Article to obtain approval for use of an unnamed product.
e. Product Options:
   1) Where Specification paragraph titled "Product Options" indicate that size, profiles, and dimensional requirements on Drawings are based on specific product or system, provide either specific product or system indicated or comparable product or system by another manufacturer.
   2) Comply with provisions in "Product Substitutions" Article to obtain approval for use of unnamed product.

C. Basis-of-Design Products:
   1. Where Specification paragraphs or subparagraphs titled "Basis-of-Design Product" are included and also introduce or refer to list of manufacturers' names, provide either specified product or comparable product by one of other named manufacturers.
   2. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on product named.
   3. Comply with provisions in "Product Substitutions" Article to obtain approval for use of unnamed product.
   4. Substitutions may be considered.

D. Visual Matching Specification:
   1. Where Specifications require matching established sample, select product and manufacturer that complies with requirements and matches Architect's sample.
   2. Architect's decision will be final on whether proposed product matches satisfactorily.

3. Where no product is available within specified category that matches satisfactorily and complies with other specified requirements, comply with provisions of Contract Documents on "substitutions" for selection of matching product.

E. Visual Selection Specification:
   1. Where Specifications include phrase "as selected from manufacturer's colors, patterns, textures" or similar phrase, select product and manufacturer that complies with other specified requirements.
   2. Standard Range:
      a. Where Specifications include phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
   3. Full Range:
      a. Where Specifications include phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

F. Performance Specification Requirements:
   1. Where Specifications require compliance with performance requirements, provide products that comply with requirements, and are recommended by manufacturer for application indicated.
   2. General overall performance of product is implied where product is specified for specific application.
   3. Manufacturer's recommendations may be contained in product literature, or by manufacturer's certification of performance.

2.02 PRODUCT SUBSTITUTIONS

A. Timing:
   1. Requests for Substitutions are restricted to before bid opening as stated in Instruction to Bidders.
   2. Requests received after that time may be considered or rejected at discretion of Architect.
   3. Architect will consider request for substitution after commencement of Work only when specified product or construction method cannot:
      a. Be provided within Contract Time.
      b. Receive necessary approvals.
      c. Be provided in manner compatible with or coordinate with other materials.
      d. Provide required warranty.

B. Conditions:
   1. Contractor's substitution request will be received and considered by Architect when following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action except to record noncompliance with these requirements
      a. Burden of proof of merit of proposed substitution is upon proposer.
      b. Extensive revisions to Contract Documents are not required.
      c. Requested substitution is consistent with Contract Documents and will produce indicated results.
      d. Request is timely, fully documented and properly submitted.
      e. Request is directly related to "or equal" clause or similar language in Contract Documents.
         1) Specified product or construction method cannot be provided within Contract Time.
         2) Request will not be considered when product or method cannot be provided as result of failure to pursue Work promptly, failure to identify items requiring long lead times, or failure to coordinate activities properly.
      f. Specified product or construction method cannot:
         1) Receive necessary approval by governing authority, and requested substitution can be approved.
         2) Be provided in manner that is compatible with other materials, and where Contractor certifies that requested substitution will overcome incompatibility.
         3) Be coordinated with other materials, and where Contractor certifies that requested substitution can be coordinated.
         4) Provide warranty required by Contract Documents and where Contractor certifies that requested substitution provide required warranty.
      g. Substantial advantage is offered Owner, in cost, time, energy conservation, or other considerations of merit, after deducting additional responsibilities Owner must assume.
         1) Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner or separate Contractors, and similar considerations.
      h. When requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of Work, is uniform and consistent, is compatible with other products, and is acceptable to contractors involved.

C. Architects Action:
   1. When necessary, within one week of receipt of request for substitution, Architect will request additional information or documentation for evaluation of request for substitution.
   2. Within 2 weeks of receipt of request, or one week of receipt of additional information or documentation, whichever is later, Architect will notify Contractor of acceptance or rejection of requested substitution.

3. Form of Acceptance: Change Order.
4. Use product specified when Architect cannot make decision on use of proposed Substitution within time allocated.
5. Architect will not be responsible for locating or securing information which is not included in substantiating data.
6. Architect's decision of acceptance or rejection of requested substitution is final.

D. Architect's cost for evaluating substitutions requested by Contractor, including making subsequent revisions to Drawings, Specifications and other resulting documentation, will be paid by Owner with reimbursement from Contractor by deductive change order.

E. Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data, or Samples that relate to construction activities not complying with Contract Documents does not constitute acceptable or valid request for substitution, nor does it constitute approval.

PART 3 EXECUTION

3.01 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in applications indicated.
1. Anchor each product securely in place, accurately located and aligned with other Work.
2. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 01 6000

SECTION 01 6000

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Following Administrative and Procedural Requirements:
      a. Selection of products for use in Project
      b. Product delivery, storage, and handling.
      c. Manufacturers' standard warranties on products.
      d. Special warranties.
      e. Product substitutions.

B. Related Sections:
   1. Section 01 4200: References; applicable industry standards for products specified.
   2. Section 01 7700: Closeout Procedures; submittal of warranties for contract closeout.

C. Related Requirements:
   1. Refer to District’s Division 00 Documents, including General Conditions, and other Division 01 Sections, for additional requirements.
   2. Specific requirements for warranties on products and installations specified to be warranted are included in appropriate Divisions 02 through 33 Sections.

1.02 DEFINITIONS

A. Definitions used in this Article are not intended to change meaning of other terms used in Contract Documents, such as "specialties", "systems", "structure", "finishes", "accessories", and similar terms.
   1. Such terms are self-explanatory and have well recognized meanings in construction industry.

B. Products:
   1. Items purchased for incorporating into Work, whether purchased for Project or taken from previously purchased stock.
   2. Term "product" includes terms "material," "equipment," and terms of similar intent.
   3. Named Products:
      a. Items identified by manufacturer's product name, including make or model number or other designation, shown or listed in manufacturer's published product literature, that is current as of date of Contract Documents.

4. New Products:
    a. Items that have not previously been incorporated into another project or facility, except that products consisting of recycled-content materials are allowed, unless explicitly stated otherwise.
        1) Products salvaged or recycled from other projects are not considered new products.

C. Substitutions:
1. Changes in products, materials, equipment, and methods of construction required by Contract Documents and proposed by Contractor
2. Following are not considered substitutions:
    a. Substitutions requested during bidding period, and accepted by written Addendum prior to opening of bids or award of Contract.
3. Revisions to Contract Documents requested by Owner or Architect.
4. Specified options of products and construction methods included in Contract Documents.
5. Compliance with governing regulations and orders issued by governing authorities.

D. Basis-of-Design Product Specification:
1. Where specific manufacturer's product is named and accompanied by words "Basis-of-Design", including make or model number or other designation, to establish significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of other named manufacturers.

E. Manufacturer's Warranty:
1. Preprinted written warranty published by individual manufacturer for particular product and specifically endorsed by manufacturer to Owner.

F. Special Warranty:
1. Written warranty required by or incorporated into Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Owner.

1.03 SUBMITTALS

A. Product Listing Schedule:
1. Prepare schedule showing products specified in tabular form acceptable to Architect to include:
    a. Generic names of products required.
    b. Manufacturer's name and proprietary product names for each item listed.
2. Form:
    a. Prepare Product Listing Schedule with information on each item tabulated under following column headings:
        1) Related Specification Section number.

2) Generic name used in Contract Documents.
3) Proprietary name, model number and similar designations.
4) Manufacturer's name and address.
5) Supplier's name and address.

3. Completed Schedule:
   a. Within fifteen days after date of commencement of Work submit four copies of completed Product Listing Schedule.

      1) Furnish written explanation for omissions of data, and for known variations from Contract requirements.

1.04 QUALITY ASSURANCE

A. To fullest extent possible, provide products of same kind, from single source.

1.05 REQUESTS FOR SUBSTITUTIONS

A. Requests for Substitutions received after award of Contract will be considered only in case of substantiated product unavailability, or other conditions beyond control of Contractor.

B. Substitution Requests:
   1. Submit one electronic copy (PDF) of each request for consideration.
   2. Identify product or fabrication or installation method to be replaced.
   3. Include Specification Section number and title and Drawing numbers and titles.
      a. Refer to Article 2.02, in this Section.
   4. Substitution Request Form:
      a. Use form provided by Owner.
         1) In absence of Owner furnished form, use form included at end of this Section.
      b. Other forms will not be accepted.
      c. Requests received without properly completed substitution request form will be rejected without further review.
   5. Documentation:
      a. Show compliance with specified requirements for substitutions and following, as applicable:
         1) Statement indicating why specified material or product cannot be provided.
            a) Submit statement on official letterhead of Contractor, supplier, or manufacturer, signed by an officer of the Company.
            b) Statement will be subject to independent verification by Architect.
         2) Product identification, including manufacturer's name and address.

3) Coordination information, including list of changes or modifications needed to other parts of Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.
4) Detailed, side-by-side comparison of significant qualities including attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
5) Product Data, including drawings and descriptions of products and fabrication and installation procedures.
6) Structural calculations, where applicable or requested, prepared and signed by registered Structural Engineer licensed in California.
7) Samples, where applicable or requested.
8) List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
9) Material test reports from qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
10) Research/evaluation reports evidencing compliance with building code in effect for Project, from model code organization acceptable to authorities having jurisdiction.
11) Detailed comparison of Contractor's Construction Schedule using proposed substitution with products specified for Work, including effect on overall Contract Time.
    a) When specified product or method of construction cannot be provided within Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
12) Cost information, including proposal of change, when occurring, in Contract Sum.
    a) When substitution request is made after award of Contract, for other than reasons stated, include in request, benefit to Owner, in form of cost reduction.
13) Designation of availability of maintenance services, sources of replacement materials.
14) Contractor's certification that proposed substitution complies with requirements in Contract Documents and is appropriate for applications indicated.
15) Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

C. Basis-of-Design Product Specification Submittal:
   1. Comply with requirements in Section 01 3300.
   2. Show compliance with requirements.

D. Multiple Resubmittals:
   1. Requests for Substitutions made after Award of Contract:
      a. Requirements cover initial Request for Substitution review and one resubmittal review when necessary.
   2. Architect's and/or Consultant's cost for evaluationg additional submittals requested by Contractor beyond first resubmittal will be paid by Owner with reimbursement from Contractor by deductive change order.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store and handle products using means and methods that will prevent damage, deterioration and loss, including theft; comply with manufacturer's written instructions.
   1. Schedule delivery to minimize long term storage at Project Site and to prevent overcrowding of construction spaces.
   2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other losses.
   3. Deliver products to Project Site in undamaged condition in manufacturer's original sealed container, or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.
   4. Inspect products on delivery to ensure compliance with Contract Documents, and to ensure products are undamaged and properly protected.
   5. Store products in manner to facilitate inspection and measurement of quantity or counting of units.
   6. Store materials in manner that will not endanger Project structure.
   7. Store products subject to damage by elements under cover in weathertight enclosure above ground, with ventilation adequate to prevent condensation.
   8. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
   9. Protect stored products from damage.

1.07 PRODUCT WARRANTIES

A. Warranties specified in other Sections are in addition to, and run concurrent with, other warranties required by Contract Documents.
   1. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of Contract Documents.

B. Special Warranties:
   1. Prepare written document that contains appropriate terms and identification, ready for execution.
      a. Submit draft for approval before final execution.

2. Manufacturer's Standard Form:
   a. Modified to include Project-specific information and properly executed.
3. Refer to Division 26 through 32 Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time:
1. Comply with requirements in Section 01 7700 and General Conditions.

PART 2 PRODUCTS

2.01 PRODUCT SELECTION

A. General Product Requirements:
1. Provide products that comply with Contract Documents, that are undamaged and, unless otherwise indicated, unused at time of installation.
2. Provide products complete with accessories, trim, finish, safety guards and other devices and details needed for complete installation and for intended use and effect.
3. Standard Products:
   a. Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.
4. Owner reserves right to limit selection to products with warranties not in conflict with requirements of Contract Documents.
5. Where products are accompanied by term "as selected", Architect will make selection.
6. Where products are accompanied by term "match sample", sample to be matched is Architect's.
7. Descriptive, performance, and reference standard requirements in Specifications establish "salient characteristics" of products.

8. Where products are specified by name and accompanied by term "or equal", or "or approved equal", or "or approved", comply with provisions in "Product Substitutions" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:
1. Procedures for product selection include following:
   a. Product:
      1) Where Specification paragraphs or subparagraphs titled "Product" name single product and manufacturer, provide product named.
      2) Substitutions may be considered, unless otherwise indicated.

b. Products:
   1) Where Specification paragraphs or subparagraphs titled "Products" introduce list of names of both products and manufacturers, provide one of products listed that complies with requirements.
   2) Products and manufacturers are listed alphabetically and do not indicate order of preference, unless otherwise indicated.
c. Manufacturer/Source:
   1) Where Specification paragraphs or subparagraphs titled "Manufacturer" or "Source" name single manufacturers or sources, provide product by manufacturer or from source named that complies with requirements.
   2) Substitutions may be considered, unless otherwise indicated.
d. Manufacturers:
   1) Where Specification paragraphs or subparagraphs titled "Manufacturers" introduce list of manufacturers' names, provide product by one of manufacturers listed that complies with requirements.
   2) Where manufacturers are specified by name, accompanied by term "or equal", or "or approved equal" comply with provisions in "Product Substitutions" Article to obtain approval for use of an unnamed product.
e. Product Options:
   1) Where Specification paragraph titled "Product Options" indicate that size, profiles, and dimensional requirements on Drawings are based on specific product or system, provide either specific product or system indicated or comparable product or system by another manufacturer.
   2) Comply with provisions in "Product Substitutions" Article to obtain approval for use of unnamed product.

C. Basis-of-Design Products:
   1. Where Specification paragraphs or subparagraphs titled "Basis-of-Design Product" are included and also introduce or refer to list of manufacturers' names, provide either specified product or comparable product by one of other named manufacturers.
   2. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on product named.
   3. Comply with provisions in "Product Substitutions" Article to obtain approval for use of unnamed product.
   4. Substitutions may be considered.

D. Visual Matching Specification:
   1. Where Specifications require matching established sample, select product and manufacturer that complies with requirements and matches Architect's sample.
   2. Architect's decision will be final on whether proposed product matches satisfactorily.

3. Where no product is available within specified category that matches satisfactorily and complies with other specified requirements, comply with provisions of Contract Documents on "substitutions" for selection of matching product.

E. Visual Selection Specification:
   1. Where Specifications include phrase "as selected from manufacturer's colors, patterns, textures" or similar phrase, select product and manufacturer that complies with other specified requirements.
   2. Standard Range:
      a. Where Specifications include phrase "standard range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that does not include premium items.
   3. Full Range:
      a. Where Specifications include phrase "full range of colors, patterns, textures" or similar phrase, Architect will select color, pattern, or texture from manufacturer's product line that includes both standard and premium items.

F. Performance Specification Requirements:
   1. Where Specifications require compliance with performance requirements, provide products that comply with requirements, and are recommended by manufacturer for application indicated.
   2. General overall performance of product is implied where product is specified for specific application.
   3. Manufacturer's recommendations may be contained in product literature, or by manufacturer's certification of performance.

2.02 PRODUCT SUBSTITUTIONS

A. Timing:
   1. Requests for Substitutions are restricted to before bid opening as stated in Instruction to Bidders.
   2. Requests received after that time may be considered or rejected at discretion of Architect.
   3. Architect will consider request for substitution after commencement of Work only when specified product or construction method cannot:
      a. Be provided within Contract Time.
      b. Receive necessary approvals.
      c. Be provided in manner compatible with or coordinate with other materials.
      d. Provide required warranty.

B. Conditions:
   1. Contractor's substitution request will be received and considered by Architect when following conditions are satisfied, as determined by Architect; otherwise requests will be returned without action except to record noncompliance with these requirements
      a. Burden of proof of merit of proposed substitution is upon proposer.
      b. Extensive revisions to Contract Documents are not required.
      c. Requested substitution is consistent with Contract Documents and will produce indicated results.
      d. Request is timely, fully documented and properly submitted.
      e. Request is directly related to "or equal" clause or similar language in Contract Documents.
         1) Specified product or construction method cannot be provided within Contract Time.
         2) Request will not be considered when product or method cannot be provided as result of failure to pursue Work promptly, failure to identify items requiring long lead times, or failure to coordinate activities properly.
      f. Specified product or construction method cannot:
         1) Receive necessary approval by governing authority, and requested substitution can be approved.
         2) Be provided in manner that is compatible with other materials, and where Contractor certifies that requested substitution will overcome incompatibility.
         3) Be coordinated with other materials, and where Contractor certifies that requested substitution can be coordinated.
         4) Provide warranty required by Contract Documents and where Contractor certifies that requested substitution provide required warranty.
      g. Substantial advantage is offered Owner, in cost, time, energy conservation, or other considerations of merit, after deducting additional responsibilities Owner must assume.
         1) Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner or separate Contractors, and similar considerations.
      h. When requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of Work, is uniform and consistent, is compatible with other products, and is acceptable to contractors involved.

C. Architects Action:
   1. When necessary, within one week of receipt of request for substitution, Architect will request additional information or documentation for evaluation of request for substitution.
   2. Within 2 weeks of receipt of request, or one week of receipt of additional information or documentation, whichever is later, Architect will notify Contractor of acceptance or rejection of requested substitution.

3. Form of Acceptance: Change Order.
4. Use product specified when Architect cannot make decision on use of proposed Substitution within time allocated.
5. Architect will not be responsible for locating or securing information which is not included in substantiating data.
6. Architect's decision of acceptance or rejection of requested substitution is final.

D. Architect's cost for evaluating substitutions requested by Contractor, including making subsequent revisions to Drawings, Specifications and other resulting documentation, will be paid by Owner with reimbursement from Contractor by deductive change order.

E. Contractor's submittal and Architect's acceptance of Shop Drawings, Product Data, or Samples that relate to construction activities not complying with Contract Documents does not constitute acceptable or valid request for substitution, nor does it constitute approval.

PART 3 EXECUTION

3.01 INSTALLATION OF PRODUCTS

A. Comply with manufacturer's instructions and recommendations for installation of products in applications indicated.
1. Anchor each product securely in place, accurately located and aligned with other Work.
2. Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

END OF SECTION 01 6000

Substitution Request Form

Project: _____ Substitution Request Number: _____

To: _____ Date:_____

_____ A/E Project Number: _____

Re: _____ Contract For: _____

Specification Title: _____

Section: _____ Page: _____ Article/Paragraph: _____

Requested Substitution: _____

Manufacturer: _____ Address: _____ Phone No._____

Trade Name: _____ Model No.: _____

Installer: _____Address_____ _Phone No.: _____

History: □ New Product □ 2-5 yrs. old □ 5-10 yrs. old □ More than 10 yrs. old

Differences between requested substitution and specified product: _____

_____

Provide Point-by-Point Itemized Comparison of requested substitution with specified product data attached

REQUIRED BY A/E – Comply with Division 01 Specification Section 01 6000.

Reason for not providing specified item: _____

_____

_____

Similar Installation:

Project: _____ Architect: _____

Address: _____ Owner: _____

_____ Date Installed: _____

Proposed substitution affects other parts of Work: □ No □ Yes; explain _____

_____

_____

Benefit to Owner for accepting substitution: _____($ _____)

Proposed substitution changes Contract Time: □ No □ Yes; Add/Deduct _____days.

Supporting Data Attached (Comply with Division 01 Specification Section 01 6000):

□ Product Data □ Drawings □ Tests □ Reports □ Samples □ _____

Undersigned Certifies:

- Requested substitution has been fully investigated and determined to be equal or superior in every respect to specified product.
- Same warranty will be furnished for requested substitution as for specified product.
- Same maintenance service and source of replacement parts, as applicable, is available.
- Requested substitution will have no adverse affect on other trades, and will not affect or delay Progress Schedule.
- Cost data as stated above is complete.
- Claims for additional costs related to accepted substitution which may subsequently become apparent are to be waived.
- Requested substitution does not affect dimensions and functional clearances.
- Undersigned will make payment for changes to building design, Including architectural or engineering design, detailing, and construction costs caused by requested substitution.

Submitted by: _____

Signed by: _____

Firm: _____

Address: _____

_____

Telephone: _____

Attachmenls: _____

_____

_____

_____

_____

ARCHITECT'S REVIEW AND ACTION

□ Substitution Approved – Make submittals in accordance with Division 01 Specification Section 01 3300.

□ Substitution Approved as Noted – Make submittals in accordance with Division 01 Specification Section 01 3300.

□ Substitution Rejected – Use specified materials.

□ Substitution Request Received Too Late – Use specified materials.

Signed by: _____ Date: _____

Additional Comments: □ Contractor □ Subcontractor □ Supplier □ Manufacturer □ A/E □ _____

_____

_____

_____

_____

_____

_____

SECTION 01 7123

FIELD ENGINEERING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Furnishing services of registered Civil Engineer or licensed Land Surveyor for engineering services required for Project.
   2. Survey work required in execution of Project.
   3. Civil, structural or other professional engineering services specified, or required to execute Contractor's construction methods.
   4. Coordination with testing laboratory and soils engineer.
   5. Contractor furnished assistance.
   6. Verification of conditions.

B. Related Sections:
   1. Section 01 3300: Submittal Procedures
   2. Section 01 7700: Closeout Procedures.

C. Related Requirements:
   1. Refer to District’s Division 00 Documents, including General Conditions, for additional requirements.

1.02 SUBMITTALS

A. Comply with pertinent provisions of Section 01 3300 and following:
   1. Name and address of Surveyor or professional engineer to Architect, including changes as they may occur.
   2. Upon request of Architect, provide documentation to verify accuracy of field engineering work.
   3. Include certificate signed by registered Civil Engineer or Land Surveyor certifying that elevations and locations of improvements are in conformance, or non-conformance, with Contract Documents.

B. Record Drawings:
   1. At Project completion, obtain and pay for CD’s and Files of Project Plans.
      a. Clearly indicate differences between original drawings and completed Work within specified tolerances.
   2. Show as-built locations by coordinates of utilities onsite with top of pipe elevations at major grade and alignment changes.
   3. Date, sign and certify completed record drawing transparencies as correct, by Licensed Surveyor or Civil Engineer.
   4. Comply with requirements of Section 01 7700.

1.03 QUALITY ASSURANCE

A. Qualifications of Surveyor or Engineer:
   1. Engage registered Civil Engineer or licensed Land Surveyor acceptable to both Contractor and Owner who is qualified to perform land surveying.

2. Prior to start of Work, furnish to Owner, name and license (or registration number) issued by State of California, Board of Registration for Professional Engineers and Land Surveyors.
3. Provide notice to Owner during course of construction should identification of individual responsible for this Work change, and obtain approval of Owner for replacement.

B. Perform Field Engineering Services furnished during course of this Project under direct supervision and control of named individual civil engineer or land surveyor.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION

3.01 SURVEY REFERENCE POINTS

A. Existing horizontal and vertical control points for Project are those designated on Drawings.

B. Locate and protect control points prior to starting site work, and preserve permanent reference points during construction.
1. Make no changes or relocations without prior written notice to Architect.
2. Report to Architect when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
3. Identify and protect survey monuments on Project Site discovered during construction, which are not referenced on Project Drawings.
   a. Tie out such monuments and notify Architect prior to allowing them to be disturbed.
4. Replace permanent boundary markers disturbed during construction with new permanent monuments and file required Record of Survey or Corner Record in accordance with applicable State and County laws, at no additional cost to Owner.

3.02 PROJECT SURVEY REQUIREMENTS

A. Establish minimum of two permanent horizontal and vertical control points on Project Site, remote from building area referenced to data established by survey control points.
1. Record locations, with horizontal and vertical data, on Project Record Documents, including description of monuments in place.

B. Establish lines and levels, locations and dimensions, by instrumentation or similar technical appropriate means:
1. Site Improvements:
   a. Utility lines, including, but not necessarily limited to, storm drains, sewers, water mains, gas, electric and telephone lines.
   b. Provide adequate horizontal control to locate lines and provide vertical control in proportion to slope of line as required for accurate construction.
2. Building Lines and Levels:
   a. Furnish building corner offsets as required to adequately locate buildings.
3. Provide control lines and levels required for Mechanical and Electrical work.
4. Provide grade stakes and elevations as required to construct paved areas, landscaped areas, and other areas as required.

a. Calculate and layout subgrade elevations and intermediate controls as required to provide smooth transitions between the spot elevations indicated on plans.
b. From time to time, verify layout of Work by same methods.

5. Provide batter boards or other similar control for drainage, utility, and other onsite structures as required.

3.03 RECORDS

A. Maintain complete, accurate surveyor's log of control and survey work as it progresses.
1. Make this log available for reference.

END OF SECTION 01 7123

SECTION 01 7329

CUTTING AND PATCHING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes
   1. Administrative and procedural requirements for cutting and patching.

B. Related Sections:
   1. Section 01 1100: Summary of Work
   2. Section 01 7419: Construction Waste Management and Disposal
   3. Section 01 7423: Cleaning

C. Related Requirements:
   1. Refer to Divisions 22 and 23 Sections for cutting, patching, of plumbing and mechanical items.
   2. Refer to Divisions 26, 27, and 28 Sections for cutting, patching, of electrical and related systems.

1.02 QUALITY ASSURANCE

A. Requirements for Structural Work:
   1. Do not cut and patch structural elements in manner that would reduce their load-carrying capacity or load-deflection ratio.

B. Operational and Safety Limitations:
   1. Do not cut and patch operating elements or safety related components in manner that would result in reducing their capacity to perform as intended or result in increased maintenance or decreased operational life or safety.
   2. Obtain approval before cutting and patching following operating elements or safety related systems:
      a. Shoring, bracing, and sheeting.
      b. Primary operational systems and equipment.
      c. Air or smoke barriers.
      d. Water, moisture, or vapor barriers.
      e. Membranes and flashings.
      f. Fire protection systems.
      g. Noise and vibration control elements and systems.
      h. Control systems.
      i. Communication systems.
      j. Conveying systems.
      k. Electrical wiring systems.

C. Visual Requirements:
   1. Do not cut and patch construction exposed on exterior or in occupied spaces, in manner that would, in Architect's opinion, reduce aesthetic qualities, or result in visual evidence of cutting and patching.
   2. Remove and replace Work that has been cut and patched in visually unsatisfactory manner.

3. Engage recognized experienced and specialized fabricator to cut and patch following categories of exposed Work:
   a. Processed concrete finishes.
   b. Portland cement plaster (Stucco).

PART 2 PRODUCTS

2.01 MATERIALS

A. Use materials that are identical to existing materials.
   1. Where identical materials are not available or cannot be used where exposed surfaces are involved, use materials that match existing adjacent surfaces to fullest extent possible with regard to visual effect.
   2. Use materials whose installed performance will equal or surpass that of existing materials.

PART 3 EXECUTION

3.01 INSPECTION

A. Before cutting existing surfaces, examine surfaces to be cut and patched and conditions under which cutting and patching is to be performed.
   1. Take corrective action before proceeding if unsafe or unsatisfactory conditions are encountered.

3.02 PREPARATION

A. Comply with requirements for temporary protections specified in Section 01 5000.

B. Temporary Support:
   1. Provide temporary support of Work to be cut.
   2. Review with Structural Engineer when necessary.

C. Protection:
   1. Protect existing construction during cutting and patching to prevent damage.
   2. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

E. Take precautions necessary to avoid cutting existing pipe, conduit, or ductwork serving building, but scheduled to be removed or relocated until provisions have been made to bypass them.

3.03 PERFORMANCE

A. General:
   1. Employ skilled workmen to perform cutting and patching.
   2. Proceed with cutting and patching at earliest feasible time and complete without delay.
   3. Cut existing construction to provide for installation of other components or performance of other construction activities and subsequent fitting and patching required to restore surfaces to their original condition.

B. Cutting:
   1. Cut existing construction using methods least likely to damage elements to be retained or adjoining construction.
   2. In general, where cutting is required use hand or small power tools designed for sawing or grinding, not hammering and chopping.
   3. Cut holes and slots neatly to size required with minimum disturbance of adjacent surfaces.
      a. Temporarily cover openings when not in use.
   4. To avoid marring existing finished surfaces, cut or drill from exposed or finished side into concealed surfaces.
   5. Cut through concrete and masonry using cutting machine such as carborundum saw or diamond core drill.
   6. By-pass utility services such as pipe or conduit, before cutting, where services are shown or required to be removed, relocated or abandoned.
   7. Cut-off pipe or conduit in walls or partitions to be removed.
      a. Cap, valve or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after by-passing and cutting.

C. Patching:
   1. Patch with durable seams that are as invisible as possible.
   2. Comply with specified tolerances.
      a. Where feasible, inspect and test patched areas to demonstrate integrity of installation.
      b. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in manner that will eliminate evidence of patching and refinishing.

3.04 CLEANING

A. Thoroughly clean areas and spaces where cutting and patching is performed or used as access.
   1. Comply with requirements of Section 01 7423.

END OF SECTION 01 7329

SECTION 01 7419

CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. References.
   2. System description for construction and demolition waste management.
   3. Submittals.

B. Related Sections:
   1. Section 01 3300: Submittal Procedures.
   2. Section 01 4100: Regulatory Requirements.
   3. Section 01 5000: Temporary Facilities and Controls.
   4. Section 01 7423: Cleaning.
   5. Section 01 7700: Closeout Procedures.

1.02 REFERENCES

A. California Integrated Waste Management Act of 1989 (AB 75).

B. California Code of Regulations, Title 14 – Natural Resources
   1. Division 7 – Department of Resources Recycling and Recovery

1.03 SYSTEM DESCRIPTION

A. Collection and separation of construction and demolition waste materials generated on-site as follows:
   1. Re-use or recycling on-site.
   2. Transportation to approved recyclers or re-use organizations.
   3. Transportation to legally designated landfills for purpose of recycling, salvaging, or reusing minimum of 50 percent of construction and demolition waste generated.

1.04 SUBMITTALS

A. Construction and Demolition Waste Management Plan (Exhibit 1):
   1. Within 10 calendar days after Notice to Proceed and prior to waste removal, submit following to Owner for review and approval:
      a. Materials to be recycled, re-used, or salvaged, either on-site or off-site.
      b. Estimates of construction and demolition waste quantity (in tons) by type of material.
         1) When waste is measured by volume, give factors for conversion to weight in tons.
      c. Procedures for recycling/re-use program.
      d. Permit or license and location of Project waste disposal areas.
      e. Site Plan for placement of waste containers.

B. Construction and Demolition Waste Management Monthly Progress Report (Exhibit 2):
   1. Submit Summary of waste generated by Project, monthly with Application for Payment. Include following:
      a. Firms accepting recovered or waste materials.
      b. Type and location of accepting facilities (landfill, recovery facility, or used materials yard).
         1) When materials are to be re-used or recycled on Project Site, location should be designated as “On-site Re-use/Recycling”.
      c. Type of materials and net weight (tons) of each.
      d. Value of materials or disposal fee paid.
      e. Attach weigh bills and other documentation confirming amount and disposal location of waste materials.

C. Construction and Demolition Waste Management Final Compliance Report:
   1. Final update of Waste Management Plan to provide summary of total waste generated by Project.

D. Waste management Report for Contractors (Exhibit 3):
   1. Complete attached form and submit to Owner.

E. Solid Waste Management and Recycling Plan (Exhibit 4):
   1. Complete attached form and submit to Owner.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION

3.01 IMPLEMENTATION

A. Implement approved Waste Management Plan including collecting, segregating, storing, transporting and documenting each type of waste material generated, recycled or re-used, or disposed in landfills.

B. Designate on-site person to be responsible for instruction workers and overseeing sorting and recording of waste/recyclable materials.

C. Include waste management and recycling in worker orientation and as agenda item for regular project meetings.

D. Limit recycle and waste bin areas to approved areas indicated on Waste Management Plan.
   1. Keep recycle and waste bins neat and clearly marked to avoid contamination of materials.

3.02 ATTACHMENTS

A. Exhibit 1: Construction and Demolition Waste Management Plan.

B. Exhibit 2: Construction and Demolition Waste Management Monthly Progress Report.

C. Exhibit 3: Waste Management Report for Contractors.

D. Exhibit 4: Solid Waste Management and Recycling Plan.

END OF SECTION 01 7419

[This Page Intentionally Left Blank]

EXHIBIT 1

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT PLAN

CONSTRUCTION/MAINTENANCE/ALTERATION AND DEMOLITION PROJECTS

PROJECT NAME: _____

PROJECT NO: _____

NAME OF COMPANY:

_____

CONTACT PERSON: _____

TELEPHONE:_____

PROJECT SITE LOCATION: _____

PROJECT TYPE:

___New Construction ____Demolition ___Maintenance/Alteration Projects

PROJECT SIZE (SQ.FT.): _____

DATE AND ESTIMATED PERIOD _____

EXHIBIT 1 FORM

(1) Material Type	(2) Tons Estimated Recycle	(3) Tons Estimated Reuse	(4) Tons Estimated Salvage	(5) Tons Estimated Landfill	(6) Proposed Disposal or Recycling Facility
Total					
Diversion Rate: Columns[(2)+(3)+(4)] / [(2)+(3)+(4)+(5)				=	
Signature	Title	Date			

Column 1: “Material Type” – Enter type of materials targeted for recycling, reuse, or requiring disposal.

Columns 2 through 4: “Estimated Generation” – Enter estimated quantities (tons) of recyclable, reusable, or salvageable waste materials anticipated to be generated and state number of salvageable items.

Column 5: “Estimated Landfill” – Enter quantities (tons) of materials to be disposed in landfill.

Column 6: “Disposal Location” – Enter end-destination of recycled, salvaged, and disposed materials.

General: (1) Attach proposed Recycling and Waste Bin Location Plan.
(2) Attach name and contact data for each recycling or disposal destination to be used.

EXHIBIT 2

CONSTRUCTION AND DEMOLITION WASTE MANAGEMENT MONTHLY PROGRESS REPORT

CONSTRUCTION/MAINTENANCE/ALTERATION AND DEMOLITION PROJECTS

PROJECT NAME: _____

PROJECT NO: _____

NAME OF COMPANY:

_____

CONTACT PERSON: _____

TELEPHONE:_____

PROJECT SITE LOCATION: _____

PROJECT TYPE:

___New Construction ____Demolition ___Maintenance/Alteration Projects

PROJECT SIZE (SQ.FT.): _____

DATE AND ESTIMATED PERIOD:_____

EXHIBIT 2 FORM

(1) Material Type	(2) Tons Actual Recycle	(3) Tons Actual Reuse	(4) Tons Actual Salvage	(5) Tons Actual Landfill Name	(6) Disposal or Recycling Facility (e.g. Onsite, of Facility)
Total					
Diversion Rate: Columns[(2)+(3)+(4)] / [(2)+(3)+(4)+(5)				=	
Signature	Title	Date			

Column 1: “Material Type” – Enter type of materials targeted for recycling, reuse, or requiring disposal.

Columns 2 through 4: “Estimated Generation” – Enter estimated quantities (tons) of recyclable, reusable, or salvageable waste materials anticipated to be generated and state number of salvageable items.

Column 5: “Estimated Landfill” – Enter quantities (tons) of materials to be disposed in landfill.

Column 6: “Disposal Location” – Enter end-destination of recycled, salvaged, and disposed materials.

General: (1) Attach proposed Recycling and Waste Bin Location Plan.
(2) Attach name and contact data for each recycling or disposal destination to be used.

EXHIBIT 3

WASTE MANAGEMENT REPORT FOR CONTRACTORS

Complete this form each time materials are removed from

Project Site or reused onsite.
Submit to Owner's Project Manager.

PROJECT SITE LOCATION:_____DATE:_____

COMPANY:_____
_

MATERIAL:_____

_____

_____

WAS THE MATERIAL RECYCLED: YES_____NO_____

VOLUME/WEIGHT:_____

RECYCLING COMPANY OR DISPOSAL
SITE:_____

SUBMITTED
BY:_____

PHONE NUMBER:_____

[This Page Intentionally Left Blank]

EXHIBIT 4

SOLID WASTE MANAGEMENT AND RECYCLING PLAN

Prepare Waste Management and Recycling Plan by completing the following form for Construction and Demolition materials produced because of Work performed at Citrus Community College District. Owner requires that Contractors recycle materials when there is viable recycling company available.

Owner's Environmental Health and Safety Supervisor will assist applicants in developing and implementing Waste Management and Recycling Plan.

COMPANY NAME:_____ CONTACT:_____

ADDRESS:_____ PHONE:_____

PROJECT SITE:_____

Please fill out following form for submittal.
Form will help to identify types of materials, estimated quantities of materials, and how material will be transported and recycled or disposed.

Should you have questions regarding this form or recycling and disposal, please call Jorge Ramirez, Director of Maintenance, at 310.973.1300

EXHIBIT 4 FORM

Circle the material that will be generated at the construction site, estimate the quantity, list how the materials will be transported, and write in where the materials will be taken.

MATERIALS	**ESTIMATED QUANTITY** (in yards and tons)	**HAULER** (List hauler's name if not self–haul)	**RECYCLING COMPANY OR DISPOSAL SITE**
Salvage and used building			
Wood			
Plant Debris			
Wallboard			
Glass			
Soil			
Corrugated cardboard			
Metals			
Masonry/Tile			
Concrete/Asphalt			
Toilets (porcelain)			
Carpet Padding (foam)			
Other			
Mixed Loads (i.e. trash)			

FOR DISTRICT USE ONLY:

Approval Status:

_____ Approved

_____ Further explanation needed, see attached

_____ Denied

Reviewed by:_____Date:_____

SECTION 01 7423

CLEANING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Performance of cleaning, during progress of Work, and at completion of Work, as required by General Conditions.

B. Related Sections:
   1. Section 01 5000: Temporary Facilities and Controls; additional requirements for dust and debris control.
   2. Section 01 7419: Construction Waste Management and Disposal.

C. Related Requirements:
   1. Refer to District's Division 00 Documents, including General Conditions, for additional requirements.
   2. Cleaning for specific products of Work:
      a. Specification Section for that Work.

1.02 REFERENCES

A. South Coast Air Quality Management District (SCAQMD):
   1. Rule 403 – Fugitive Dust.

1.03 QUALITY ASSURANCE

A. Verify that requirements of cleanliness are being met.

1.04 DISPOSAL REQUIREMENTS

A. Conduct cleaning and disposal operations in compliance with applicable codes, ordinances, regulations, and anti-pollution laws.
   1. Comply with requirements of Section 01 7419.

B. In addition to specified requirements, comply with applicable requirements of fire and governing authorities having jurisdiction.

1.05 PAYMENT WITHHELD

A. Architect reserves right to withhold certification of payment requests for failure on part of Contractor to regularly clean Project in conformance with requirements of this Section.

PART 2 PRODUCTS

2.01 CLEANING MATERIALS AND EQUIPMENT

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by manufacturer of surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by cleaning products manufacturer.

PART 3 EXECUTION

3.01 PROGRESS CLEANING DURING CONSTRUCTION

A. Execute periodic cleaning to keep Work, Project Site and adjacent properties free from accumulations of waste materials, rubbish and windblown debris, resulting from construction operations.
   1. Maintain stored items in orderly arrangement allowing maximum access and providing required protection of materials.
      a. Provide on-site containers for collection of waste materials, debris and rubbish.
   2. Provide adequate storage for waste materials awaiting removal from Project Site, observing requirements for fire protection and protection of environment.
   3. Handle hazardous, dangerous or unsanitary waste materials separately from other waste material by placing it in proper containers.
   4. Burying or burning of waste materials is not permitted.
   5. Remove waste materials, debris and rubbish from Project Site periodically and dispose of at legal disposal areas away from Project Site.

B. Project Site:
   1. Inspect Project Site daily and pick up scrap, debris, and waste material.
      a. Place waste material in designated containers.
   2. Keep flammable waste in sealed metal containers until removed from Project Site.
   3. Maintain Project Site clear of debris so as not to impede construction and fire department access

C. Structures:
   1. Weekly, and more often if necessary, inspect structures and pick up scrap, debris, and waste material.
      a. Remove items and place in designated container.
   2. Weekly, sweep interior spaces clean.
      a. Keep space free from dust and other material capable of being removed by handheld broom, (i.e.: “broom clean”).
   3. Preparatory to installation of succeeding material, clean structures or pertinent portions as required to degree of cleanliness recommended by manufacturer of succeeding material.

4. Following installation of finish floor materials, clean finish floor daily, and more often if necessary.
    a. Provide adequate protection of finish where Work is being performed in space in which finish materials have been installed.
    b. For purpose of this subparagraph, term “Clean”, is to be interpreted as meaning free from foreign materials that, in opinion of Architect, may be injurious to finish floor material, (i.e.: “vacuum clean”).

3.02 DUST CONTROL

A. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.

3.03 FINAL CLEANING

B. Prior to completion of Work, remove from Project Site, tools, surplus materials, equipment, scrap, debris, and waste.

C. Employ experienced workers for final cleaning.

D. Complete following cleaning operations before requesting inspection for Certification of Substantial Completion:
    1. Site:
        a. Clean Site, including landscape development areas, of rubbish, litter and other foreign substances.
        b. Sweep paved areas broom clean, including public paved areas directly adjacent to Project Site.
            1) Remove stains, spills and other foreign deposits.
        c. Rake grounds that are neither paved nor planted, to smooth even-textured surface and remove resultant debris.
    2. Exterior and Interior:
        a. Clean exposed exterior and interior hard-surfaced finishes to dust-free condition
        b. Remove traces of soils, waste material, smudges and other foreign matter.
        c. Remove traces of splashed material from adjacent surfaces.
        d. Remove materials using equipment as instructed by manufacturer of surface materials to be cleaned.
        e. Leave concrete floors broom clean.
    3. Carpeted Surfaces:
        a. Use only dry-chemical method of cleaning.
        b. Do not use steam cleaning or water based cleaning on carpet.
        c. Use materials and methods fully approved by carpet manufacturer, as instructed in manufacturer’s published literature.
        d. Vacuum carpet.
    4. Labels:
        a. Remove labels that are not permanent labels.
    5. Transparent Materials:
        a. Clean transparent material, including mirrors and glass in doors and windows.
        b. Remove glazing compound and other substances that are noticeable vision obscuring materials.

c. Replace chipped or broken glass and other damaged transparent materials.
d. Restore reflective surfaces to their original reflective condition.
e. Clean glass inside and outside.
f. Polished Surfaces:
1) Apply polish recommended by manufacturer of material being polished to surfaces requiring routine application of buffed polish.

E. Ventilating Systems:
1. Clean permanent filters and replace disposable filters when units were operated during construction.
2. Clean ducts, blowers and coils when units were operated without filters during construction.

F. Wipe surfaces of electrical equipment.
1. Remove excess lubrication and other substances.
2. Clean plumbing fixtures to sanitary condition.
3. Clean light fixtures and lamps.

G. Comply with regulations of authorities having jurisdiction and safety standards for cleaning.
1. Do not burn waste materials.
2. Do not bury debris or excess materials on Owner's property.
3. Do not discharge volatile, harmful or dangerous materials into drainage systems.
4. Remove waste materials from Project Site and dispose of in lawful manner.
5. Where extra materials of value remaining after completion of associated Work have become Owner's property, arrange for disposition of these materials as directed.

H. Prior to final completion, or Owner occupancy, conduct inspection of sight-exposed exterior surfaces, and Work areas, to verify that entire Work is clean.

3.04 CLEANING DURING OWNER’S OCCUPANCY

A. Should Owner occupy portion of Project prior to its final completion by Contractor, comply with acceptance of partial occupancy by Owner/Architect in accordance with General Conditions of the Contract.

END OF SECTION 01 7423

SECTION 01 7700

CLOSEOUT PROCEDURES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for Project Closeout, including but not necessarily limited to:
      a. Inspection procedures.
      b. Substantial Completion
      c. Final Acceptance

B. Related Sections:
   1. Section 01 7423: Cleaning
   2. Section 01 7839: Project Record Documents

C. Related Requirements:
   1. Closeout requirements for specific construction activities are included in appropriate Sections in Divisions 02 through 33.

1.02 BENEFICIAL OCCUPANCY AND ACCEPTANCE OF SUBSTANTIAL COMPLETION

A. Comply with CCR, Title 24, Part 1 – Administrative Code, Section 4-336 CCR (Schools) Requirements for Closeout Procedures.
   1. Comply with additional requirements in District's Division 00 Sections and General Conditions of the Contract.

B. Preliminary Procedures:
   1. Before requesting inspection for certification of Substantial Completion, complete following.
      a. List exceptions in request.
   2. In application for payment that coincides with, or first follows, date Substantial Completion is claimed, show one hundred percent completion for portion of Work claimed as substantially complete.
      a. Include supporting documents for completion as indicated in Contract documents and statement showing accounting of changes to Contract Sum.
      b. When one hundred percent completion cannot be shown, include list of incomplete items, value of incomplete construction, and reasons Work is not complete.
   3. Make required submittals of specific warranties, workmanship bonds, maintenance agreements, final certifications and similar documents, along with record drawings and similar final record information in accordance with requirements in Section 01 7839.
   4. Complete final clean up requirements in accordance with Section 01 7423, including touch-up painting.
      a. Touch-up and otherwise repair and restore marred exposed finishes.

C. Inspection Procedures:
   1. Upon receipt of request for inspection, Architect will either proceed with inspection or advise Contractor of unfilled requirements.
   2. Should Architect and Owner determine that Work is not substantially complete:
      a. Architect will promptly notify Contractor in writing, giving reason(s) for his determination.
      b. In conjunction with Inspector of Record and Construction Manager, Architect will prepare list of items (Punch List) to be completed or corrected.
         1) Punch List may be developed for less than entire project, when approved by Architect and Owner.
      c. Remedy deficiencies and notify Architect when Work is ready for reinspection.
      d. Architect will prepare Certificate of Substantial Completion, accompanied by Punch List, following inspection, or advise Contractor of construction that must be completed or corrected before certificate will be issued
   3. Architect will repeat inspection when requested and if assured that Work has been substantially completed in each phase, will submit Certificate of Substantial Completion to Contractor and Owner for their written acceptance of responsibilities assigned them in Certificate.
      a. Owner reserves right to occupy each completed phase upon issuance of Certificate of Substantial Completion.
   4. Results of completed inspection will form basis of requirements for final acceptance.

D. Mandatory Substantial Completion Submittals:
   1. To include, but are not necessarily limited to:
      a. Redlined' As-Built Set (marked up drawings).
      b. On As-Built Set and Specifications manual record revisions to original contract document with contrasting color.
      c. Operation and Maintenance Manuals for items specified in pertinent Sections and for other items approved by Architect.
      d. Warranties and Guarantees.
      e. Training.
      f. Spare parts, materials, and extra stock.
      g. Evidence of payment and release of liens, when requested by Owner.
      h. List of Subcontractors, service organizations and principal vendors, including current names, addresses and telephone numbers, where they may be contacted for emergency service, including nights, weekends, and holidays.

1.03 FINAL ACCEPTANCE

A. Preliminary Procedures:
   1. Before requesting final inspection for certification of final acceptance and final payment, complete following.
      a. List exceptions in request.
   2. Prepare and submit Project Closeout Request notice that Work is ready for final inspection and acceptance.
   3. Architect, and Owner's Project Inspector will verify that Punch List items are complete.

4. Should Architect or Owner's Project Inspector determine Work is incomplete or defective:
   a. Architect or Owner's Project Inspector will promptly notify Contractor in writing, listing incomplete or defective work.
   b. Remedy deficiencies promptly and notify Owner's Project Inspector when ready for re-inspection.

B. Reinspection Procedure:
1. Architect will reinspect Work upon receipt of notice that Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to Architect.
2. Upon completion of reinspection, Architect will prepare certificate of final acceptance, or advise Contractor of Work that is incomplete, or of obligations that have not been fulfilled but are required for final acceptance.
3. When necessary, reinspection will be repeated.
4. When Architect determines Work is acceptable under Contract Documents, he will notify Owner's Project Inspector that Project is complete per Contract Drawings and Specifications.
5. Upon acceptance, Contractor must certify that Project has been completed in compliance with Contract Documents.
   a. Submit copies of this report to following:
      1) Architect.
      2) Owner's Project Inspector.

C. Final Payment Procedure.
1. Submit following in accordance with requirements of Section 01 7839:
   a. Final payment request with releases and supporting documentation not previously submitted and accepted.
   b. Include certificates of insurance for products and completed operations where required.
2. Updated final statement, accounting for final additional changes to Contract Sum.
3. Certified copy of Architect's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, and list has been endorsed and dated by Architect.
4. Consent of surety to final payment.
5. Comply with additional requirements in District's Division 00 Sections and General Conditions of the Contract.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION *(Not Applicable)*

END OF SECTION 01 7700

SECTION 01 7839

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Administrative and procedural requirements for preparing, maintaining, and submitting following:
      a. Project Record Documents.
      b. Operating and Maintenance Data and Manuals.
      c. Warranties, Guarantees, and Bonds.
      d. Spare parts and Maintenance Materials.
      e. Instructions to Owner's Personnel.

B. Related Sections:
   1. Section 01 7700: Closeout Procedures

C. Related Requirements:
   1. Refer to District's Division 00 Documents, including General Conditions, for additional requirements.
   2. Separate Specification Sections requiring Record Documents.

1.02 PROJECT RECORD DOCUMENTS

A. Dedicated Record Set:
   1. Maintain one set of Contract Drawings and one copy of Project Specifications for use during construction to record changes made during construction..
      a. Record revisions with contrasting color.
      b. Do not use record documents for construction purposes.

B. Record Documents and Shop Drawings:
   1. Record in concise and neat manner and on continual basis actual revisions to Work.
   2. Include reference to appropriate document with date revision/change was approved or directed.
   3. Changes/Revisions to Drawings and Specifications include, but are not necessarily limited to:
      a. Changes made by RFI, CCD, and CO.
      b. Changes made to shop drawings.
   4. Mark set to show actual installation where installation varies substantially from Work as originally shown.
      a. Mark whichever drawing is most capable of showing conditions fully and accurately.
      b. Where shop drawings are used, record cross-reference at corresponding location on Contract drawings.
      c. Give particular attention to concealed elements that would be difficult to measure and record at later date.
   5. Mark record sets with red erasable pencil; use other colors to distinguish between variations in separate categories of Work.

6. Mark new information that is important to Owner, but was not shown on Contract Drawings or shop drawings.
7. Note related Change Order numbers where applicable.
8. Label each document "**PROJECT RECORD**" in neat large printed letters.
9. Record information concurrently with construction progress.
    a. Do not conceal Work until required information is recorded.
10. Legibly mark each item to record actual construction including:
    a. Measured depths of foundations in relation to finish first floor datum.
    b. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
        1) Identify drains and sewers by invert elevation.
    c. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of Work.
    d. Identify ducts, dampers, valves, access doors and control equipment wiring.
    e. Field changes of dimension and detail.
    f. Details not on original Drawings.

C. Store Record Documents and Samples in Contractor's Field Office, separate from documents used for construction.
1. Protect record documents from deterioration and loss in secure, fire-resistive location.
2. Provide access to record documents for Architect's reference during normal working hours.
3. Provide files and racks for storage of Documents
4. Provide secure storage space for storage of samples.
5. Maintain documents in clean, dry, legible condition and in good order.
    a. Replace soiled or illegible documents.

D. Record Specifications:
1. Maintain one complete copy of Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction.
2. Legibly mark these documents and record at each product section description of actual products installed to show substantial variations in actual Work performed in comparison with text of specifications and modifications including following:
    a. Manufacturer's name, trade name, product model and number and supplier.
    b. Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation, including following:
        1) Authorized product substitutions or alternates utilized.
        2) Changes made by Addenda and Modifications.
3. Note related record drawing information and product data.
4. Upon completion of Work, submit record specifications to Architect for Owner's records.

E. Owner's Project Inspector will verify that Project Record Documents are fully updated prior to approving Payment Applications.
1. Obtain Owner's Inspector's signature on record set verifying information.

F. Record drawings will be reviewed by Architect for completeness and acceptance.

G. As-Built Drawings:
   1. Turn over to Owner in following manner:
      a. Separate each discipline (i.e. Civil, Architectural, Mechanical, Electrical, Pluming, and so on)
      b. Identify disciplines of Drawings by adding white tag.
      c. Tag each discipline.
      d. Tag Size: No. 8, 8-11/16 by 2-3/4 inches.
      e. Legibly write on tag name of Project, and discipline inside tube.
      f. Separately tube each discipline by using U-Line tube or equal.
      g. Size of Tube: 4 inches minimum and 6 inches maximum.

H. Record of Electronic (Digital) Files:
   1. Immediately before inspection of Substantial Completion, review marked-up Record Set with Architect and Owner's Inspector.
   2. When authorized, prepare full set of corrected digital files of Record Documents.
   3. Submit following documents:
      a. Scan sheets in As-Built Set, furnish annotated PDF electronic files.
      b. CD or CD's of PDF files and file labeling is to include following information:
         1) Project name.
         2) Date.
         3) Name of Architect.
         4) Name of Contractor
         5) Disciplines included in CD (i.e. Title sheet, Civil, Architectural, Structural, Mechanical, and so on)
         6) Label and index files contained in CD in sequential order to match Title Sheet of Contract Documents.

I. RFI's:
   1. Furnish one copy of RFI's questions and answers submitted on Project.
   2. Submit RFI binder in following manner:
      a. Provide binders as specified in "Record Document Storage" Article.
      b. Label binder on cover and spine: RFI's.
         1) Identify Project Name/Building Name, and Project Number on cover.
      c. Furnish tab for each individual RFI.
      d. Submit RFI Binders inside storage boxes as specified in "Record Document Storage" Article.
         1) Include two labels on face and side of box or boxes.

1.03 MAINTENANCE AND OPERATING (M&O) DATA AND MANUALS

A. Submit two sets prior to Substantial Completion inspection for Architect's review and approval.

B. Manual Format:
   1. Prepare data in form of instructional manual for use by Owner's personnel.
      a. Provide binders as specified in "Record Document Storage" Article.
      b. Identify Project Name/Building Name and Project Number on cover of manual.
   2. Table of Contents: Include in each volume, neatly typewritten.
      a. Identify Contractor, name of responsible principal, address, and phone number.

b. List each product included, indexed to content of volume.
c. List, with each product, name, address, and telephone number of subcontractor or installer and maintenance contractor, as appropriate and nearest source of supply for parts and replacement.
d. Identify location of installed equipment.
e. Submit M&O Manuals inside storage boxes as specified in “Record Document Storage” Article.

3. Product Data:
   a. Include only those sheets which are pertinent to specific product.
   b. Annotate each sheet to clearly identify specific product or part installed.
   c. Include CD with Product Data information.
      1) Maintenance schedules and equipment list must be in editable Word or Excel spreadsheet format.
4. Drawings:
   a. Supplement product date with Drawings as necessary to clearly illustrate relations of component parts of equipment and systems.
   b. Coordinate Drawings with information in Project Record Documents to ensure correct illustration of completed installation.
   c. Do not use Project Record Documents as maintenance drawings.
   d. Full size and half size hard copies of Drawings are required.
5. Copy of each warranty and service contract as specified.

1.04 RECORD DOCUMENT STORAGE

A. Binders:
   1. Commercial quality, heavy-duty, three-ring D binders with durable and cleanable vinyl-covers at front and spine, with internal pockets to hold CD.
   2. Size: 8-1/2 by 11 inches with ring size as required.
   3. Provide new white binders.

B. Storage Boxes:
   1. “Bankers Box” or equal quality.
      a. Size: 11 by 15 inches or equal size.
   2. Include two labels on face and side of box.
   3. Label boxes as follows:
      a. Use Avery Label 6573 or equal size.
      b. Type information on label, including Bid No., Project Name, and Number of boxes (i.e. Box 1 of 5).
         1) Refer to attached sample label at end of this Section.
         2) Font for Labels:
            a) Vernada, 48 point for Bid No.
            b) Vernada, 16 point for remainder of content on label.

1.05 WARRANTIES, GUARANTEES, AND BONDS

A. Disclaimers and Limitations:
   1. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of warranty on Work that incorporates products, nor does it relieve suppliers, manufacturers, and subcontractors required to countersign special warranties with Contractor.

B. Manufacturer's warranties and guarantees not withstanding, warrant entire Work against defects in materials and workmanship for twelve months from Date of Acceptance of Substantial Completion.
   1. Warranties and guarantees between Contractor and Owner are not affected by warranties and guarantees between Contractor and manufacturers and Contractor and suppliers.

1.06 WARRANTY REQUIREMENTS

A. Related Damages and Losses:
   1. When correcting warranted Work that has failed, remove and replace other Work that has been damaged as result of such failure or that must be removed and replaced to provide access for correction of warranted Work.

B. Reinstatement of Warranty:
   1. When Work covered by warranty has failed and been corrected by replacement or rebuilding, reinstate warranty by written endorsement.
   2. Provide Reinstated Warranty equal to original warranty with equitable adjustment for depreciation.

C. Replacement Cost:
   1. Upon determination that Work covered by warranty has failed, replace or rebuild Work to acceptable condition complying with requirements of Contract Documents.
   2. Contractor is responsible for cost of replacing or rebuilding defective Work regardless of whether Owner has benefited from use of Work through portion of its anticipated useful service life.

D. Owner's Recourse:
   1. Written warranties made to Owner are in addition to implied warranties, and do not limit duties, obligations, right and remedies otherwise available under law, nor are warranty periods be interpreted as limitations on time in which Owner can enforce such other duties, obligations, rights, or remedies.
   2. Rejection of Warranties:
      a. Owner reserves right to reject warranties and to limit selections to products with warranties not in conflict with requirements of Contract Documents.

E. Owner reserves right to refuse to accept Work for Project where special warranty, certification, or similar commitment is required on such Work or part of Work, until evidence is presented that entities required to countersign such commitments are willing to do so.

F. Submit warranties and guarantees to Contractor for Architect’s review and approval prior to final payment.

G. Do not start warranty period for delayed warranty items, until items have been completed.

H. Furnish two original copies with wet signatures of warranties and guarantees on Project.

I. Organize warranties/guarantees into orderly sequence based on Table of Contents in Project Specifications:
   1. Bind warranties/guarantees in 8-1/2 by 11 inch heavy-duty, three ring binders, same as specified in “Maintenance And Operating (M&O) Data and Manuals” Article.
   2. Identify each binder on front and spine with printed sheet “**WARRANTIES**”, project name and name of contractor.
   3. Contractor to issue Contractor’s and Subcontractor’s Warranties/Guarantees using attached Warranties/Guarantees form found at end of this Section.

1.07 SUBMITTALS

A. Submit written warranties to Architect prior to date certified for Substantial Completion.
   1. When Architect's Certificate of Substantial Completion designates commencement date for warranties other than date of Substantial Completion for Work, or designated portion of Work, submit written warranties upon request of Architect.

1.08 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit (2) copies of final approved manual to Owner’s Project Inspector prior to final payment.

B. Content for each unit of mechanical equipment and each mechanical system, as applicable and appropriate, including but not limited to following:
   1. Description of units, or system and component parts.
   2. Operating procedures.
   3. Maintenance procedures.
   4. Servicing and lubrication schedule, with list of lubricants required.
   5. As-installed control diagrams by controls manufacturer.
   6. Other data as required in various specification sections.

C. Content, for each electrical and electronic system, as applicable and appropriate, including but not limited to following:
   1. Description of system and component parts.
   2. Circuit directories of panel boards.
   3. As-installed color-coded wiring diagrams.
   4. Operating procedures.
   5. Maintenance procedures.
   6. Other data as required in individual sections.

D. Prepare and include additional data as may be required for instruction of Owner’s personnel.

E. Additional requirements for operating and maintenance data: As may be specified in individual Sections.

F. Provide complete information for products specified in individual Sections.

1.09 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide instruction/training to Owner personnel as indicated in individual specification sections and as required.

B. Provide to Owner, date and list, including signatures, of Owner personnel who attended training.
   1. Schedule instructional meeting or meetings after instructional manuals have been submitted, reviewed, and approved by Architect.
   2. Coordinate meetings to include tier subcontractors.

C. Instruction sessions will be held in Owner designated area on Project Site and at Owner's convenience.
   1. Schedule amount of time required for each session as specified in individual sections.

D. Review contents of Manuals with Owner's personnel in full detail to explain every aspect of operation and maintenance.

1.10 SPARE PARTS AND MAINTENANCE MATERIALS

A. Provide products, spare parts, maintenance and extra materials in quantities specified in individual Sections.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION *(Not Applicable)*

END OF SECTION 01 7839

[This Page Intentionally Left Blank]

WARRANTY/GUARANTEE FORM

FOR_____WORK

We, the undersigned, do hereby warranty and guaranty that the parts of the Work described above which we have furnished or installed for:

Project Name: (Insert Project Name)

Owner: (Insert Owner's Name)

Location: (Insert Project Location)

Are in accordance with the Contract Documents and that all said work as installed with fulfill or exceed all the Warranty and Guaranty requirements. We agree to repair or replace work installed by us, together with any other work which is displaced or damaged by so doing, that proves to be defective in workmanship, material, or operation within a period of:

(Insert written years) year(s)

from the date of filing of the Notice of Completion, ordinary wear and tear and unusual neglect or abuse excepted.

In the event of our failure to comply with the above-mentioned conditions within a reasonable time period determined by the Owner, after notification in writing, we, the undersigned, all collectively and separately, hereby authorize the Owner to have said defective work repaired and/or replaced and made good, and agree to pay to the Owner upon demand all monies that the Owner may expend in making good said defective work, including all collection costs and reasonable attorney fees.

Date:

(Insert Name of Contractor)	(Insert Name of Subcontractor, Manufacturer or Supplier)
Signature:	Signature:
Name:	Name:
Title:	Title:
State License No.	State License No.:

Local Representative: For maintenance, repair, or replacement service, contact:

Name:

Address:

Phone:

[This Page Intentionally Left Blank]

Bid No. XXXX

[Project Name] **DSA No. N/A**

RFI BINDERS 01 OF 04

BINDERS 01 OF 04: RFI'S 001 THRU 050

BINDERS 02 OF 04: RFI'S 051 THRU 100

BINDERS 03 OF 04: RFI'S 101 THRU 150

BINDERS 04 OF 04: RFI'S 151 THRU 200

Box 1 of 5

SAMPLE

SECTION 02 4113

SELECTIVE SITE DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Furnishing labor, materials, and equipment necessary for selective site demolition, dismantling, cutting, and alterations as indicated, specified, or required for completion of Work.
2. General items, including but not necessarily limited to following:
   a. Protection of existing improvements to remain.
   b. Protection of existing trees and vegetation to remain.
   c. Cleaning existing improvements to remain.
   d. Removing debris, waste materials, and equipment.
   e. Removal of items for performance of Work.
   f. Salvageable items to be retained by Owner.
3. Selective Site Demolition Work:
   a. Consisting of, but not necessarily limited to, Work as indicated on Drawings:
      1) Removal of existing hardscape only to extent necessary for proper installation of Work and interfacing with existing construction.
      2) Removal of Above-Grade Improvements:
         a) Remove surfacing and pavements, including bases for pavements.
         b) Removal of existing curbs, gutters, walks, concrete or wood headers, valve boxes, posts, poles, fences, and concrete walls.
         c) Removal of debris, waste materials, and equipment
      3) Removal of Below-Grade Improvements
         a) Removal of existing footings at relocatable buildings to be demolished.
         b) Abandonment or removal of manhole frames and covers, catch basins, catch basin grates, manholes, underground pipe, and other work as specifically indicated.
            i Includes disconnecting and capping of utilities.
         c) Removal of abandoned underground piping or conduit which interferes with construction is included under this Section.

B. Related Sections:
1. Section 01 1100: Summary of Work.
2. Section 01 5000: Temporary Facilities and Controls; additional traffic control and other protection procedures.
3. Section 01 5723: Temporary Erosion and Sediment Control.
4. Section 01 7419: Construction Waste Management and Disposal.
5. Section 02 4116: Building Demolition
6. Section 31 0000: Earthwork; rough grading after demolition.

C. Related Requirements:
   1. Refer to Civil Drawings for additional selective demolition of existing site improvements.
   2. Refer to respective Sections of Divisions 21 through 23, and 26 through 28, and respective Demolition Drawings for cutting, patching, removing, or relocating plumbing, HVAC, and electrical items.

1.02 SUBMITTALS

A. Shop Drawings:
   1. Indicate extent of items and systems to be removed.
   2. Indicate items to be salvaged or items to be protected during demolition.
   3. Indicate locations of utility terminations and extent of abandoned lines to be removed.
      a. Include details indicating methods and location of utility terminations.

1.03 QUALITY ASSURANCE

A. Prior to commencement of Work, schedule walkthrough with Owner's Authorized Representative and Architect to confirm Owner property items have been removed from scheduled Work areas.
   1. Identify and mark remaining property items and schedule their removal.
   2. Review limits of demolition and items indicated on shop drawings.
   3. Perform Work of this Section by employing workers skilled in demolition of site improvements, under Contractor's full time direct supervision.

B. Coordinate demolition for correct sequence, limits, and methods.
   1. Schedule demolition Work to create least possible inconvenience to public and facility operations.

1.04 PROJECT CONDITIONS

A. Drawings may not indicate in detail entire demolition Work to be performed.
   1. Examine existing conditions to determine full extent of required demolition.
   2. Existence and location of underground utility pipes or structures shown are obtained by search of available records.
      a. Contractor is required to take due precautionary measures to protect utilities shown and other lines or structures not shown
      b. Design Professional is not responsible for location of underground utilities or structures whether or not shown on and installed by Contract Documents.
      c. It is Contractor's responsibility to examine conditions before commencing operations.
         1) Should unidentified conditions or conditions that vary from those indicated be encountered, promptly notify Architect for clarification before proceeding.
   3. Immediately notify Owner and Architect, should such unidentified conditions be discovered.

B. Repair damage to existing improvements or damage due to excessive demolition.

C. Provide necessary measures to avoid excessive damage from inadequate or improper means and methods, improper shoring, bracing or support.

D. Comply with requirements of Section 01 5000 and additional protections specified in other Division 02 Sections

PART 2 PRODUCTS

2.01 HANDLING OF MATERIALS

A. Items Scheduled for Salvage by Owner:
   1. Clean, package and label items for storage.
   2. Deliver to location designated by Owner's authorized representative.

B. Items Scheduled for Reuse:
   1. Store items on Project Site and protect from damage, theft, and other deleterious conditions.

C. Storage or sale of removed items on Project Site will not be permitted.

PART 3 EXECUTION

3.01 GENERAL

A. Protection:
   1. Provide safeguards, including, but not necessarily limited to, safety partitions, warning signs, lights, barricades, and other forms of protection for protection of workers, occupants, and public, are installed.
      a. Comply with requirements of Section 01 5000.

B. When safety of existing construction appears to be endangered, take immediate measures to correct such conditions.
   1. Cease operations and immediately notify Architect and Owner.

3.02 SELECTIVE SITE DEMOLITION PROCEDURES

A. General:
   1. Remove existing construction only to extent necessary for proper installation of new Work and interfacing with existing construction.
   2. Cut back finished surfaces to straight, plumb or level lines as required for smooth transition.
   3. Where openings are cut oversize or in improper locations, replace or repair to required condition.

B. Concrete and Asphalt (Bituminous) Surfacing Removal:
   1. Break up and completely remove following existing items:
      a. Existing concrete surfacing, curbs, gutters, and walks.
      b. Bituminous (asphalt) surfacing to indicated limits.
   2. Perform cutting to neat and even line with proper tools or concrete cutting saw.
      a. Minimum Depth of Cut: 1-1/2 inches, unless otherwise indicated

C. Remove concrete and asphalt pavement broken beyond indicated limits to nearest joint or score line and replace with new paving to match existing.

3.03 CUTTING EXISTING CONCRETE

A. Engage skilled workers familiar with requirements and space necessary for placing concrete to perform cutting of existing concrete.
   1. Perform concrete cutting with concrete cutting wheels and hand chisels.
   2. Do not damage concrete intended to remain.

B. Cutting of Non-Structural Concrete:
   1. As indicated or as reviewed by Architect.
   2. Replace concrete demolished in excess of amounts indicated.
   3. Prior to cutting or coring concrete, determine locations of hidden utilities or other existing improvements and provide necessary measures to protect them from damage.

3.04 REMOVAL OF EXISTING UTILITY SERVICES

A. Plumbing:
   1. Remove existing below grade plumbing services as indicated on Drawings.
      a. Cap off existing piping to remain as indicated and specified.
   2. Coordinate with requirements specified in Division 22 Sections.

B. Electrical:
   1. Remove existing electrical equipment fixtures and services not indicated for reuse and not necessary for completion of Work.
   2. Remove abandoned conduit and cap unused portions of existing conduit.

3.05 REMOVAL OF EXISTING FENCING

A. Remove existing fencing as indicated that is not to be reused..
   1. Deliver fencing, including hardware items, as salvage to location as directed by Owner.
   2. Completely remove fencing, including concrete footings where occurring.

3.06 REMOVAL OF OTHER MATERIALS

A. Remove existing improvements not specifically indicated or required but necessary to perform Work.
   1. Cut to clean lines, allowing for installation of Work.

B. Remove existing lawn sprinkler lines and fittings.
   1. Cut back to existing lines to remain and cap.
   2. Coordinate with specified requirements under landscape irrigation Section and as indicated on Landscape Drawings.

3.07 PATCHING

A. Patch or repair materials to remain when damaged by performance of this Work.
   1. Provide finish material and appearance of patch or repair Work matching existing.

3.08 CLEANING

A. Conform to requirements specified in Section 01 7423 and as follows:
   1. Clean existing materials to remain with appropriate tools and equipment.
   2. Protect existing improvements during cleaning operations.
   3. Dampen debris by fog water spray prior to transporting by truck.
   4. Keep debris pick-up area broom-clean and washed daily with clean water.
   5. Continuously clean up and remove items as demolition Work progresses.

3.09 REMOVAL AND DISPOSAL

A. Remove waste and debris, other than items to be salvaged.
   1. Turn over salvaged items to Owner, or store and protect for reuse where required.

B. Remove and legally dispose of rubbish, debris, and waste materials off Project Site.
   1. Comply with requirements of Section 01 7419
   2. Fill and compact excavations in accordance with Section 31 0000.

END OF SECTION 02 4113

SECTION 02 4116

BUILDING DEMOLITION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Demolition and removal of following as indicated on Drawings:
      a. Existing relocatable buildings.
   2. Protection of existing improvements to remain.
   3. Protection of existing trees and vegetation to remain.
   4. Removal of Below-Grade Improvements:
      a. Removal of foundations and footings at relocatable buildings indicated to be demolished.
      b. Other Work as specifically indicated.

B. Related Sections:

1.	Section 01 4100:	Regulatory Requirements; current Code edition.
2.	Section 01 5000:	Temporary Facilities and Controls; additional traffic control and other protection procedures.
3.	Section 01 5713:	Temporary Erosion and Sediment Control
4.	Section 01 7419:	Construction Waste management and Disposal.
5.	Section 02 4113:	Selective Site Demolition; partial removal of existing site hardscape improvements
6.	Section 31 0000:	Earthwork; rough grading after demolition.
7.	Section 31 1000:	Site Clearing; clearing and grubbing of organic site materials.

C. Related Requirements:
   1. Refer to following for additional work related to demolition of existing relocatable buildings:
      a. Civil Site Demolition Drawings.
      b. Respective Sections in Divisions 22, 26, and 33 for removal, abandonment, or capping of existing plumbing piping, electrical service, and underground utilities to relocatable buildings to be demolished.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, current edition:
   1. Part 2, California Building Code (CBC), Volumes 1 and 2:
      a. CBC Chapter 33 – Safeguards During Construction.
   2. Part 9, California Fire Code (CFC):
      a. CFC Chapter 33 – Fire Safety During Construction and Demolition.

B. National Fire Protection Association (NFPA):
   1. NFPA 241 – Standard for Safeguarding Construction, Alteration, and Demolition Operations.

C. South Coast Air Quality Management District (SCAQMD):
   1. Rule 403 – Fugitive Dust.

1.03 QUALITY ASSURANCE

A. Demolition Firm Qualifications:
   1. Engage experienced firm that has successfully completed selective demolition work similar to that indicated for this Project.

1.04 PROJECT CONDITIONS

A. Occupancy:
   1. Buildings and other structures to be demolished will be vacated and discontinued in use prior to start of Work.

B. Condition of Structures:
   1. Owner assumes no responsibility for actual condition of structures to be demolished.

C. Partial Removal:
   1. Items of salvable value to Contractor may be removed from structure as Work progresses.
      a. Salvaged items must be transported from Project Site as they are removed.
      b. Storage or sale of removed items on Project Site will not be permitted.

D. Salvable Improvements:
   1. Carefully remove items to be salvaged that are to remain Owner's property
      a. Store on Owner's premises where indicated, unless otherwise directed.

E. Explosives:
   1. Use of explosives is not permitted.

F. Comply with requirements of Section 01 5000 and following:
   1. Traffic:
      a. Conduct demolition operations and removal of debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities.
      b. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.
      c. Provide alternate routes around closed or obstructed traffic ways when required by governing regulations.
   2. Protection of Existing Improvements to Remain:
      a. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing improvements indicated to remain in place.
      b. Protect improvements on adjoining properties as well as those on Owner's property.
      c. Restore improvements damaged by this Work to their original condition, as acceptable to Owners or other parties or authorities having jurisdiction.

3. Protection of Existing Trees and Vegetation to Remain:
   a. Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line.
   b. Provide temporary fences, barricades or guards as required to protect trees and vegetation to be left standing.
   c. Water trees and other vegetation which are to remain within limits of Contract Work as required to maintain their health during course of construction operations.
   d. Provide protection for roots over 1-1/2 inch diameter that are cut during construction operations.
      1) Coat cut faces with emulsified asphalt, or other acceptable coating, specially formulated for horticultural use on cut or damaged plant tissues.
      2) Temporarily cover exposed roots with wet burlap to prevent roots from drying out; provide earth cover as soon as possible.
   e. Repair or replace trees and vegetation damaged by construction operations, in manner acceptable to Architect.
      1) Perform tree damage repair using qualified tree surgeon.
      2) Replace trees which cannot be repaired and restored to full-growth status, as determined by tree surgeon.

1.05 REGULATORY REQUIREMENTS

A. Intent of these Drawings and Specifications is that Work of demolition is to be in accordance with California Code of Regulations, Title 24, as referenced in this Section.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION

3.01 POLLUTION CONTROLS

A. Use water sprinkling, temporary enclosures, and other suitable methods to limit amount of dust and dirt rising and scattering in air to lowest practical level.
   1. Comply with rules and regulations of SCAQMD.

B. Comply with governing regulations pertaining to environmental protection.

C. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations, as directed by Architect or governing authorities.
   1. Return adjacent areas to condition existing prior to start of Work.

3.02 REMOVAL OF ABOVE-GRADE IMPROVEMENTS

A. Building Demolition:
   1. Demolish buildings completely and remove from Project Site.
   2. Use such methods as required to complete Work within limitations of governing regulations.
   3. Proceed with demolition in systematic manner.

B. Remove concrete slabs, concrete and masonry walls, posts, poles, fences, and other work as specifically indicated.

3.03 REMOVAL OF BELOW-GRADE IMPROVEMENTS

A. Remove foundations, footings, walls, and other work as specifically indicated.

B. Cleanout and fill up septic tanks or cesspools, in accordance with governing Health and Safety Standards, and with requirements of Section 31 2300

3.04 DISPOSAL OF WASTE MATERIALS

A. Remove waste materials from Owner's property and legally dispose of it in accordance with Section 01 7419.

B. Burning of removed materials from demolished structures will not be permitted on Project Site.

END OF SECTION 02 4116

SECTION 03 3000

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Formwork for cast-in-place concrete and installation of embedded items.
      a. Work includes footings for chain link and decorative metal fence and gates.
   2. Reinforcing steel for concrete unless specifically noted otherwise.
   3. Reinforced concrete with compressive strengths as shown.
   4. Under-slab moisture vapor barrier/retarder
   5. Lightweight Concrete Fill
   6. Stair fill.
   7. Concrete Finishing:
      a. Includes mock-up panels for slab and wall finishes:
         1) Broom finishes on slabs.
         2) Smooth form finish on walls.
         3) Grout cleaned (sack) finish on walls.
   8. Concrete Sealers.

B. Related Sections:

1.	Section 01 4100:	Regulatory Requirements; current Code edition.
2.	Section 01 4500:	Quality Control
3.	Section 01 4525:	Concrete Moisture Testing
4.	Section 05 5000:	Metal Fabrications
5.	Section 07 1813:	Pedestrian Traffic Coatings; coating on concrete stair treads.
6.	Section 07 9200:	Joint Sealants
7.	Section 09 0562:	Moisture Vapor Emission Control System; emissions control for floor coverings and coatings.
8.	Section 32 0523:	Concrete for Exterior Improvements; miscellaneous site concrete not specified elsewhere.
9.	Section 32 1313:	Concrete Paving; walks, curbs, and driveways.

C. Products Furnished But Not Installed Under This Section:
   1. Reinforcing steel for masonry work.

D. Products Installed But Not Furnished Under This Section:
   1. Built-in anchors, inserts, bolts and other embedded items for connection of other Work.
   2. Built-in sleeves, thimbles, dovetail slots and water stops.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
   1. Chapter 19A – Concrete

B. ASTM International (ASTM):
   1. ASTM A 615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
   2. ASTM A 706 – Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement
   3. ASTM A 1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
   4. ASTM C 31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field
   5. ASTM C 33 - Standard Specification for Concrete Aggregates
   6. ASTM C 39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
   7. ASTM C 42 – Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams
   8. ASTM C 88 – Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate
   9. ASTM C 94 – Standard Specification for Ready-Mixed Concrete
   10. ASTM C 143 – Standard Test Method for Slump of Hydraulic-Cement Concrete
   11. ASTM C150 – Standard Specification for Portland Cement
   12. ASTM C 171 – Standard Specification for Sheet Materials for Curing Concrete
   13. ASTM C 260 – Standard Specification for Air-Entraining Admixtures for Concrete.
   14. ASTM C 330 – Standard Specification for Lightweight Aggregates for Structural Concrete.
   15. ASTM C 595 – Standard Specification for Blended Hydraulic Cements
   16. ASTM C 618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
   17. ASTM C 685 – Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing
   18. ASTM D 882 – Test Method for Tensile Properties of Thin Plastic Sheeting
   19. ASTM C 1116 – Standard Specification for Fiber-Reinforced Concrete.
   20. ASTM D 1434 – Standard Test Method for Determining Gas Permeability Characteristics of Plastic Film and Sheeting
   21. ASTM D 1709 – Test Methods for Impact Resistance of Plastic Film by Free-Falling Dart Method
   22. ASTM D 1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
   23. ASTM D 1752 – Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction
   24. ASTM D 2419 – Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate
   25. ASTM E 329 – Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection
   26. ASTM E 1155 – Standard Test Method for Determining FF Floor Flatness and FL Floor Levelness Numbers
   27. ASTM E 1745 – Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
   28. ASTM F 1249 – Test Method for Water Vapor Transmission Rate Through Plastic Film and Sheeting Using a Modulated Infrared Sensor

C. American Concrete Institute (ACI):
   1. ACI 117 – Specification for Tolerances for Concrete Construction and Materials (ACI 117-10) and Commentary-Reapproved 2015
   2. ACI 301 – Specification for Structural Concrete for Buildings.
   3. ACI 302.1R – Guide to Concrete Floor and Slab Construction
   4. ACI 302.2R – Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring Materials.
   5. ACI 304 – Recommended Practice for Measuring, Mixing and Placing Concrete.
   6. ACI 305 – Recommended Practice for Hot Weather Concreting.
   7. ACI 306 – Recommended Practice for Cold Weather Concreting.
   8. ACI 318 – Building Code Requirements for Reinforced Concrete.
   9. ACI 347 – Recommended Practice for Concrete Formwork

D. International Associations of Plumbing & Mechanical Officials (IAPMO):
   1. Uniform Evaluation Service (UES):
      a. Evaluation Report (ER):
         1) Number 0129 – nVent Lenton Mechanical Splice System for Steel Reinforcing Bars.

E. California Department of Transportation (Caltrans):
   1. Office of Materials Engineering and Testing Services:
      a. California Test Methods (CTM):
         1) CTM 217 – Method of Test for Sand Equivalent.
         2) CTM 227 – Method of Test for Evaluating Cleanness of Coarse Aggregate

F. The Engineered Wood Association (APA):
   1. Voluntary Product Standard Structural Plywood (PS 1-09)
   2. Guide to Plywood Grades

G. West Coast Lumber Inspection Bureau (WCLIB):
   1. Standard Grading Rules No. 17, current edition.

G. American Welding Society (AWS):
   1. AWS D1.4 – Structural Welding Code – Reinforcing Steel.
   2. AWS D1.8 – Seismic Welding Supplement.

H. South Coast Air Quality Management District (SCAQMD):
   1. Rule 1113 – Architectural Coatings

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's product data with installation instructions for proprietary materials including reinforcement and forming accessories, form coatings, admixtures, joint materials, sealers/hardeners, curing materials (when permitted), and others as requested by Architect.

B. Mix Designs:
   1. Prepare mix designs for Architect’s review and include following information in mix design data:
      a. Design:

1) Project name, address, Site location, and location of design usage.
2) Contractor, Sub-Contractor, Supplier and Plant Location.
3) Mix Number.
4) Specified compressive strength, maximum aggregate size, slump, and placement method.
5) Application and location in structure.
6) Signature and stamp of licensed civil engineer responsible for mix design.

2. Materials:
   a. Design Method.
   b. Water-Cement Ratio.
   c. Cement:
      1) Type, amount, and compliance with specified criteria statement.
   d. Aggregates:
      1) Source(s), gradations (Individual and combined).
   e. Admixtures:
      1) Brand, classification, dosage, addition method.
      2) Obtain specified approvals for admixtures prior to including in mix designs.
   f. Water source.
   g. Test Results, Batch Quantities, Yield (calculations).
3. Special Considerations:
   a. Unit Weight.
   b. Other considerations relative to placement, curing, finish, and testing.

C. Shop Drawings:
   1. Cast-in-place Concrete:
      a. Show construction joint locations and details.
   2. Lightweight Concrete:
      a. Indicating locations to receive lightweight concrete fill
   3. Reinforcing Steel:
      a. Submittals are required.
      b. Providing steel reinforcing as indicated on Drawings and as specified herein is responsibility of Contractor.
      c. Prepared Shop Drawings are for use by Contractor and will be reviewed by Structural Engineer.

D. Batch Plant Certificates:
   1. Accompany each load of materials or concrete with signed copy of batch plant certificate stating quantity of each material, amount of water, admixtures, departure time and date.
   2. When continuous batch plant inspection is waived, provide affidavit in accordance with Title 24, CBC, Part 2, Section 1704A.3.3 to Owner's Testing Laboratory.

E. Testing and Inspection Reports:
   1. Owner's Testing Agency:
      a. Laboratory Reports:
         1) Laboratory test or evaluation reports for concrete materials and mix designs, performed in accordance with Section 01 4500, to Owner, Architect, Contractor, and Division of the State Architect.
         2) Do not begin concrete production until mix designs have been reviewed and accepted by Architect.

2. Reinforcing Steel Reports:
    a. Certified mill test reports (tensile and bending) for each heat or melt of steel prior to delivery of material to Project Site.
    b. Where reinforcing is to be welded, furnish mill test reports verifying weldability of steel.

F. Contractor's Notarized Certifications:
1. Testing Laboratory's Certificate of Compliance.
2. Certified copies of mix designs for each concrete class specified including compressive strength test reports.
3. Certification that materials meet requirements specified:
    a. Including, but not necessarily limited to:
        1) Aggregates
        2) Admixtures
        3) Curing Materials
4. Certification from vendor that samples originate from and are representative of each lot proposed for use.
5. Manufacturer of Ready-Mixed Concrete:
    a. Deliver Certificate to Project Inspector with each mixer truck:
        1) Bearing signature of representative of testing laboratory, and stating quantity of cement, water, fine and coarse aggregate and admixture contained in load.:

G. Bearing signature of representative of testing laboratory, and stating quantity of cement, water, fine and coarse aggregate and admixture contained in load.Schedule of placing for Architect's review before starting Work.

H. Samples:
1. Upon request of Architect
    a. Furnish formwork and accessories, including expansion joint fillers and waterstops.
    b. Concrete sealer/harder products as required for application to mock-up slab panels.

1.04 QUALITY ASSURANCE

A. Formwork and Accessories:
1. Design Criteria: Formwork conforming to ACI 347.
    a. Design Formwork to:
        1) Prevent leakage or washing out of cement mortar.
        2) Resist spread, shifting, and settling.
        3) Reproduce accurately required lines, grades, and surfaces within tolerances specified.
    b. Safety:
        1) Responsibility for adequate strength and safety of formwork including falsework, and shoring rests with Contractor.
2. Allowable Tolerances:
    a. Construct Formwork to produce concrete within tolerance limits recommended in ACI 347, unless otherwise noted.

B. Reinforcing:
1. Welders' Qualifications:
    a. Qualify welders in accordance with AWS D1.4 and AWS D1.

2. Do not permit reinforcing steel to rust where there is danger of staining exposed surfaces of adjacent concrete.
    a. Replace rust-stained concrete at Contractor's expense.
3. Allowable Tolerances:
    a. Place reinforcing steel within tolerances permitted by ACI 318, Section 26.6.2, unless otherwise approved by Architect.
4. Owner's Testing Agency will provide tests in accordance with CBC Chapter 17A.
    a. Collect mill test reports for reinforcement.
    b. Take samples from bundles at fabricators.
        1) When bundles are identified by heat number and accompanied by mill analysis, take two specimens from each ten tons, or fraction thereof, of each size and grade.
        2) When reinforcement is not positively identified by heat numbers or when random sampling is intended, take two specimens from each 2 tons, or fraction thereof, of each size and grade.
5. Test for Tensile and Bending Strengths:
    a. Provide inspection of welding, including prior fit-up, welding equipment, weld quality and welder certification in accordance with AWS D1.4 and AWS D1.8
    b. Perform chemical analysis sufficient to determine carbon equivalent and minimum preheat temperature when reinforcement does not conform to low-alloy steel requirements of CBC Section 1903A.8.

C. Concrete:
1. Testing Laboratory Qualifications:
    a. Testing Laboratory under direction of registered Civil Engineer licensed in State of California, having operated successfully for four years prior to this Work, conforming to requirements of ASTM E 329.
2. Requirements of ACI 301 govern Work, materials, and equipment related to this Section.
    a. Specifications set minimum results required, and references to procedures are intended to establish minimal guides.
3. Responsibility for quality of concrete in place rests with Contractor who also bears burden of proof that concrete meets minimum requirements.
4. Placing of concrete by means of pumping will be acceptable method of placement providing that Contractor can demonstrate that:
    a. Specified concrete strengths will be met.
    b. Equipment has record of satisfactory performance under similar conditions and using similar mix.
    c. Trial batches have been made.

D. Mock-Up Slab Panels:
1. Size: Approximately 5 feet by 5 feet, unless otherwise indicated.
2. Construct mock-up slab panels for following finishes where scheduled:
    a. Trowel Finish
    b. Light Textured Broom Finish
3. Do not proceed with placing and finishing of concrete slab areas indicated to receive specified finish until mock-up panel is accepted by Architect.
4. Apply specified concrete sealer to one-half of mock-up slab panel, when requested by Architect,
5. Retain mock-up slab panel on Project Site for comparison purposes with actual slab finish work.

a. Demolish and remove mock-up panel from Project Site after completion and acceptance of final slab finish.

1.05 DELIVERY, STORAGE, AND HANDLING

A. General:
1. Ensure storage facilities are weather tight and dry.
2. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use.

B. Reinforcing:
1. Deliver reinforcement and accessories to Project Site not more than 48 hours before placement.
2. Store in manner to prevent excessive rusting and fouling with grease, dirt, or other bond-weakening coatings.
3. Take precautions to maintain identification after bundles are broken.

C. Cast-in-Place Concrete:
1. Store bulk cement in bins capable of preventing exposure to moisture.
2. Use sacked cement in chronological order of delivery.
a. Store each shipment so that it may be readily distinguishable from other shipments.

1.06 PROJECT CONDITIONS

A. Sequencing Schedule for Formwork:
1. Ensure timely delivery of embedded items.
2. Be responsible for cutting and patching necessitated by failure to place embedded items.
3. Plan erection and removal to permit proper sequence of concrete placing without damage to concrete.

PART 2 PRODUCTS

2.01 MATERIALS

A. Formwork and Accessories:
1. Forming Materials:
a. Panel or board forms at Contractor's option.
1) Panel Forms:
a) Minimum 5/8 inch thick exterior grade plywood with sealed edges, PS 1 grade Plyform Class I and II B-B Exterior or HDO Exterior.
2. Wood Framing:
a. WCLIB standard grade or better Douglas Fir.
3. Form Ties and Spreaders:
a. Metal type acting as spreaders, leaving no metal within one inch of concrete face and no fractures, spalls, depressions or other surface disfigurations greater than 3/4 inch in diameter.
4. Expansion Joint Filler:
a. Fiber Type:

1) Premolded non-extruding preformed bituminous saturated fiberboard units, ASTM D 1751, 1/4 inch thick unless otherwise noted.
2) Provide one of following, or approved equal:
   a) W. R. Meadows, Inc. - Sealtight Fibre Expansion Joint (Basis-of-Design)
   b) J.D. Russell Company – Fiberflex Fiber Expansion Joint
   c) Right / Pointe Company – Fibre Expansion Joint
   d) SpecChem Fiber Expansion Joint

b. Cork Type:
1) Preformed cork, ASTM D1752, Type II, 1/2-inch size unless otherwise noted.
   a) Right / Pointe Company – Cork-Standard Expansion Joint, or approved equal.

5. Form Release Agent:
   a. Must not stain or otherwise adversely affect architectural concrete surfaces.
   b. Provide one of following, or approved equal:
      1) Atlas Construction Supply, Inc. – Atlas Premium Gold Release
      2) Nox-Crete Co. – Nox-Crete Form Coating
      3) Right / Pointe Company – Right Release Water Base

B. Waterstops:
1. Sodium bentonite based waterstop conforming to following physical properties:
   a. Sodium Bentonite Content: 75 percent.
   b. Hydrostatic Head Resistance: 231 ft.
   c. Wet/Dry Cycling, (25 cycles at 231 ft.): No effect
   d. Specific gravity, (ASTM 0 71): 1.57
   e. Flash Point, (ASTM 093): > 300 °F.
2. Product and Manufacturer:
   a. Waterstop-RX by CETCO div. Minerals Technologies.
   b. Waterstop Adhesive: CETSEAL by CETCO

C. Under Slab Moisture Barrier/Retarder:
1. Vapor Retarder:
   a. Minimum 15 mil thick, complying with ASTM E 1745, Class A and following:
      1) Water Vapor Permeance, ASTM F 1249 / E 154, Section 7: 0.01 perms or less.
      2) Puncture Resistance, ASTM D 1709: Minimum 2266 grams.
      3) Tensile Strength, ASTM D 882: 70.6 lbf/in
      4) Methane Transmission Rate, ASTM D 1434: 192.8 GTR mL(STP)/m^2/day.
2. Provide one of following products, or approved equal:
   a. Moistop Ultra 15 by Fortifiber Building Systems Group.
   b. VaporBlock 15 by Raven Industries, Inc.
   c. Stego Wrap Vapor Barrier by Stego Industries, LLC

D. Reinforcing:
1. Bars:
   a. New billet steel, ASTM A 615 Grade 60.
      1) ASTM A 706 Grade 60, where welded.
2. Tie Wires and Spirals: ASTM A 1064.

3. Bar Supports:
   a. As required for assembling and supporting reinforcement in place.
   b. Typical: CRSI Class B, pregalvanized.
   c. Concrete adobes for foundations and slabs on grade.
4. Threaded Coupler:
   a. Lenton Standard coupler by ERICO, or approved equal.
      1) Conforming to IAPMO UES ER 0129.
   b. Coupler is to develop 125 percent of specified yield strength reinforcement.
5. Welded Wire Fabric:
   a. Conforming to ASTM A 1064
   b. Fabricated from as-drawn steel wire into flat sheets.
   c. For use with concrete stair fill only.
6. Reinforcing for Lightweight Concrete:
   a. Synthetic fiber reinforcement conforming to ASTM C 1116.

E. Curing Paper:
1. Conforming to ASTM C 171, Type 1, regular.

F. Concrete:
1. General Requirements:
   a. Furnish cement and aggregates with proven history of successful use with one another.
      1) Sources of cement and aggregate are to remain unchanged throughout Work, unless Architect approves request for change made at least 10 days prior to anticipated date of casting.
   b. Ready-mixed concrete meeting requirements of ASTM C 94.
   c. Deviations in properties of materials tested by Owner's Testing Agency is cause for their rejection pending additional test results and redesign of mix by Contractor's Testing Laboratory.
   d. Use of frozen aggregates is not permitted.
2. Portland Cement:
   a. Conforming to ASTM C150, Type II / V, low alkali.
   b. Use one brand of cement throughout Project, unless otherwise acceptable to Architect.
3. Aggregates for Normal Concrete:
   a. Conform to Chapter 19A, Concrete, CCR, Title 24, Part 2 CBC Sections 1705A.3.2, 1903A.5, and following:
   b. Coarse Aggregate:
      1) Conforming to ASTM C 33.
      2) Consisting of clean, hard, fine grained, sound crushed rock, or washed gravel, or combination of both.
      3) Free from oil, organic matter or other deleterious substances and not contain more than two percent by weight of shale or cherty material.
   c. Fines:
      1) Conforming to ASTM C 33.
      2) Sand Equivalent:
         a) Not less than 75 when tested per ASTM D 2419.
   d. Provide aggregates from single source for exposed concrete.
4. Aggregates for Lightweight Concrete Fill::
   a. Coarse Aggregate:
   b. Lightweight aggregate conforming to ASTM C 330.

c. Sealed expanded shale such as "Rocklite", as produced by Lightweight Processing Company, or approved equal.

5. Fine Aggregate:
   a. Hardrock aggregate conforming to ASTM C 33, or lightweight aggregate conforming to ASTM C 330.

G. Water:
1. Clean and potable, free from impurities detrimental to concrete.

H. Admixtures:
1. Use of admixtures is not permitted unless request is submitted to Architect and Structural Engineer for review and Structural Engineer's approval.
2. Use of calcium chloride or admixtures containing calcium chloride is prohibited.
3. Upon receipt of Structural Engineer approval, Contractor modifies mix designs as necessary, and submits modifications to Owner's Testing Agency for testing and acceptance
4. When approved, following types of admixtures may be used, conforming to manufacturer's recommendations for use:
   a. Water Reducing: Conforming to ASTM C 494, Type A.
   b. Accelerating or Retarding: Conforming to ASTM C 494
   c. Air Entraining: Conforming to ASTM C 260.
5. Do not use admixtures which have not been incorporated and tested in accepted mix designs.

I. Fly Ash:
1. Fly ash conforming to ASTM C 618, Class N or F may be used at Contractor's option.
   a. Use of Class C is not permitted.
2. Do not substitute more than 15 percent by weight of fly ash or other pozzolan, for ASTM C 150, Portland Cement.

J. Non-Shrink, Non-Metallic Grout:
1. Premixed high strength grout requiring only addition of water at Project Site.
   a. BASF Corporation, Construction Chemicals – MasterFlow 928
   b. Five Star Products, Inc. – Five Star Grout.
   c. Sika Corporation – SikaGrout 428 FS

K. Curing Materials:
1. Concrete Curing Paper:
   a. Conforming to ASTM C 171, non-staining, reinforced type.
      1) Orange Label Sisalkraft by Fortifiber Building Systems Group.
      2) Approved equal.
2. Liquid Curing Compound:
   a. Conforming to ASTM C 309, Type 1, Class B, approved standard product resin type.
      1) Deliver in unopened labeled containers.
      2) Water based acrylic polymer blend, free of wax or oil, compatible with subsequent applied finishes or floor coverings.
      3) Do not apply curing compounds in areas designated to receive floor coverings.

L. Joint Sealing Compound:
1. Refer to Section 07 9200.

2.02 SOURCE QUALITY CONTROL

A. Furnish Plywood bearing APA grade-trademark.

B. Owner's Testing Agency will:
   1. Review mix designs, certificates of compliance, and samples of materials Contractor proposes to use.
   2. Test and inspect materials, as necessary, in accordance with ACI 318 and CBC Sections 1705A, 1903A, and 1910A for compliance with requirements.
   3. Take samples as required from Contractor's designated sources.
   4. Take one grab sample for each 100 tons of Portland cement except that, when used in bulk loading ready-mix plants where separate bins for pretested cement are not available, take grab samples for each shipment of cement placed in bin with not less than one sample being taken for each day's pour and subsequently test such samples when required by Architect who may be so advised by DSA.
   5. Test coarse, intermediate, and fine aggregate by use of solution of sodium or magnesium sulfate, or both whenever in judgment of Architect such tests are necessary to determine quality of material.
      a. Perform such tests in accordance with ASTM C 88.
      b. Loss not to exceed 6 percent of either fine intermediate or coarse aggregate.
      c. Aggregate failing to comply with this requirement may be used in Work provided it contains less than 2 percent of shale and other deleterious particles and shows loss in soundness test of not more than 10 percent when tested in sodium sulphate solution.
      d. Test aggregates as required by CBC Sections 1705A.3.2 and 1903A.5.
   6. Test for sand equivalent of fine aggregate in accordance with California Test 217.
   7. Test for cleanness value of coarse and intermediate aggregate in accordance with California Test 227.
   8. Inspect plant prior to starting Work to verify following:
      a. Plant is equipped with approved metering devices for determining moisture content of fine aggregate.
      b. Other plant quality controls are adequate.
   9. Continuously inspect quality and quantity of materials used in transit mixed concrete, in batched aggregates and ready-mixed concrete at mixing plant or other location per CBC Sections 1705A.3, 1905A.1.16, 1910A.1, and ACI 318 Section 26.12 as modified, where other materials are measured.

C. Waiver of Batch Plant Inspection:
   1. Continuous batch plant inspection may be waived in accordance with CBC Section 1705A.3.3.1
   2. Following requirements apply when batch plant inspection is waived:
      a. Qualified technician of Testing Agency to perform check of first batch at start of day.
      b. Licensed weighmaster to positively identify materials as to quantity and certify to each load by batch ticket.
      c. Batch tickets, including material quantities and weights, are to:
         1) Accompany load
         2) Be transmitted to Project Inspector by truck driver with load identified thereon.
         3) Do not place load without batch ticket identifying mix.

4) Inspector will keep daily record of placements, identifying each truck, its load, time of receipt, and approximate location of deposit in structure, and will transmit copy of daily record to enforcement agency.

2.03 MIX DESIGNS

A. General Requirements:
1. Perform tests or assemble necessary data indicating conformance with Specifications.
2. For each mix submit data showing that proposed mix will attain required strength in accordance with requirements of CBC Sections 1705A.3 and 1905A.1.16 per ACI 318 Section 26.12.2 (a) as modified
3. Instruct Laboratory to base mix design on use of materials tested and approved by Owner's Testing Agency.
4. Include compression strength test reports with mix design per CBC Section 1904A and 1905A.1.9
5. Design Mix, test, and adjust when necessary in ample time before first concrete is scheduled to be placed.
   a. Submit laboratory data and strength test results for revised mix design to Architect prior to using Mix in Project.
6. Ensure mix designs will produce concrete to strengths specified and of uniform density without segregation.
7. When mix yield exceeds 1-cubic yard, modify mix design to no more than one cubic yard without changing cement content.
8. Contractor's mix designs are subject to review by Architect and Owner's Testing Agency.
9. Introduction of calcium chloride will not be permitted.
10. Water/Cement Ratio: 0.45 maximum, unless noted otherwise on Structural Drawings.

B. Admixtures:
1. Where use of admixtures has been approved, provide admixtures produced by establish reputable manufacturers.
   a. Conform to types of admixtures specified under “Materials” Article.
   b. Use in compliance with manufacturer’s printed directions.
   c. Do not use admixtures which have not been incorporated and tested in accepted mix designs.
   d. Refer to CBC Section 1903A.6 and ACI 318 Section 26.4.2.2(b) as modified.

C. Mix Design for Lightweight Concrete:
1. Concrete mix design for mix that will be provided for Work.
2. Include water/cement ratio, size of aggregate, and types and amounts of admixtures.
3. Predict minimum compressive strength, maximum slump, and air content percentage.

D. Patching Mortar:
1. Mix in proportions by volume of one part cement to two parts fine sand.

E. Non-Shrink, Non-Metallic Grout:
1. Follow approved manufacturer's printed instructions and recommendations.

F. Stair Fill Mix:
1. For steel pan stair treads and landings.
   a. Portland cement, fine and coarse aggregate
   b. Minimum 2500 psi compressive strength at 28 days
   c. Coarse Aggregate: Maximum 3/8 inch, size No.8, conforming to ASTM C 33
   d. Water/Cement Ratio: 0.45 maximum.
   e. Weight of Mix: 145 lb./cu.ft.
   f. Laboratory mix not required

2.04 MIXING

A. Batching Plant Conditions:
1. Ensure equipment and plant will afford accurate weighing, minimize segregation and will efficiently handle materials to satisfaction of Architect and Owner's Testing Agency.
2. Use approved moisture meter capable of determining moisture content of sand.

B. General Requirements:
1. Thoroughly clean concrete equipment before use for architectural concrete mixes to avoid contamination.
2. Mix cement, fine and coarse aggregates, admixtures and water to exact proportions of mix designs.
   a. Use method of mixing complying with ACI 318, Section 26.4
3. Measure fine and coarse aggregates separately according to approved method which provides accurate control and easy checking.
4. Adjust grading to improve workability; do not add water unless otherwise directed.
5. Maintain proportions, values, or factors of approved mixes throughout Work.
6. Mix concrete in transit mixers five minutes immediately prior to discharge in addition to mixing as called for by ACI 304 and ASTM C 94.

C. Admixtures:
1. Use automatic metering dispenser to introduce admixture into mix.
2. Use Dispenser recommended and calibrated by admixture manufacturer.

2.05 FINISH MATERIALS

A. General:
1. Provide concrete sealer materials complying with requirements of SCAQMD Rule 1113.

B. Concrete Sealer **Type 2**:
1. Lithium-Silicate sealer, hardener, and densifier.
2. Use for interior concrete slabs specified to receive light broom finish.
   a. Refer to Finish Schedule for specific locations.
3. Products:
   a. Subject to compliance with specified requirements, provide following, or approved equal:
      1) Conslideck LS by Prosoco, Inc.
   b. Comply with SCAQMD Rule 1113.
   c. Comply with ANSI/NFSI B101.3 for slip-resistance.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas where formwork will be constructed and verify that:
   1. Excavations are sufficient to permit placement, inspection, and removal of forms.
   2. Excavations for earth forms have been neatly and accurately cut.
   3. Conditions are otherwise proper for formwork construction.
   4. Do not start Work until unsatisfactory conditions have been corrected.

B. Examine units of Work to be cast and verify that:
   1. Construction of formwork is complete.
   2. Required reinforcement, inserts, and embedded items are in place.
   3. Form ties at construction joints are tight.
   4. Concrete-receiving places are free of debris.
   5. Depths of depressed slab conditions are correct for delayed finish noted and for its proper bonding to concrete.
   6. Conveying equipment is clean and properly operating.
   7. Architect has reviewed formwork and reinforcing steel and that preparations have been checked with Project Inspector.

C. Do not begin placement of concrete before unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Obtain necessary information for coordination of formwork with items to be embedded in concrete and other related work.

B. Ensure availability of sufficient labor, equipment and materials to place concrete correctly in accordance with scheduled casting.

C. Protect finished surfaces adjacent to concrete-receiving places.

D. Clean transportation and handling equipment at frequent intervals and flush thoroughly with water before each day's run.
   1. Do not discharge wash water into concrete form.

E. Construction Joints:
   1. Clean and roughen construction joint contact surfaces by removing surface laitance and exposing sound mortar.
   2. Sandblasting and bush-hammering are acceptable methods.

3.03 FORMWORK CONSTRUCTION

A. General:
   1. Design, erect, support, brace, and maintain formwork to support vertical and lateral, static, and dynamic loads that might be applied until concrete structure can support such loads.
      a. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position.
      b. Maintain formwork construction tolerances complying with ACI 347.

2. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb Work in finished structures.
   a. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in Work.
   b. Use selected materials to obtain required finishes.
   c. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.
3. Frame openings where indicated on Architectural, Structural, Mechanical, Plumbing and Electrical Drawings.

B. Earth Forms:
1. Construct wood edge strips at top sides of excavations.
2. Provide forms for footings wherever concrete cannot be placed against solid earth excavation.
3. Remove loose dirt and debris prior to concrete pours.
4. Foundation concrete may be placed directly into neat excavations provided foundation trench walls are stable as determined by Geotechnical Engineer, subject to approval of DSA.
   a. In such case, minimum formwork shown on Drawings is mandatory to insure clean excavations immediately prior to and during placing of concrete.
   b. Refer to Structural Drawings for footing requirements where footings are not formed.

C. Formed Elements:
1. Carefully align inside and outside forms before tightening ties.
2. Plywood Forms:
   a. Insure vertical joints are plumb and horizontal joints are level; arrange joints and ties in geometrical pattern as approved by Architect.
3. Form inside corners at exposed conditions with mitered boards or plywood so that no concrete is placed against form ends.
4. After erection, seal cracks, holes, slits, gaps, and apertures in forms so that they will withstand the pressure and will remain completely watertight.
5. Provide means to seal bottom of forms at construction joints such as foam tape or other gasket devices.
6. Apply coating of release agent prior to erection of formwork following approved manufacturer's recommendations.

D. Expansion Joints:
1. Provide in exterior concrete on grade at maximum 24 feet on center or as noted and at intersections with vertical surfaces, curbs, manholes or other penetrations through slabs.

2. Use fiber type expansion joint fillers typically and depress 1/4 inch unless otherwise noted.
3. Use cork type expansion joint fillers at conditions with non-bituminous waterproofing, liquid waterproofing, or sealant systems.

E. Construction Joints:
1. Provide where shown on Drawings as directed by Architect and per ACI 318, Section 26.5.6.

2. Provide key indentations at joints.
3. Provide pour strips on inside face of forms at horizontal joints, but remove strips and thoroughly clean out reglets before placing subsequent portions of wall.
4. Prevent formations of shoulders and ledges.
5. Provide means for drawing forms into firm contact with concrete before placing additional concrete over previous pours where shrinking and warping has separated concrete from forms.

F. Embedded Items:
1. Properly locate, unless locating is specified elsewhere, and place inserts and embedded items required by other trades prior to casting concrete.

3.04 REINFORCING PLACEMENT

A. General:
1. Place bars as noted.
2. Reinforcement to be continuous.
a. Refer to Structural Drawings for lap splice schedule.
b. Stagger splices where possible.
c. Securely wire contact lap splices together to maintain alignment.
3. Ensure placement will permit concrete protection in conformance with CRSI or to extent shown.
4. Support and fasten bars securely with spacers, chairs or ties to permit their being walked upon without displacement or movement both before and during placement of concrete.
a. Wire-tie bar intersections.
5. Do not bend bars around openings or sleeves.
a. Wherever conduits, piping, inserts, or sleeves, and like items interfere with placing of reinforcement, obtain Architect's approval of placing before concreting.
6. Do not field bend bars unless expressly noted in Contract Documents.

B. Prior to placing concrete, verify reinforcement has been bent, positioned, and secured in accordance with Drawings; ensure removal of oil, grease, dirt, or other bond-weakening coatings; replace severely rust-pitted reinforcing bars.

C. Quality Assurance:
1. Project Inspector will inspect placement of reinforcement and notify Structural Engineer of discrepancies in placement.
2. Owner's Testing Agency will inspect shop and field welding of reinforcing bars in accordance with CBC Section 1903A.8; 1705A.3.1 - Table 1705A.3, Item 2 and Table 1705A.2.1, Item 5b

3.05 CONCRETE PLACEMENT

A. Notify Project Inspector, Architect, Structural Engineer, Testing Laboratory and DSA at least 48 hours before placing concrete.

B. Place concrete in accordance with CBC Section 1705A and ACI 318.

C. Place concrete in cycles as continuous operation to permit proper and thorough integration and to complete scheduled placement.

1. Do not place concrete where sun, wind, heat, or facilities prevent proper finishing and curing.

D. Convey concrete as rapidly and directly as practicable to preserve quality and to prevent separation from re-handling and flowing.
   1. Do not deposit concrete initially set.
   2. Place concrete within ninety minutes after adding water unless otherwise noted.
   3. Re-tempering of concrete which has partially set will not be permitted.

E. Take precautions to avoid damage to under-slab moisture barrier and displacement of reinforcement and formwork.

F. Deposit concrete vertically in its final position.
   1. Avoid free falls in excess of six feet where reinforcement will cause segregation and in typical conditions unless Architect approves otherwise.

G. Keep forms and reinforcement clean above pour line by removing clinging concrete with wire brush before placing next lift.
   1. Remove leakage through forms.

H. Interruption in placement longer than 60-minutes will be cause for discontinuing placement for remainder of day.
   1. In this event, cut back concrete and provide construction joints as Architect directs
   2. Clean forms and reinforcement as necessary to receive concrete at later time.

I. Hot Weather Concreting:
   1. Conform to ACI 305 and following requirements when mean daily temperature rises above 75 degrees F.
   2. Establish upper temperature limit of concrete mixes for each class of concrete.
      a. Ensure that concrete temperature during placing are not so high as to cause difficulty from loss of slump, flash set, or cold joints, and do not exceed 90 degrees F.
      b. Consider other project climatic conditions detrimental to concrete quality such as relative humidity, wind velocity, and solar radiation.
   3. Make trial batches of concrete for each mix design at limiting mix temperature selected.
      a. In lieu of trial batches, submit compression strength test reports (20 minimum) at limiting temperature for each proposed mix to Owners testing laboratory for review.
   4. Employ practices to maintain concrete below maximum limiting temperature in accordance with ACI 305.
      a. Concrete ingredients may be cooled before mixing, or flake ice or well-crushed ice of size that will melt completely during mixing may be substituted for part of mixing water.
   5. Employ practices to avoid potential problems of hot weather concreting in accordance with ACI 305.
   6. When temperature of reinforcing steel or steel deck forms is greater than 120 degrees F, spray reinforcing and forms with water just prior to placing concrete.

J. Cold Weather Concreting:
   1. No placement of concrete will be allowed at temperatures below 20 degrees Fahrenheit or when mean daily temperature for curing period is anticipated to be below 20 degrees Fahrenheit.
   2. No concrete placement will be allowed on frozen sub-grade.
   3. Conform to ACI 306 and following requirements when mean daily temperature falls below 40 degrees Fahrenheit.
      a. Ensure that reinforcement, forms, or ground to receive concrete are completely free from frost.
      b. Temperature of concrete at time of placement for footings not to be lower than 50 degrees Fahrenheit.
         1) Minimum temperature at time of placement for other concrete to be 60 degrees Fahrenheit.
         2) Maximum temperature at time of placement to be 90 degrees Fahrenheit.
      c. Maintain concrete at temperature no lower than 50 degrees Fahrenheit for minimum 7 day period after placement by means of blanket insulation, heaters, or other methods as approved by Architect.
      d. Keep record of concrete surface temperature for first 7 days after each pour.
         1) Make Record open to inspection by Architect.

K. Consolidating:
   1. Use vibrators for thorough consolidation of concrete.
   2. Provide vibrators for each location during simultaneous placing to ensure timely consolidation around reinforcement, embedded items and into corners of forms; ensure availability of spare vibrators in case of failures.
      a. Vibrate through full depth of freshly placed concrete.
   3. Do not place vibrators against reinforcement, attach to forms, or use to spread concrete.
   4. Exposed Concrete:
      a. Vibrate with rubber type heads and, in addition, spade along forms with flat strap or plate.

L. Construction Joints:
   1. Verify location and conformance with typical details
      a. Provide only where designated or approved by Architect.
      b. Comply with ACI 318, Section 26.5.6
   2. Horizontal and vertical construction joints to be thoroughly sandblasted to clean and roughen entire surface to minimum 1/4-inch relief exposing clean coarse aggregate solidly embedded in mortar matrix.
   3. Just prior to depositing concrete, wet surface of construction joint thoroughly.

M. Contraction (Control) Joints in Slabs-on-Grade:
   1. Construct contraction joints in slabs-on-ground to form panels of patterns indicated on Shop Drawings.
      a. Use saw cuts 1/8 inch x 1/4 slab depth, unless otherwise indicated.
   2. Time saw cutting to allow sufficient curing of concrete to prevent raveled or broken edges.
   3. Contraction joints in unexposed floor slabs may be formed by saw cuts as soon as possible after slab finishing as may be safely done without dislodging aggregate, maximum 24 hours after pouring.

4. When joint pattern is not shown, provide joints not exceeding 15 feet in either direction and located to conform to bay spacing wherever possible; at column centerlines, half bays, third-bays

N. Formed Elements:
1. Space points of deposit to eliminate need for lateral flow.
   a. Placing procedures of concrete in forms permitting escape of mortar, or flow of concrete itself, will not be permitted.
2. Level top surface upon stopping Work.
3. Take special care to fill each part of forms by depositing concrete directly as near final position as possible, and to force concrete under and around reinforcement, embedded items, without displacement.
4. After concrete has taken its initial set, exercise care to avoid jarring forms or placing strain on ends of projecting reinforcement.

3.06 CURING

A. General Requirements:
1. Deploy curing measures immediately after placement and for measures other than application of curing compound, extend for seven days.
   a. Architect may recommend longer periods based upon prevailing temperature, wind and relative humidity.
   b. Comply with ACI 318, Section 26.5.3.
2. Avoid alternate wetting and drying and fluctuations of concrete temperature.
3. Protect fresh concrete from direct rays of sun, rain, freezing, drying winds, soiling, and damage.
4. Do not permit curing method to affect adversely finishes or treatments applied to finish concrete.

B. Curing Method, Typical:
1. Keep forms and concrete surfaces moist during period forms are required to remain in place.
2. Obtain Architect's approval of alternate measures.

3.07 FORM REMOVAL

A. Secure Architect's approval for time and sequence of form removal.

B. Form Removal:
1. Remove forms carefully to avoid damaging corners and edges of exposed concrete.
2. Remove forms after concrete has developed sufficient strength to sustain its own weight and superimposed loads, but not before concrete compressive strength has reached 0.70 f'c and 7 days minimum time, or as otherwise specified by Architect.
3. Estimated curing time required to obtain desired strength:
   a. Present results of 7 day test cylinder break to Architect to demonstrate compliance with above specified strength requirements prior to form removal.
   b. Where 7 day test cylinder break demonstrates strength that is less than that specified, Contractor may elect to take additional cylinders at time of next pour to demonstrate strength requirements.
   c. Cost of taking and testing additional sample will be borne by Contractor.

C. Reuse of Forms:
   1. Architect will approve reuse of forms provided they are straight, clean, free from nails, dirt, hardened concrete, or other injurious matter and edges and surfaces are in good condition.
   2. Clean and repair damage caused by placing, removal, or storage.
      a. Reuse of formwork with repairs or patches which would result in adverse effects to architectural concrete finish will not be permitted.
   3. Store formwork in manner to prevent damage or distortion.
   4. Reseal as required to achieve concrete of specified quality.
      a. Form Sealer:
         1) Pre-Form 100 by Nox-Crete Products Group, Omaha, NE, or approved equal.

3.08 CLEANING, PATCHING, AND DEFECTIVE WORK

A. Where concrete is under strength, out of line, level or plumb, or shows objectionable cracks, honeycombing, rock pockets, voids, spalling, exposed reinforcement, signs of freezing, or is otherwise defective, and, in Architect's judgment, these defects impair proper strength or appearance of Work, Architect will require its removal and replacement at Contractor's expense.

B. Immediately after stripping and before concrete is thoroughly dry, patch minor defects, form-tie holes, honeycombed areas, and similar areas, with patching mortar.
   1. Install patch to match finish of adjacent surface unless otherwise noted.
   2. Remove ledges and bulges.

C. Compact mortar into place and neatly file defective surfaces to produce level, true planes.
   1. After initial set, dress surfaces of patches mechanically or manually to obtain same texture as surrounding surfaces.

D. Rock Pockets:
   1. Cut out to full solid surface and form key.
   2. Thoroughly wet before placing mortar.
   3. Where Architect deems rock pocket too large for satisfactory mortar patching as described, cut out defective section to solid surface, key and pack solid with concrete to produce firm bond and match adjacent surface.

E. Cleaning
   1. Ensure removal of bituminous materials, form release agents, bond breakers, curing compounds when permitted, and other materials employed in concrete work which would otherwise prevent proper application of sealants, liquid waterproofing, and other delayed finishes and treatments.
   2. Where cleaning is required, take care not to damage surrounding surfaces or leave residue from cleaning agents.

3.09 CONCRETE SLAB FINISHES

A. General:
   1. Comply with recommendations in ACI 302.1 R for screeding, restraightening, and finishing operations for concrete surfaces.
   2. Do not wet concrete surfaces.

B. Float Finish:
   1. Apply float finish to following slab surfaces:
      a. Surfaces to receive trowel finish
      b. Surfaces which are to be covered with membrane, fluid-applied waterproofing, or membrane roofing.
      c. Other finishes as specified
   2. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating.
   3. Begin floating when surface water has disappeared or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both.
   4. Consolidate surface with power-driven floats or by hand-floating where area is small or inaccessible to power units.
   5. Check and level surface plane not exceeding tolerances specified in Article 2.06 when tested with 10 foot straightedge.
      a. Cut down high spots and fill low spots.
      b. Uniformly slope surfaces to drains.
      c. Immediately after leveling, refloat surface to uniform, smooth granular texture.

C. Scratch Finish:
   1. Apply scratch finish to slab surfaces scheduled to receive concrete floor topping or mortar setting beds for tile, Portland cement, and other bonded applied cementitious finish flooring material.
      a. After placing slabs, plane surface not exceeding tolerance specified in Article 2.06 when tested with a 10 foot straightedge.
      b. Slope surfaces uniformly to drains where required.
      c. After leveling, roughen surface before final set, with stiff brushes, brooms, or rakes.

D. Trowel Finish:
   1. Apply trowel finish to slab surfaces to be exposed to view, and slab surfaces to be covered with resilient flooring, carpet, tile set over cleavage membrane, paint, or other thin film finish coating system.
      a. After floating, begin first trowel finish operation using power-driven trowel.
      b. Begin final troweling when surface produces ringing sound as trowel is moved over surface.
      c. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance.
      d. Finish and measure surface so gap at any point between concrete surface and an unlevel0ed freestanding 10 foot long straightedge, resting on two high spots and placed anywhere on surface, does not exceed [1/8] [1/4] inch.
      e. Grind smooth surface defects which would telegraph through applied floor covering system.

E. Broom Finishes:
   1. Light Textured Broom Finish:
      a. Provide light texture by drawing soft bristle broom lightly across concrete surface in one direction, as indicated on Drawings, to provide uniform fine line texture finish.
   2. Match finish of approved mock-up panel specified in “Quality Assurance” Article.

3.10 CONCRETE SEALER APPLICATION

A. Apply specified sealers only to concrete surfaces where scheduled in Finish Schedule.

B. Apply sealers only to surfaces that are sound, properly troweled and finished, and that are clean, dry, and free of form release agents, retarders, alkali, curing compounds, oil, grease and other contaminants.
   1. Acid-clean and etch discolored or stained slabs before sealer is applied when, in Architect's judgment, satisfactory uniform finish cannot be otherwise achieved.

C. Apply Concrete Sealer Type 2 only to concrete slabs scheduled or indicated to receive light broom finish.
   1. Refer to Finish Schedule for specific locations.

3.11 FIELD QUALITY CONTROL

A. Owner's Testing Agency will:
   1. Perform testing in accordance with ACI 318 and CBC Section 1903A and 1905A.
   2. Review concrete mix designs.
   3. Inspect concrete and grout placement continuously.
   4. Test concrete to control slumps according to ASTM C143.
   5. Continuously monitor concrete temperature as it arrives on Project Site.
   6. Test concrete for required compressive strength in accordance with CBC Section 1705A.3 – Table 1705A.3, Item 6; 1905A.1.16; and ACI 318 – Section 26.12 as modified:
      a. Make and cure three specimen cylinders according to ASTM C 31 for each 50 cubic yards, or not less than once for each 2,000 sq. ft. or fraction thereof, of surface area for slabs and walls of each class poured at Project Site each day.
         1) Complying with CBC Section 1905A.1.17
      b. Retain one cylinder for 7 day test and two for 28-day test.
      c. Number each cylinder 1A, 1B, 1C, 2A, 2B, 2C, and so on.
         1) Date each set; and keep accurate record of pour each set represents.
      d. Transport specimen cylinders from Project to laboratory after cylinders have cured for 24 hours on Project Site.
      e. Cover cylinders and keep at air temperatures between 60 and 80 degrees Fahrenheit.
      f. Test specimen cylinders at age 7 days and age 28 days for specified strength according to ASTM C 39.
      g. Base strength value on average of two cylinders taken for 28 day test.
   7. Test and inspect materials, as necessary, in accordance with ACI 318, MM Test Method 227 (Coarse and Intermediate Aggregates) and MM Test Method 217 (Fine Aggregates), for compliance with requirements specified in this Section.

B. Submit ticket for each batch of concrete delivered to Project Site.
   1. Provide following information on Ticket:
      a. Design mix number.
      b. Signature or initials of ready mix representative.

c. Time of batching.
d. Weight of cement, aggregates, water and admixtures in each batch with maximum aggregate size.
e. Total volume of concrete in each batch.
f. Notation to indicate equipment was checked for contaminants prior to batching.

2. Pay Owner's Testing Agency for taking core specimens of hardened structure and testing specimen according to ASTM C 88 and C 42 when laboratory tests of specimen cylinders show compressive strengths below specified minimum.

3.12 CLEANING

A. Perform Work to keep affected portions of Project Site neat, clean, and orderly.
1. Remove, immediately upon completion of Work, surplus materials, rubbish, and equipment associated with or used in performance.
2. Be aware that failure to perform clean-up operations within 24 hours of notice by Architect will be considered adequate grounds for having work done by others at no added expense to Owner.

3.13 PROTECTION

A. Protect concrete from injurious action of elements and defacement during construction operations.

B. Protect exposed corners of concrete from traffic or use which will damage them.

C. Make provisions to keep exposed concrete free from laitance caused by spillage or leaking forms or other contaminants.
1. Do not allow laitance to penetrate, stain, or harden on surfaces which have been textured.

END OF SECTION 03 3000

SECTION 04 2200

CONCRETE UNIT MASONRY

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Concrete Unit Masonry Work, including but not limited to:
      a. Concrete Masonry Units.
         1) Including grouted wall caps.
      b. Mortar and Grout
      c. Installation of reinforcing steel furnished under Section 03 3000
      d. Control Joints
      e. Testing and Inspection.

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 01 4500: Quality Control; testing laboratory services.
   3. Section 03 3000: Cast-in-Place Concrete; furnishing of reinforcing steel for masonry work and placing of dowels in concrete for start of masonry work.
   4. Section 07 9200: Joint Sealants; sealant and backer rod for joints in concrete masonry.
   5. Section 09 9100: Painting; painting of concrete unit masonry.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
   1. Chapter 21A - Masonry

B. American Concrete Institute (ACI):
   1. ACI 315 – Manual of Standard Practice for Detailing Reinforced Concrete Structures.
   2. ACI 318 – Building Code Requirements for Structural Concrete.
   3. Building Code Requirements for Masonry Structures – TMS 402 / A530 / ASCE 5
   4. Specification for Masonry Structures – TMS 602 / ACI 530.1 / ASCE 6

C. ASTM International (ASTM):
   1. ASTM C 90 – Standard Specification for Loadbearing Concrete Masonry Units
   2. ASTM C 94 – Standard Specification for Ready Mixed Concrete.
   3. ASTM C 140 – Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units
   4. ASTM C 270 – Standard Specification for Mortar for Unit Masonry.
   5. ASTM C 426 – Standard Test Method for Linear Drying Shrinkage of Concrete Masonry Units
   6. ASTM C 476 – Standard Specification for Grout for Masonry

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's literature describing products, including mix designs, history of compression tests, and mixing requirements as they apply to each different masonry unit, accessory, and other manufactured product to be used in concrete unit masonry construction.
   2. Literature includes, but is not necessarily limited to, preformed rubber control joints and mortar and grout additives.

B. Certificates:
   1. Material certificates for following signed by manufacturer and Contractor, certifying that each material complies with requirements designated:
      a. Each material and grade of reinforcing bars, in accordance with requirements of Section 03 3000.
         1) Include mill test reports.
      b. Each type and size of anchors, inserts, ties, and accessories.
   2. Certificate of compliance with standards designated.
   3. Plant certificates for concrete masonry units to Owner’s Testing Agency, and Architect, stating that units have been properly cured before shipment and that they conform to requirements of these specifications, including but not necessarily limited to, requirements for moisture content per ASTM C 90 Type 1 units.
   4. Masonry units shipped without certification will be rejected.

C. Mix Designs:
   1. For mortar and grout.
   2. Manufacturer’s literature for grout admixtures

D. Mill Test:
   1. Mill test reports for reinforcing steel.

E. Extreme Weather Procedures:
   1. Cold and hot-weather construction procedures evidencing compliance with requirements specified in ACI 530.1 and these specifications.

F. Shop Drawings:
   1. Coordination and shop drawings for concrete masonry unit walls consisting of elevations and sections indicating materials and assembly, color surface finish, courses, and reinforcing.
   2. Comply with following requirements:
      a. Illustrate detailing, fabrication, bending and placement of unit masonry reinforcing bars.
      b. Comply with ACI 315 showing bar schedules, stirrup spacing, diagrams of bent bars and arrangements of masonry reinforcement.
      c. Indicate location of conduit, plumbing, and other items embedded in unit masonry walls and coordinate this Work with placement of unit masonry reinforcement.
      d. Provide shop drawings drawn to scale.

G. Test Reports:
1. Material test reports indicating and interpreting test results relative to compliance with tests described in “Quality Assurance” Article and “Field Quality Assurance” Article.

H. Samples:
1. Unit Samples:
a. Concrete masonry units of each color and texture specified.
2. Accessories embedded in concrete masonry Work.

1.04 QUALITY ASSURANCE

A. Concrete Unit Masonry Work:
1. Comply with standards and requirements of above references.
2. Where discrepancies exist between references and Contract Documents, comply with requirements of Contract Documents.

B. Allowable Tolerances:
1. Place concrete unit masonry within 1/8 inch of dimensions noted.
2. Maximum Variation from Plumb of Walls: 1/8 inch in 20 feet.
3. Provide joints with uniform thickness of 3/8 inch unless otherwise noted.
a. Joints Variation:
1) Not more than 1/16 inch in adjacent courses within two feet and not less than 5/16 inch thick and not greater than 7/16 inch thick.

C. Reinforcing Steel:
1. Do not permit reinforcing steel to rust where there is danger of staining exposed surfaces of adjacent concrete.
2. Replace rust-stained concrete and masonry at no additional expense to Owner or Project.

D. Testing Laboratory Services:
1. Laboratory Selection, Payment, and Reports:
a. Comply with requirements of Section 01 4500.
2. Certificates and Reports:
a. Collect plant certificates from Contractor for concrete masonry units and mill test reports for reinforcing listed in “Submittals” Article
3. Perform Following Tests:
a. Concrete Masonry Units:
1) Sample and test in accordance with ASTM C90, C 140, and C 426
b. Portland Cement:
1) Sample and test Portland cement or provide mill test reports, per Sections 01 4500 and 03 3000..
c. Mortar and Grout Tests:
1) Comply with CBC, Part 2, Section 2105A.2.2.1.4
2) Take minimum of one set of cylinders on each of first three days of masonry work and at least at one week intervals thereafter.
d. Mandatory Tests:
1) Sample and test concrete masonry units for measurement of dimensions, compressive strength, and absorption in accordance with ASTM C140 as follows:
a) Section 6 – Measurement of Dimensions.
b) Section 7 – Compressive Strength.

c) Section 8 – Absorption.

2) Compressive Strength Tests of Units:

a) Comply with CBC 2105A.2.2.1.2.

4. Moisture Content and Drying Shrinkage Testing:
   a. Conduct moisture content and linear shrinkage testing in accordance with ASTM C 426.
   b. Maximum linear shrinkage of 0.065 percent from saturated to oven dry condition.
   c. Provide Test Data that is traceable to units being supplied for Project, and complies with ASTM C 90, Section 8.3.
5. Cores:
   a. Perform core tests on sample concrete masonry Work and structure in accordance with CBC, Part 2, Chapter 21A, Section 2105A.4
   b. Location of Cores in Structure:
      1) As approved by Architect and Division of the State Architect.
6. Reinforcing Testing:
   a. Sample and test reinforcing per Division 01 Sections and Section 03 3000.
7. Field test masonry unit moisture content prior to concrete block installation.
   a. Refer to “Field Quality Assurance” Article.

E. Masonry Inspection:
   1. Masonry work will be continuously inspected during laying by inspector specially approved for that purpose by Division of the State Architect.
   2. Cost of such inspection will be paid for by Owner.

F. Comply with provisions of ACI 530 and 530.1, except where exceeded by requirements of Contract Documents.

G. Examination Criteria:
   1. Examination, selection, and approval are for purpose of achieving final installation of concrete unit masonry with greatest possible uniformity of appearance and structural integrity based on following criteria:
      a. Conformance with testing and quality assurance measures as specified.
      b. Color and texture matching per approved mock-up for range, random variation, and finish.
      c. Conformance to Contract Documents and approved shop drawings within specified dimensions and tolerances.
      d. Other criteria as specified.
   2. Non-conformance with above criteria is grounds for removal and replacement of Work at no cost to Owner.
   3. Determination that Work complies with specified criteria wil be made by Architect.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged material in original containers with seals unbroken and labels intact until time of use.

B. Deliver concrete masonry units to Project Site, conforming to moisture requirements of ASTM C90.
   1. Ensure that masonry units meet moisture requirements during laying of units and grouting until wall is complete.

C. Unload and inspect each masonry unit carefully and store on raised platform protected from weather meeting ASTM C90 requirements at time of laying and grouting.
   1. Reject and remove from Project Site material not conforming to specification requirements.
   2. Reject concrete masonry units that are not in conformance with manufacturer's specifications:
      a. Color or texture of concrete masonry units deviates from range of colors and textures of approved samples, as determined by Architect.
      b. Concrete masonry units that are chipped, cracked, or otherwise damaged.

D. Protect cementitious materials against exposure to moisture.
   1. Use of cementitious or other materials that have become caked and hardened from absorption of moisture is not permitted.

E. Prior to installation, unload concrete masonry units onto working pallets as described in "Preparation" Article.

1.06 PROJECT CONDITIONS

A. Environmental Conditions:
   1. Do not place unit masonry when temperature is below 40 degrees F, unless Architect approves and Contractor provides means for preventing damage from freezing before and after placement.

B. Protection:
   1. Protect surrounding Work as required against damage from masonry Work.
   2. Satisfactorily clean and correct damage to surrounding Work resulting from masonry Work.
   3. Conforming to Take necessary means and precautions to protect masonry units from moisture absorption during shipping, storage on Project Site, during placement prior to grouting of wall, and during wall construction, until masonry wall is completed and graffiti-resistant coating is applied.

PART 2 PRODUCTS

2.01 MATERIALS

A. General – Hollow Concrete Masonry Units:
   1. Provide concrete masonry units that have been air cured for not less than 28 days.
      a. Size:
         1) Nominal 8 by 8 by 16 inches, except where otherwise indicated.
   2. Provide bond beam units at horizontal reinforcing.
   3. Compressive strength of Masonry (f'm) per Structrural Drawings
   4. Provide concrete masonry units that have been air cured for not less than 28 days.
   5. Manufactured by one of following, or approved equal:
      a. Angelus Block
      b. Orco Block (Basis-of-Design)

B. Smooth Face (Precision) Hollow Concrete Masonry Units::
   1. Conforming to ASTM C 90, medium weight (115 pcf):
      a. Smooth face.
   2. Color: Standard gray

C. Provide Concrete Masonry Units that have been air cured for not less than 28 days.

2.02 MORTAR AND GROUT MATERIALS

A. Cement for Mortar and Grout:
   1. Type I or Type II Portland Cement conforming to ASTM C 150.
   2. Type II Portland Cement may be used only when it equals strength of Type I.
   3. Use low alkali (0.6 percent maximum) type cement for mortar and grout

B. Sand:
   1. Conform to ASTM C 144, except with not less than 3 per cent of sand passing No. 100 sieve.
   2. Sand for Grout:
      a. Conform to ASTM C 404.

C. Pea Gravel:
   1. Conform to ASTM C 33.
   2. Size Range: No. 8 to 3/8 inch.

D. Lime:
   1. Hydrated lime conforming to ASTM C 207, Type S

E. Water:
   1. Clean, potable, and free from impurities detrimental to mortar and grout..

2.03 MASONRY ACCESSORIES

A. Reinforcing Bars:
   1. Bars:
      a. New billet steel conforming to following:
         1) ASTM A615, Grade 60
         2) ASTM A706, Grade 60, where welded.
   2. Tie Wires: ASTM A82.
   3. Comply with requirements of Section 03 3000.

B. Control Joints:
   1. Preformed rubber in profiles required or shown.
   2. Provide products by one of following, or approved equal:
      a. RS Series by Hohmann & Barnard, Inc.
      b. 2900 Series by Wire-Bond

C. Additives and Admixtures:
   1. Required in grout to:
      a. Reduce early water loss to masonry units.
      b. Produce expansive action in plastic grout to offset initial shrinkage and promote bonding of grout to interior masonry unit surfaces.
   2. SikaGrout Aid by Sika Corporation, or approved equal.
   3. Add admixtures in accordance with admixture manufacturers instructions.

4. Use of admixtures is not permitted unless request is submitted to Architect and Structural Engineer for review and Structural Engineer's approval.
5. Do not use admixtures which have not been incorporated and tested in accepted mix designs.

2.04 MORTAR AND GROUT MIXES

A. Mortar:
   1. CBC Chapter 21A, Section 2103A.2.
   2. Conform to ASTM C 270, Type S and Articles 2.1 and 2.6A of TMS 602/ACI 530.1/ASCE 6
      a. Compressive Strength: Minimum 1,800 psi at 28 days.
   3. Mix in batch mechanical mixer permitting accurate control of water amounts.
      a. Place approximately half of required water and sand into mixer while turning.
      b. Add cement and remainder of sand and water into mixer in that order and mix materials for at least three minutes with minimum of water to produce workable consistency.
      c. Site mixing of mortar is not permitted without review and acceptance of Contractor's procedure by Owner's Testing Agency and Structural Engineer.
   4. Add lime and continue mixing as long as required to secure uniform mass.
   5. Total mixing time may not be less than 3 minutes or more than 10 minutes.
   6. Place mortar in final position within 1 hour after mixing.
      a. Re-tempering of mortar is not permitted.
      b. Remove from Work mortar or grout which is unused within one hour after initial mixing.

B. Grout:
   1. CBC Chapter 21 A, Section 2103A.3.
   2. Conform to Article 2.2 of TMS 602/ACI 530.1/ASCE 6
      a. Compressive Strength: Minimum 2,000 psi at 28 days.
   3. Mix grout in accordance with ASTM C 94
   4. Thoroughly mix grout ingredients in quantities needed for immediate use in accordance with ASTM C476 for fine and coarse grout.
      a. Per DSA IR 21-2.10:
         1) Grout mix complying with requirements of CBC Section 2103A.3.
         2) Solidly fill cells with grout in reinforced hollow unit masonry per CBC Section 2104A.1.3.11.2
         3) Use coarse grout in grout spaces 2 inches or more in width and in filled cells per CBC Section 2104A.3.1
         4) Sufficient water may be added to make workable mix that will flow into masonry voids without separation or segregation.
         5) Grout Slump: 8 to 11 inches per TMS 602, Article 2.6 B.2 and ASTM C 476, Section 4.2.2.
         6) Provide grout mixes containing approved admixture conforming to specified requirements.
         7) Use approved admixture in strict accordance with manufacturer's instructions and appropriate listing from ICC-ES or other acceptable evaluation agency per IR A-5
   5. Use grout aid in grout to reduce early water loss to masonry units and produce expansive action in grout sufficient to offset initial shrinkage.

a. Mix grout admixture in accordance with manufacturer's recommendations and requirements.

6. Use sufficient water to make workable mix that will flow into joints of masonry units with typical rates of absorption for ASTM C 90 Type I units.

C. General Mixing Requirements:
1. Measure materials accurately.
2. Shovel measurements will not be permitted.
3. Use mechanical mixer of at least one-sack capacity.
4. Completely empty drum before charging succeeding batch of materials.
5. Exercise extreme care in measuring ingredients for partial batches.
6. Comply with mixing requirements of ACI 318.

2.05 SOURCE QUALITY CONTROL

A. Source Limitations for Masonry Units:
1. Obtain exposed masonry units of uniform texture and color, or uniform blend within ranges accepted for these characteristics, with units from same batch, through one source from single manufacturer.
2. Use only one source for concrete masonry units throughout Work.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine areas to receive masonry and verify following:
1. Foundation surface is level to permit bed joint within range of 1/4 to 3/4 inch.
2. Edge is true to line to permit projection of masonry to less than 1/4 inch.
3. Projecting dowels are free from loose scale, dirt, concrete, or other bond-inhibiting substances and properly located.

B. Do not begin before unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean concrete surfaces to receive masonry.

B. Remove laitance or other foreign material lodged in surface by sandblasting or other means as required.

C. Ensure masonry units are clean and free from dust, dirt, or other foreign materials before laying.

D. Roughen concrete below walls to expose aggregate.
1. Remove loose particles and in hot weather dampen concrete surfaces before laying blocks.
2. Contact surfaces of foundations and floors that are to receive masonry work are to be mechanically roughened to 1/4 inch amplitude.
3. Comply with ACI 318, Section 6.4.

E. Ensure random color variations in installation of concrete masonry units.
1. Unload from three delivered pallets onto working pallet to be used for construction.

2. Alternate among pallets when unloading to ensure mix of concrete masonry units on working pallet.

3.03 REINFORCING

A. General:
   1. Clean free of loose rust, mill scale, earth, or other materials which will reduce bond to mortar or grout.
   2. Shop fabricate to comply with Drawings.
   3. Conform to requirements of ACI 315 where specific details are not shown, or where Drawings and Specifications are not more restrictive.
   4. Do not use reinforcing bars with kinks or bends not shown on Drawings or final shop drawings, or bars with reduced cross-section due to excessive rusting or other causes.

B. Place bars where noted in accordance with ACI 315 and CBC 2104A and do not disturb after start of masonry placement.
   1. Position reinforcing accurately at spacing shown.
   2. Support and secure vertical bars against displacement.
      a. Where vertical bars are shown in close proximity, provide clear distance between bars of not less than nominal bar diameter or 1 inch, whichever is greater.
   3. Horizontal reinforcing may be placed as masonry work progresses.
      a. Lay horizontal reinforcing in bond beam units.
   4. Minimum clearance between bar and concrete masonry unit is 1/2 inch and between parallel bars is 1 inch.
   5. Horizontal and Vertical Reinforcing:
      a. Hold in position by wire positioners or spacing devices near ends and at intervals not to exceed 200 bar diameters, and as required to prevent displacement by construction loads or placement of grout beyond tolerances allowed by CBC 2104A.

C. Splice reinforcing bars where shown.
   1. Do not splice at other points unless acceptable to Architect.
   2. Provide lapped splices, unless otherwise shown.
   3. In splicing vertical bars or attaching to dowels, lap ends, place in contact and wire tie.
   4. Provide not less than minimum lap shown, or where not shown, as required by governing code.
   5. Weld splices where shown.
   6. Comply with requirements of AWS D1.4 for welding materials and procedures and with Section 03 3000 for welded reinforcement.

D. Completely embed bars in mortar or grout for joint reinforcement embedded in horizontal mortar joints
   1. Provide not less than 5/8 inch mortar coverage on exterior face of walls and 1/2 inch at other locations.
   2. For other reinforcement provide minimum coverage of one bar diameter over bars, but not less than 3/4 inch except where exposed to weather or soil in which case provide minimum coverage of 2 inches.

3.04 PLACEMENT

A. General Requirements:
   1. Comply with CBC Section 2104A.
   2. Ensure masonry units are sound, clean and free of cracking, chipping and broken edges at time of placement.
      a. Use double open-ended beam units, typical.
      b. Use proper units to provide for windows, doors, bond beams, lintels, and pilaster, in order to minimize cutting.
   3. Accurately cut and fit units as required to accommodate other work using masonry saws.
   4. Lay masonry units plumb, true to line, with level courses accurately placed.
   5. Adjust unit to final position while mortar is soft and plastic.
   6. Align vertical cells accurately to provide continuous, unobstructed opening for grouting.
   7. Remove units disturbed after stiffening of mortar, clean joints, and relay unit with fresh mortar.
   8. In hot weather, moisten contact surfaces of masonry units to receive mortar immediately before laying to prevent excessive drying of mortar.
   9. Do not lay up one tier of wall more than 16 inches ahead of other tier.
   10. Where necessary to stop longitudinal run, rack back one-half block length in each course.
   11. Do not attach construction supports to walls, except where permitted by Architect.
   12. Install anchors, bolts, and other embedded items accurately as Work progresses and prior to grouting.
   13. Coordination:
      a. Masonry Installer and Reinforcing Steel Installer: Meet and coordinate placement of reinforcing steel prior to placement of concrete or grout.

B. Bond Pattern:
   1. Running bond.
   2. Corners:
      a. Provide standard masonry bond by overlapping units.

C. Joints:
   1. Maintain joint widths shown, except for minor variations required to maintain bond alignment.
      a. Ensure full coverage of face shells in both horizontal and vertical joints and on webs.
   2. Where not otherwise indicated, lay walls with 3/8 inch joints.
   3. Cut joints flush for masonry walls which are to be concealed or to be covered by other materials.
   4. Joints Exposed to Weather:
      a. Tool exposed joints slightly concave to achieve solid, smooth, watertight, compacted joints, well bonded to masonry at edges.
   5. Rake out mortar in preparation for application of sealants where shown.
   6. Immediately fill holes made by line pin with mortar when pin is withdrawn.
   7. Remove surplus mortar from joints.

D. Cold Weather Requirements:
   1. When daily temperature is below 40 degrees F., ensure reinforcing, masonry units contacting mortar, and grout are free of frost.

2. Protect mortar and grout from freezing for at least 48 hours after installation whenever temperature falls below 40 degrees F.
3. Maintain mortar and grout at temperature no lower than 50 degrees F., while being used and until installed.
4. In freezing or near freezing weather, provide equipment of adequate size for heating of mortar and grout.
5. Do not add water to mix at temperature greater than 140 degrees F.

E. Hot Weather Requirements:
1. Implement requirements of approved Hot Weather construction procedures when ambient air temperature exceeds 100 degrees F or 90 degrees F with wind velocity greater than 8 mph.

F. Protection:
1. Protect face materials against staining.
2. Remove misplaced grout or mortar immediately.
3. Protect sills, ledges, offsets, and similar items from mortar drippings or other damage during construction.

G. Built-in Work:
1. As Work progresses, build-in items specified under this and other sections of these specifications.
   a. Fill in solidly with masonry around built-in items.
   b. Solid grout steel frames where occurring in masonry construction.
2. Install reglets and nailers for flashing and other related work where shown to be built into masonry work.
3. Install bolts, dowels, plates, anchors, hangers and like items where shown to be built into masonry for Work of other trades.

H. Requirements for Walls to be Grouted by High-Lift Method:
1. Lay up walls full story prior to grouting.
   a. Brace walls adequately to resist wind lateral and other forces.
2. Build vertical grout barriers or dam of solid masonry across grout space at no more than 25 feet on centers to control horizontal flow of grout.
3. Provide cleanouts by leaving out every other unit in bottom course.
   a. Seal after inspection and before grouting.
   b. Allow 24 hour cure time for face shell plugs and adequately brace to resist grout pressure.
4. During laying up, remove mortar fins and other foreign matter from grout space with stick and compressed air.
5. Grout:
   a. High slump workable mix placed by pumping.
6. Use mechanical vibrators for consolidation.
7. Grout is to be reconsolidated after it has taken on plastic consistency but prior to taking on initial set.
8. “Pour” is considered as entire height of grout fill placed in one day and is composed of number of successive placed grout lifts.
9. “Lift” is layer of grout placed in single continuous operation.
10. Maximum Height of Pour:
    a. Twelve feet for eight inch walls
    b. Sixteen feet for twelve inch walls.

3.05 GROUTING

A. Use either high-lift or low-lift grouting techniques, at Contractor's option, subject to other limitations of Contract Documents.

B. Ensure vertical cells have proper vertical alignment, to maintain continuous unobstructed vertical cell area of 3 by 3 inches.
   1. Use grout that is sufficiently fluid to ensure complete filling of every section of units, but not so thin as to allow segregation of aggregate.
   2. Grout every cell.

C. Water/Cement Ratio for Grout:
   1. Not more then 7-1/2 gallons of water per sack of cement.

D. Provide grout pours in excess of 24 inch height with cleanouts.

E. Maximum Lift of Grout Pour:
   1. 4 feet, unless high-lift method is used.

F. When grouting is stopped for period of one hour or longer, form horizontal construction joints by stopping grout one inch below top of uppermost unit.

G. Grouting of Steel Door Frames:
   1. Grout steel door frames where installed in masonry construction with grout specified in Article 2.02

H. Low-Lift Grouting:
   1. Conform to with CBC 2104A.1.3.1.1.1.1.
   2. Limit height of pours to 4 feet.
   3. Limit height of masonry to 16 inches above each pour.
   4. Pour grout only after vertical reinforcing is in place.
      a. Place horizontal reinforcing as grout is poured.
      b. Prevent displacement of bars as grout is poured.
   5. Place grout for each pour continuously and consolidate immediately.
      a. Do not interrupt pours for more than 1-1/2 hours.

I. When grouting is stopped for more than one hour, terminate grout minimum 1/2 inch, 2 inches maximum below top of upper masonry unit to form positive key for subsequent placement.

J. Solid grout cells and courses – No Exceptions.
   1. Consolidate with 3/4 inch diameter mechanical vibrator inserted into each and every cell.

3.06 POINTING AND CLEANING

A. Point holes or defective mortar joints upon completion of Work.
   1. Where necessary, cut out and repoint defective joints.

B. At end of workday, fiber-brush new surfaces to remove mortar splotches.
   1. clean with mild detergent or enzymes, and rinse with clean water.

C. Do not use acid solution to remove green stain or efflorescence resulting from salts.
   1. Follow recommendations of manufacturer for removal of such stains.

D. Upon completion of Work, remove from Project Site, surplus materials, rubbish, and debris resulting from Work.

3.07 FIELD QUALITY ASSURANCE

A. Special Inspections:
   1. Special Inspectors:
      a. Prequalified and approved by DSA and employed by Owner to perform continuous masonry inspection per CBC 1701A.
   2. Masonry Inspector Requirements:
      a. Present at Project Site during masonry construction and perform following duties:
         1) Review plans and specifications and meet with Contractor to discuss requirements before Work commences.
         2) Before masonry Work commences, hold joint meeting with Contractor and Architect to review requirements for surveillance and quality control of masonry Work.
         3) Check brand and type of cement, lime (when used), and source of sand.
         4) Inspect foundation or slab to ascertain that it is clean and ready to receive units.
         5) Check reinforcing steel dowels for straightness, proper alignment, spacing, size and length.
         6) Observe manner in which units are laid up to ensure that joints are full of mortar and kept tight during work.
            a) Inspect cells to assure that fins will not interfere with grouting or foaming.
            b) Instruct masons to keep cells clean of mortar droppings and inspect to determine compliance.
         7) Observe placing of grout continuously.
         8) Perform or supervise performance of required sampling and field-testing as specified.
         9) Keep complete record of inspection of work.
         10) Report daily to Owner's Representative progress of masonry inspection.
         11) Submit verified reports to DSA.

B. Determine strength of masonry by unit strength method in accordance with CBC 2105A.2.2.1

C. Mortar and Grout Testing: Test mortar and grout in accordance with ASTM C 780 (mortar) and ASTM C 404 (Grout)

3.08 CLEANING AND PROTECTION

A. Thoroughly clean surfaces of concrete unit masonry and metal gates of foreign or deleterious matter such as dirt, mud, oil, or grease that would impair bonding to painted finish.

B. Protect concrete unit masonry and metal gates from damage and dirt until final finishes are applied and accepted by Owner.

END OF SECTION 04 2200

SECTION 05 0513

SHOP-APPLIED COATINGS FOR METAL

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Factory applied high performance painted finishes for following:
   a. Aluminum extrusions for:
      1) Aluminum window frames
   b. Coil Coated Sheet:
      1) Aluminum sheet for metal flashing and trim.
2. Factory applied high performance powder coating for perforated metal panels.

B. Related Sections:

1.	Section 07 6200:	Sheet Metal Flashing and Trim; prefinished metal
2.	Section 08 5115:	Aluminum Windows
3.	Section 09 9100:	Painting; ferrous and galvanized metal
4.	Section 09 9600:	High Performance Coatings; AESS and other exposed steel

C. Related Requirements:
1. Refer to respective Sections of Divisions 22, 23 and 26 through 28 for
   a. Prefinished plumbing items, mechanical equipment grilles.
   b. Prefinished electrical equipment.

1.02 REFERENCES

A. National Association of Architectural Metal Manufacturers (NAAMM):
1. AMP 500 – Metal Finishes Manual

B. Aluminum Association (AA):
1. CA-92 – Care of Aluminum
2. DAF-45 – Designation System for Aluminum Finishes.

C. Fenestration & Glazing Industry Alliance (FGIA):
[formerly American Architectural Manufacturers Association (AAMA)]
1. AAMA 2604 – Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).
2. AAMA 2605 – Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

D. ASTM International (ASTM):
1. ASTM B 137 – Standard Test Method for Measurement of Coating Mass Per Unit Area on Anodically Coated Aluminum
2. ASTM B 244 – Standard Test Method for Measurement of Thickness of Anodic Coatings on Aluminum and of Other Nonconductive Coatings on Nonmagnetic Basis Metals with Eddy-Current Instruments

3. ASTM D 2244 – Standard Practice for Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates.
4. ASTM D 4214 – Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.

1.03 SUBMITTALS

A. Product Data:
   1. For each metal finish system specified; including primers.
   2. Material List:
      a. Provide inclusive list of required coating materials.
         1) Indicate each material and cross-reference specific coating, finish system, and application.
         2) Identify each material by manufacturer's catalog number and coating material proposed for use.
   3. Manufacturer's Information:
      a. Provide manufacturer's technical information, including instructions for handling, storing and applying each coating material proposed for use.
   4. Certification by manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's).

B. Samples:
   1. Prepare samples on metal of same alloy and gage to be used for Work, for color and finish.
   2. Provide minimum 4 by 8 inch pieces, and 8 inch lengths of larger sizes as required to show finished Work.
   3. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected

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

D. Quality Control Submittals:
   1. Certificates of Compliance:
      a. Manufacturer’s certification that finishes applied on Project components comply with referenced FGIA (AAMA) standards.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications:
   1. Engage experienced applicator who has completed high performance coating system applications similar in material and extent to that indicated for this Project with record of successful in-service performance.

B. Source Limitations:
   1. Obtain primers for each coating system from same manufacturer as finish coats.

C. Coating Manufacturer Responsibilities:
1. General – Responsible for quality control, including inspection and records of inspection.
a. Make available to Architect and Owner, upon request.
2. Conduct periodic inspections of surface preparation and coating operations as necessary.
3. Notify Architect should Contractor fail to meet one or more portions of specification.

1.05 WARRANTIES

A. Warranties for High Performance Pigmented Organic Coatings (PVDF):
1. Special Finish Warranty:
a. Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period.
b. Furnish applicator’s warranty providing coverage that coatings:
1) Will not chip, crack or peel (lose adhesion).
a) Excludes minute fracturing which may occur in proper fabrication of building parts.
b) Will not chalk in excess of ASTM D4214 Number 8 rating, determined by procedure outlines in ASTM D 4214.
c) Will not change color more than five Delta-E Hunter units as determined by ASTM D 2244, Method 6.3.
d) Fading or color changes may not be uniform when surfaces are not equally exposed to sun and elements.
e) Mica and metallic coatings are exempt due to inability to accurately measure color; mica and metallic flakes reflect and scatter light in random patterns.
2) Warranty does not include normal weathering.
c. Warranty Period:
1) 10 years from date of Substantial Completion for Type A coating system.
2) 20 years from date of Substantial Completion for Type B coating system.
3) 5 years from date of Substantial Completion for Type C coating system.
2. Jointly warrant completed high performance metal finishes by respective coating manufacturer and coating applicator to meet weathering tests and performance requirements as specified.
3. Coating applicator must apply for coating warranty at time of application.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Products:
1. High Performance Pigmented Organic Metal Finishes are based on following systems as manufactured by PPG Industries, or approved equal by Valspar:
a. Metal Finish Type A:
1) High Performance Fluoropolymer Coating System for Extruded Aluminum.

2) Manufacturer's standard 3 coat system, consisting of primer, color coat, and clear topcoat.

b. Metal Finish Type B:
1) High Performance Fluoropolymer Coating System for Coil-Coated Steel Sheet.
2) Manufacturer's standard 2 coat system, consisting of nominal 0.2 mil corrosion inhibitive primer and 0.75 fluoropolymer color topcoat.

B. Basis-of-Design Products:
1. High Performance Powder Coating on aluminum is based on products as manufactured by Tiger Drylac:
a. Metal Finish Type C:
1) High Performance Powder Coated Finish

C. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:
1. Submit items listed in “Submittals” Article and as specified in Section 01 3300, For evaluation of proposed system.
2. Furnish documentation that tests have been made for identical systems within ranges of specified.
3. Acceptance is also subject to availability of acceptable color matching specified color.
4. Manufacturer's minimum 10 year finish and material warranty for Type A.
5. Manufacturer's minimum 20 year finish and material warranty for Type B
6. Manufacturer's minimum 5 year finish and material warranty for Type C

2.02 COATING MATERIALS – GENERAL

A. Material Compatibility:
1. Provide primers and finish coat materials that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality:
1. Provide manufacturer's highest grade of various high performance coatings specified; of uniform color throughout and color-fast.
2. Materials not displaying manufacturer's product identification are not acceptable.

C. Coating Manufacturers and Coating Applicators:
1. Develop jointly methods and procedures for surface preparation, priming, and finish coating of materials.

2.03 HIGH-PERFORMANCE PIGMENTED ORGANIC COATING SYSTEMS

A. High Performance Metal Finish Type A:
1. High performance pigmented organic coating, meeting or exceeding performance and test provisions of AAMA 2605 for ten years minimum and following requirements:
a. Minimum 70 percent PVDF (Kynar 500 or Hylar 5000) resin system base with pigmentation.

1) Non-chalking, resistant to ultraviolet deterioration, of uniform color throughout, and colorfast.

b. Prepare, pretreat, and apply coating to exposed metal surfaces following coating and resin manufacturer's jointly developed methods and procedures for surface preparation, priming, and application of finish coating to entrance doors and frames and window materials.

2. Fluoropolymer Coating System:
   a. Manufacturer's standard [2] [3] -coat thermo-cured system, consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride (PVDF) resin system base by weight complying with AAMA 2605.
3. Shop apply Metal Finish Type A to aluminum components as follows:
   a. Two Coat System:
      1) PPG Duranar Sunstorm Coating System consisting of:
         a) Primer Coat: 0.2 to 0.3 mil dry film thickness.
         b) Color Coat: 1.0 mil minimum dry film thickness.
4. Color:
   a. As selected by Architect from manufacturer’s full line.
5. Aluminum components to receive Metal Finish Type A:
   a. Window frames:
   b. Additional items as indicated in Finish and Color Schedules

B. High Performance Metal Finish Type B:
1. High performance pigmented organic coating, meeting or exceeding performance and test provisions of AAMA 2605 for twenty years minimum and following requirements:
   a. Minimum fluoropolymer 70 percent PVDF (Kynar 500 or Hylar 5000) resin system base by weight complying with AAMA 2605.
   b. Provide 1 mil dry film thickness coating one side, 0.3 to 0.4 mil other side, or approved equal.
   c. PPG Duranar Coil Coating System, or approved equal
   d. Colors:
      1) As scheduled to match adjacent finishes.

C. High Performance Metal Finish Type C:
1. Polyester TGIC super durable powder coating:
   a. Electrostatically applied.
2. High performance pigmented organic coating system, meeting or exceeding performance and test provisions of AAMA 2604 for five years minimum.
3. Non-chalking, resistant to ultraviolet deterioration, of uniform color throughout, and colorfast.
4. Coating manufacturer and applicator to develop jointly methods and procedures for preparation, priming, and finish coating of metal materials.
5. Applicator: Licensed by powder manufacturer for application of specified coating.
6. Product and Manufacturer:
   a. Series 38 – super durable by Tiger Drylac U.S.A., Inc., St. Charles, IL, or approved equal.
7. Finish: Smooth semi-gloss.
8. Color: As scheduled

2.04 PERFORMANCE REQUIREMENTS

A. Provide factory applied metal finish systems suitable for application to aluminum extrusions and coil coated material.

B. Conform to applicable performance standards where referenced in specification:

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Visible Surfaces of Exposed Work:
   1. Defined as surfaces which will be exposed to view from exterior and in interior of completed building.

B. Perform finishing after fabrication, forming, fitting, and welding have been completed.

C. Provide finishes on exposed Work that are uniform in appearance.
   1. Members are to match each other exactly throughout installed Work.

D. Specified finishes establish type and quality required.
   1. Finishes are subject to Architect's acceptance.

3.02 CLEANING

A. Comply with Section 01 7423 and following:
   1. Clean in accordance with coating manufacturer's recommendations.
   2. Do not use materials or methods which may damage finishes or surrounding
      a. construction.

3.03 PROTECTION

A. Protect finished surfaces from damage until acceptance by Owner.

END OF SECTION 05 0513

SECTION 05 1200

STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Structural steel framing, including structural steel shown on Structural Drawings.
      a. Standard shapes, plates and rods shown on Architectural, Mechanical, and Electrical Drawings that connect to building structure.
      b. Welded stud connectors for composite construction, concrete engagement, and attachment of building components.
      c. Anchor rods.
      d. Bent plate deck closures.
      e. Shop priming/painting and field touch-up.
      f. Architecturally Exposed Structural Steel (AESS); including shop and field preparation and painting.

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 03 3000: Cast-in-Place Concrete
   3. Section 04 2200: Concrete Unit Masonry
   4. Section 05 3000: Metal Decking
   5. Section 05 5000: Metal Fabrications
   6. Section 09 9600: High Performance coatings; field painting of exposed structural steel.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
   1. Chapter 22A – Steel

B. ASTM International (ASTM):
   1. ASTM A 6 – Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling
   2. ASTM A 108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
   3. ASTM A 123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   4. ASTM A 153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   5. ASTM A 307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength
   6. ASTM A 435 – Standard Specification for Straight-Beam Ultrasonic Examination of Steel Plates
   7. ASTM A 563 – Standard Specification for Carbon and Alloy Steel Nuts
   8. ASTM A 780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings

9. ASTM A 898 – Standard Specification for Straight Beam Ultrasonic Examination of Rolled Steel Structural Shapes
10. ASTM B 695 – Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
11. ASTM F 436 – Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel
12. ASTM F 844 – Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use
13. ASTM F 959 – Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners
14. ASTM F 1554 – Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
15. ASTM F 3125 – Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength

C. American Institute of Steel Construction (AISC):
1. AISC 360 – Specification for Structural Steel Buildings, March 9, 2005.
2. AISC 348 – Specification for Structural Joints Using ASTM A325 or A490 Bolts, June 30, 2004.
3. AISC 303 – Code of Standard Practice for Steel Buildings and Bridges, March 18, 2005.
    a. Provisions of AISC 303 do not effect change in duties and responsibilities of Owner, Contractor or Structural Engineer from those set forth in these Contract Documents.
    b. Where discrepancies exist between requirements of Contract Documents and AISC 303, requirements of Contract Documents govern.
4. AISC 341 – Seismic Provisions for Structural Steel Buildings, Including Supplement Number 1, March 9, 2005.
5. AISC 358 – Prequalified Connections for Special and Intermediate Moment Frames for Seismic Applications, December 13, 2005.

D. American Welding Society (AWS):
1. AWS D1.1 – Structural Welding Code -- Steel.
2. AWS D1.8 – Seismic Welding Supplement.
3. AWS A2.4 – Standard Symbols for Welding, Brazing and Nondestructive Examination.
4. AWS A5 – Filler Metal Specifications.
5. AWS C4.1 – Criteria for Describing Oxygen-Cut Surfaces and Oxygen Cutting Surface Roughness Gauge.
6. AWS QC1 – Standard for AWS Certification of Welding Inspectors.

E. The American Society of Mechanical Engineers (ASME):
1. ASME B18.21.1 – Washers: Helical Spring-Lock, Tooth Lock, and Plain Washers (Inch Series).

F. The Society for Protective Coatings (SSPC):
1. SSPC-SP 1 – Solvent Cleaning.
2. SSPC-SP 2 – Hand Tool Cleaning.
3. SSPC-SP 3 – Power Tool Cleaning.
4. SSPC-SP 6 – Commercial Blast Cleaning.
    a. Shop preparation only.

5. SSPC-SP 11 – Power Tool Clean to Bare Metal
    a. Field preparation only for welds and damaged shop primer.

G. Field preparation only for welds and damaged shop primer American Society of Non-Destructive Testing (ASNT):
1. ANSI/ASNT CP-189 – Standard for Qualification and Certification of Nondestructive Testing Personnel.
2. ASNT Recommended Practice No. SNT-TC-1A – Personnel Qualification and Certification in Nondestructive Testing.

1.03 DEFINITIONS

A. Demand-Critical Welds:
1. Designated on Structural Drawings.
2. Part of Seismic-Load-Resisting System.

B. Gouge:
1. Depression deeper than overall surface roughness.

C. Heavy Sections:
1. Rolled and built-up sections as defined below.
2. ASTM A 6 shapes with flanges thicker than 1-1/2 inches.
3. Welded built-up members with plates exceeding 2 inches in thickness,
4. Column base plates exceeding 2 inches in thickness.

D. Nondestructive Testing:
1. Nondestructive Testing (NDT) Includes:
    a. Magnetic Particle Testing (MT
    b. Penetrant Testing (PT)
    c. Radiographic Testing (RT
    d. Ultrasonic Testing (UT).
2. Terms nondestructive examination (NDE) and nondestructive testing (NDT) are synonymous.

E. Protected Zone:
1. Defined as structural members, or portions thereof, to which connections of structural and non-structural elements are limited.
2. Designated on Structural Drawings.

F. Quality Assurance Plan:
1. Set of written requirements containing set of procedures that are to be followed by Owner's Testing Agency to confirm compliance with these requirements.

G. Seismic-Load-Resisting System (SLRS):
1. Defined as items designated "SLRS" on Structural Drawings, including columns, beams, and braces, and their connections along grid lines denoted "SLRS" on framing plans.

H. Terminology for Architecturally Exposed Steel (AESS):
1. Architecturally exposed steel describes members and connections that will remain exposed to view from exterior and to interior occupied and public areas of completed building.

1.04 SUBMITTALS

A. Include following in accordance with requirements of Section 01 3300:
   1. Manufacturer's test reports and literature describing products, including but not necessarily limited to following, and excluding those listed in Article 1.06 B:
      a. Manufacturer's Certifications for electrodes, fluxes and shielding gasses to be used.
         1) Certifications satisfying AWS A5 requirements.
         2) Certificate of Compliance from Contractor supplying materials.
         3) Certifications that product meets additional requirements of Project.
      b. Manufacturer's product data sheets for welding material to be used.
         1) Data sheets describing product, limitations of use, recommended welding parameters, and storage and exposure requirements, including baking and rebaking.
   2. Plans of levels showing dimensioned location of edge of slab, deck, and openings.
      a. Submit prior to shop and erection drawings.
   3. Shop and Erection Drawings:
      a. Detailed shop and erection drawings for structural steel prior to start of fabrication and erection, showing:
      b. Size and location of structural members and connection material.
      c. Type, size and location of bolts and welds.
      d. Identification of high-strength bolted joints as snug-tight, pretensioned or slip-critical, as required by Contract Documents.
      e. Locations where Construction Documents require backing bars to be removed.
      f. Locations where Construction Documents require supplemental fillet welds where backing is permitted to remain.

B. Do not fabricate material prior to obtaining final review of submittals.

1.05 QUALITY ASSURANCE

A. Welding Inspector Qualifications:
   1. Welding Inspectors:
      a. Trained and thoroughly experienced in inspecting welding operations, and qualified as Certified Welding Inspectors (CWI) in accordance with AWS D1.1, AWS D1.3, AWS D1.8, and AWS QC1.
   2. NDT Personnel Qualifications:
      a. NDT personnel:
         1) Qualified under one of ASNT documents referenced in this Section.
      b. Perform NDT by NDT Level I personnel under close, direct supervision of NDT Level II.

B. Demand-Critical Welds:
   1. UT may be performed only by UT technicians certified as Level II by their employer, or as ASNT Level III certified by examination by ASNT.
   2. Train Ultrasonic testing technicians who perform flaw detection or sizing in applicable UT procedure and require them to demonstrate their competence through testing as prescribed in AWS D1.8, Annex E.

C. Bolting Inspector Qualifications:
   1. Demonstrate competency through administration of written examination and through hands-on demonstration by Inspector of methods to be used for bolt installation and inspection.

D. Qualifications:
   1. Steel Fabricator Qualifications:
      a. Have had not less than 5 years experience in fabrication of structural steel and be able to furnish evidence of his ability, facilities, proficiency of his personnel, and completed projects.
      b. Be City of Los Angeles Approved Licensed Fabricator.
      c. Experienced in fabricating AESS similar to that indicated for this Project, with record of successful in-service performance, and sufficient production capacity to fabricate AESS without delaying Work.
   2. Steel Erector's Qualifications:
      a. Have had not less than 5 years experience in erection of structural steel and be able to furnish evidence of his ability, facilities, proficiency of his personnel and completed projects.
   3. Welder Qualifications:
      a. Welders, Welding Operators, and Tackers:
         1) Qualified in accordance with AWS D1.1 and D1.8.
         2) Have valid Welding Performance Qualification Record (WPQR) for each welding procedure to be performed.
      b. Requalify Welders whose work fails to pass inspection before they perform further welding.
      c. Supplemental Welding Personnel Testing:
         1) Welders and welding operators performing work on bottom-flange Demand-Critical Welds:
            a) Pass Supplemental Welder Qualification Testing, as required by AWS D1.8, Section 5.1.
      d. FCAWS and FCAW-G are considered separate processes for welding personnel qualification
      e. Qualification Period:
         1) Requalify personnel who have not welded for period of three or more months.
         2) Requalify Welding personnel required to be tested using Supplemental Welding Personnel Testing by test within 12 months prior to beginning welding on Project.
      f. Pay costs of certifying qualifications and requalification of welding personnel.

E. Quality Assurance Submittals:
   1. Owner’s Testing Agency will submit following items:
      a. Quality Assurance Plan:
         1) Quality Assurance Plan containing Quality Assurance and Inspection items contained in this Section.
         2) Qualifications of Owner’s Testing Agency management and personnel designated for Project.
         3) Qualification records for Owner’s Testing Agency’s Inspectors and NDT technicians designated for Project.
         4) Owner’s Testing Agency’s Quality Control Plan for monitoring and control of Agency’s operations.

b. Written Practice for Owner's Testing Agencies:
   1) Maintain Written Practice for selection and administration of inspection personnel, describing training, experience, and examination requirements for qualification and certification of inspection personnel, including those of subcontracting agencies.
   2) Include following descriptions in Written Practice:
      a) Agency's procedures for determining acceptability of structure in accordance with applicable codes, standards, and specifications.
      b) Agency's inspection procedures, including general inspection, material controls, visual welding inspection, and bolting inspection.
   3) Bolting Inspection Procedures:
      a) Comply with AISC 348 and Quality Assurance Plan.
   4) Welding Inspection Procedures:
      a) Meet requirements of AWS D1.1 and D1.8, and Quality Assurance Plan.
   5) Nondestructive Testing Procedures:
      a) Describe in Written Practice responsibility of each level of certification for determining acceptability of material and welds in accordance with applicable codes, standards, specifications and procedures.

F. Structural Steel Pre-Construction Conference:
   1. When requested by Structural Engineer, hold Pre-construction Conference prior to performing fabrication or erection work, to review following:
      a. Submittal requirements
      b. Welding and bolting procedures
      c. Fabrication and erection issues
      d. Inspection requirements for structural steel operations.
   2. Attendees to include:
      a. Owner's Representative/Project Inspector
      b. Architect
      c. Structural Engineer
      d. Owner's Testing Agency
      e. Steel fabricator and steel erector personnel supervising shop, field, and Quality Control Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle packaged materials in original containers with seals unbroken and labels intact until time of use.

B. Store structural steel and handle in manner that prevents damage or distortion.
   1. Discharge materials carefully
      a. Do not dump onto ground.

C. Do not store materials on structure in manner that might cause distortion or damage to members of supporting structure.

D. Store structural steel members, whether on or off site, above ground on platforms, skids, or other support; store other materials in weather-tight, dry place until use.

E. Store materials to permit easy access for inspection and identification.

F. Electrode Requirements:
   1. Package weld filler metals conforming to requirements of AWS D.1.1.
      a. Only receive FCAW electrodes in undamaged moisture-resistant containers.
      b. Protected electrodes against contamination and injury during shipment and storage.
      c. When removed from protective packaging and installed on machines, take care to protect electrodes and coatings from deterioration or damage.
   2. Modification or lubrication of electrode after manufacture is not permitted.
      a. Exception – Drying only permitted when recommended by manufacturer.
   3. Electrode Storage and Exposure Limits for Demand-Critical Welds:
      a. Exposure Time Limit for Electrodes:
         1) Conform to AWS D1.8, Section 6.4.

G. Store fasteners in protected place.
   1. Except for ASTM F 1852 “twist-off” type assemblies, clean and re-lubricate bolts, nuts and washers that become dry or rusty before use.
   2. ASTM F 1852 fastener components may be re-lubricated following manufacturer’s written instructions, and must be retested after re-lubrication and prior to use to verify suitability for installation.

1.07 PROJECT CONDITIONS

A. Provide Owner’s Testing Agency with free access to places on and off Project Site where materials are stored or fabricated, to places where equipment is stored or serviced, and to Project Site.

B. Sequencing and Scheduling:
   1. Notify Architect and Owner’s Testing Agency in sufficient time prior to shop or field fabrication and erection to permit testing and inspection without delaying Work.
   2. Ensure timely delivery of items to be embedded in Work of other sections; furnish setting drawings and directions for installation
   3. Provide templates for setting of anchor rods, one per location.

PART 2 PRODUCTS

2.01 MATERIALS

A. Structural Steel:
   1. Domestically fabricated in United States of America (USA) for welded pieces.

B. Steel Shapes, Plates, Tube, Pipe, and Other Sections:
   1. As noted on Drawings.
   2. HSS Shapes:
      a. Manufactured (rolled and seam welded) in USA.
   3. Alternatively, HSS shapes from outside USA when accepted:
      a. Test seam welds by ultrasonic examination.
   4. Costs of tests and repairs, borne by Contractor.

C. Heavy Sections:
   1. Heavy Sections in Seismic-Load-Resisting System:
      a. Supplied with Charpy V-notch (CVN) testing in accordance with AISC 341 requirements.
   2. Plates and Flanges in Heavy Sections:
      a. Free of laminations within 3 inches of areas to be welded with complete-joint-penetration welds.

D. Standard Threaded Fasteners:
   1. Machine Bolts and Nuts: ASTM A 307, Grade A.
   2. Plain Washers: ASTM F 844.
   3. Beveled Washers: ANSI B18.23.1.

E. High Strength Bolts:
   1. ASTM F 3125, snug-tight, unless otherwise noted.
   2. Bolted Joints in Seismic-Load-Resisting System:
      a. Slip-Critical, with pre-tensioned high-strength bolts and Class A faying surface or better.
   3. Twist-off-Type Tension-Control Bolt Assemblies: ASTM F 3125.
   4. Direct Tension Indicators: Load Indicator Washers: ASTM F 959
   5. Nuts for High Strength Bolts: ASTM A563.
   6. Washers for High Strength Bolts: ASTM F436.

F. Welding Materials:
   1. Comply with AWS D1.1 and D1.8 with nominal 70 ksi tensile strength.
   2. Supplemental Requirements for Seismic-Load-Resisting System:
      a. Welds: Meet requirements of AWS D1.8, Section 6.

G. Welded Stud Connectors:
   1. Headed Shear Studs:
      a. AWS D1.1 “Type B ” automatic end-welded headed studs made from ASTM A108, Grade 1015 or 1020.
   2. Threaded Studs:
      a. Automatic end-welded threaded studs made from ASTM A108, Grades 1010 through 1020.

H. Anchor Rods and Nuts:
   1. ASTM F1554; Grade as noted on Drawings.
   2. Grade 55:
      a. Weldable per supplement S1.
      b. Minimum CVN toughness of 15 ft-lbs at 40 degrees F per supplement S4.
   3. Grade 105:
      a. Minimum CVN toughness of 15 ft-lbs at minus 20 degrees F per supplement S5.

I. Threaded Rods:
   1. As noted on Drawings.

J. Clevises and Turnbuckles:
   1. AISI C 1035
   2. Design strengths corresponding to AISC Steel Construction Manual with ultimate capacities at least 200 percent of tabulated LRFD values.

K. Shop Primer:
1. Carbozinc 859 VOC Organic Zinc-Rich Epoxy Primer by Carboline Company, Hydro-Zinc 94-H20 by Tnemec Company; or approved equal.
   a. VOC compliant.with SCAQMD Rule 1113.
2. Coordinate selection of primer with finish paint requirements in Section 09 9600.
   a. Primer and finish coat materials for exposed steel are required to be complete system by one manufacturer
3. Prime painting with specified shop primer is required of structural steel, exposed or concealed, except where indicated otherwise.

L. Galvanizing:
1. Provide zinc coating for those items indicated or specified to be galvanized, as follows:
   a. ASTM A 123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8 inch thick and heavier.
   b. ASTM A 386 for galvanizing assembled steel products.
      1) Perform galvanizing after fabrication with Work assembled in as large sections as can be handled.
   c. ASTM A 153 for galvanizing iron and steel hardware.
2. Remove projections, barbs, and icicles after galvanizing.
3. Do not galvanize AESS and other exposed structural steel and components specified to receive zinc-rich primer and high performance paint system.

M. Galvanizing Repair Paint:
1. Zinc-rich coatings meeting requirements of ASTM A 780 or SSPC Paint-20, with dry film containing not less than 94 percent zinc dust by weight.

N. Dry-Pack Cement Grout:
1. Portland cement (ASTM C 150, Type I or Type III) and clean, uniformly graded, natural sand (ASTM C 404, Size No.2).
2. Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum water required for placement and hydration.

O. Nonshrink Nonmetallic Grout:
1. Factory premixed, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.
2. Provide one of following or grout specifically recommended by manufacturer for types of applications indicated:
   a. Masterflow 713 Plus; BASF Building Systems
   b. Sealtight 588 Grout; W.R. Meadows
   c. Five Star Grout; Five Star Products, Inc.
   d. SikaGrout 212; Sika Corporation.

P. Architecturally Exposed Structural Steel (AESS):
1. Provide Architecturally Exposed Structural Steel as defined in Article 1.05 H, for members and connections indicated.
2. Conform to AESS 4 level of quality control and following:
   a. Exposed surfaces to be smooth, free of embedded scale, trademarks, roll imperfection marks, and other surface irregularities.
      1) Fill depressions with weld metal of same composition as parent metal.
   b. Grind welds, raised marks smooth and flush with adjacent surfaces.

c. Exposed members to be straight and true.
1) Select or straighten members to meet permissible variations of ASTM A 6 for carbon steel, subject to tolerances of AISC specification for AESS.
2) Conform to tolerance requirements indicated for members that received or mate with other Work.
3) Select or straighten steel to receive, support, or stiffen members of building enclosure system

3. Do not galvanize steel identified as AESS, or otherwise indicated to receive high performance coating..

2.02 SOURCE QUALITY CONTROL

A. Owner's Testing Agency will:
1. Review ladle analysis and certificates of compliance.
a. Where certification is questionable, test material to verify compliance.
2. Inspect shop fabrication.
3. Provide management, personnel, equipment, and services required to perform quality control functions required below.
4. Verify that no improper attachments to Protected Zone have been made.
5. Inspect Heavy Sections:
a. Heavy Section Flanges:
1) Ultrasonically examined at locations to be groove-welded, for evidence of laminations, inclusions, or other discontinuities, in accordance with ASTM A898.
a) Examination includes entire area within 3 inches of such joints.
b. Plates:
1) Ultrasonically examine in accordance with ASTM A435.
2) Reject material exhibiting discontinuity causing total loss of back reflection that cannot be contained within circle with diameter of greater of 3 inches or one-half the plate thickness.
6. Forward copies of product and procedure certificates, data sheets, and test and inspection reports to Owner, Architect, Structural Engineer, Contractor, and DSA.
7. Review and approve Welding Procedure Specifications (WPSs).

B. Welding Inspection:
1. Welding Inspector:
a. Do not consider following list to be exclusive of additional inspection tasks that may be necessary to meet requirements of AWS D1.1 and D1.8, CBC, and Quality Assurance Plan.
b. Perform tasks indicated in following list:
1) Review and understand applicable portions of specifications, Contract Documents and shop drawings for Project.
2) Verify that applicable welder qualifications, welding operator qualifications, and tack welder qualifications are available, current, accurate, and in compliance with this Section.
3) Verify welder identification and qualification.
a) Verify that required supplemental welder qualification testing, when required for joint, has been executed and that welder has passed.
4) Verify that each welder has unique identification mark or die stamp to identify welds.

5) Verify that applicable Welding Procedure Specifications (WPSs), with Procedure Qualification Records (PQRs) as needed, are available, current and accurate, and comply with AWS D1.1 and D1.8 and this Section.
6) Verify that approved Welding Procedure Specification (WPS) has been provided and that each welder performing weld has reviewed WPS.
   a) Make copy of appropriate WPS available for each joint, although need not be present at each joint location.
7) Review mill test reports for main member and designated connection base material for compliance with Project requirements.
8) Verify base material identification with Contract Documents.
9) Verify electrode, flux and shielding gas certifications for compliance with Contract Documents.
10) Verify welding consumables with approved WPSs.
11) Verify that electrodes are used only in permitted positions and within welding parameters specified in WPS.
12) Verify that electrodes and fluxes are properly stored, and that exposure limits for welding materials are satisfied.
13) At suitable intervals, observe joint preparation, assembly practice, preheat temperatures, interpass temperatures, welding techniques, welder performance, and post-weld controlled cooling and heat treatment to ensure that requirements of WPS and AWS D1.1 and D1.8 are satisfied.
14) At suitable intervals, verify current and voltage of welding equipment in application of WPS, when needed, by calibrated amp and voltmeter.
   a) Measure current and voltage near arc with this equipment.
15) Inspect Work to ensure compliance with AWS D1.1 and D1.8 and specified weld acceptance criteria.
16) Schedule NDT technicians in timely manner, after visual inspection is complete and assembly has cooled.
   a) Perform Final NDT on specific weld at least 24 hours after welding has been completed.
17) Mark welds, parts, and joints that have been inspected, and accepted, with distinguishing mark or die stamp, or maintain records indicating specific welds inspected and accepted by each inspector.
18) Document accepted and rejected items in written report.
   a) Transmit report to designated recipients in timely manner.

C. Nondestructive Testing of Welded Joints:
   1. Magnetic Particle Testing:
      a. Conducted by Owner's Testing Agency at frequency designated in Table 2-1.
      b. Perform in accordance with AWS D1.1, and AWS D1.8 Annex F.
   2. Ultrasonic Testing:
      a. Conducted by Owner's Testing Agency for percentage of joints designated in Table 2-1.
      b. Perform in accordance with AWS D1.1 and D1.8.
   3. Weld Acceptance Criteria:
      a. Perform in accordance with AWS D1.1 and D1.8.
      b. Identify regions of welds that cannot be inspected and recorded, and notify Structural Engineer.

4. K-Area Welding Inspection:
   a. After welds of continuity plates and doubler plates have cooled to ambient temperature, test column webs for cracking using liquid penetrant (PT) or magnetic particle testing (MT) over zone 3 inches above and below each weld.

D. Table 2-1. Nondestructive Testing Requirements

Nondestructive Testing Requirements		
Weld Category	Complete-Joint-Penetration Welds[1]	Partial-Joint-Penetration Welds and Fillet Welds
Welds not described Below	No NDT required unless otherwise noted	No NDT required unless otherwise noted
SLRS welds not described below	MT 25 percent of joints, full length[2]	MT 25 percent of joints, 6 inch spot at random[2]
Top-flange joints at cantilever beam connections[3]	MT 100 percent of joints, full length UT 100 percent of joints, full length	MT 100 percent of joints, full length
Demand-Critical Welds: Butt joints in column splices	MT 100 percent of joints, full length UT 100 percent of joints, full length[4]	UT 25 percent of joints, full length[2]

E. Notes for Table 2-1:
1. UT is required only when the weld thickness is 5/16 inch or greater.
2. Where joint fails testing, test 100 percent of joints until 40 consecutive welds pass.
   a. Testing rate may then be reduced to 25 percent.
3. Test joint on each side of cantilever beam support.
4. Reduce rate of UT to 25 percent, when after 40 welds have been inspected, individual welder's reject rate is less than 5 percent.

2.03 FABRICATION

A. General Requirements:
1. Fabricate structural steel in accordance with AISC 360 (Chapter M and Section J2), AISC 303, and AWS D1.1 and D1.8 as applicable to Statically Loaded Structures, except as otherwise noted herein.
   a. Assume thermally cut edges are subject to tension stresses.
   b. Delete paragraphs M4.6 and M5.1 from Chapter M of AISC 360.
2. Fabricate and assemble Work, including AESS, in shop to greatest extent possible.
3. Where possible, use procedures that do not require Architect's approval.
   a. Such approval may not be given in some circumstances.
4. Coordinate as required for attachment of other work to structural steel.
5. Drill or punch holes for passage of reinforcing steel shapes, sections, plates, or bars as indicated on Structural Drawings.
   a. Notify Architect of conditions not shown or noted.
6. Allowable Tolerances:
   a. Comply with AISC 360, Chapter M, and AISC 303, Section 6.
   b. Where more restrictive tolerances are necessary to properly install other building systems and components then adopt more restrictive tolerances.

7. Holes and attachments to structural steel in areas designated as Protected Zone are not allowed except as explicitly shown or noted on Structural Drawings.

B. Fabrication Requirements for AESS:
1. Locate field joints in AESS assemblies at concealed locations or as acceptable to Architect.
a. Detail AESS assemblies to minimize field handling and expedite erection.
2. Fabricate AESS with exposed surfaces smooth, square, and of surface quality consistent with specified AESS level of quality control.
a. Use special care in handling and shipping of AESS both before and after shop painting.
b. Fabricate so that piece marks are fully hidden in final structure, or made to permit full removal after erection.
3. Welding of AESS:
a. In addition to general welding requirements specified, conform to following for AESS:
1) Grind welds of AESS smooth including seams of tubes.
2) Make groove welds flush to surfaces on each side, within tolerance of plus 1/16 inch and minus 0 inch of plate thickness.
3) Oversize welds as required and grind to provide smooth transition.
4) At locations where welding on far side of exposed connection occurs, grind distortion and marking of steel to smooth profile with adjacent material.
b. Provide continuous welds of uniform size and profile where welding is noted on Drawings .
4. Fabricate steel to half normal tolerance as specified in AISC Code of Standard Practice, Section 10.
5. Maintain uniform joint gap of 1/8 inch, plus or minus1/32 inch at copes and blocks.
6. Deliver steel with no mill marks (stenciled, stamped, or raised) in exposed locations.
a. Omit mill marks by cutting of mill material to appropriate lengths where possible.
1) Where not possible, fabricator may fill and grind surface finish consistent with specified level of quality control.
7. Grind edges of sheared or punched steel consistent with specified level of quality control.
a. Flame cutting of AESS is not permitted.
8. Seal weld open ends of round and rectangular hollow structural section with 3/8 inch closure plates.
a. Provide continuous, sealed welds at angle to gusset plate connections and similar locations where AESS is exposed to weather.

C. Connections:
1. Shop Connections:
a. Bolted or welded as noted.
2. Field Connections:
a. Locate splices only where noted or approved by Architect.
3. Assemble structural steel in shop to maximum extent possible, prior to shop priming or galvanizing.

D. Bolted Joints:
   1. Punch or drill holes 1/16 inch larger than bolt size.
      a. Drill material having thickness in excess of connector diameter plus 1/8 inch rather than punch.
   2. Ream unfair holes, but only up to next larger bolt size and install bolt corresponding to new hole size.
      a. Where unfairness exceeds maximum, weld hole in base material solid and drill hole of proper size.
   3. Remove burrs that would prohibit solid seating of connected parts.
   4. Mark completely tightened bolts with identifying symbol.
   5. Provide hardened washers over slotted holes.
   6. Draw up tight, check threads with chisel or provide approved lock washers where bolts are not pretensioned.
   7. Assembly with Standard Threaded Fasteners:
      a. Provide beveled washers under bolt heads or nuts resting surfaces exceeding five percent slope with respect to head or nut.
   8. Assembly of High-Strength Structural Bolted Joints:
      a. Meet requirements of AISC 348.
      b. Seismic-Load Resisting System Joints:
         1) Slip-critical (friction-type) as defined in AISC 348 with Class A or better faying surfaces.
      c. Provide hardened washers under provided under the element turned in tightening procedure of high strength bolts.
      d. Direct Tension Indicator Washers, Where Used:
         1) Provide under head of slip-critical high strength bolts.

E. Welded Construction – Shop and Field:
   1. Weld in accordance with AISC 360, AWS D1.1 and D1.8, and CBC Chapter 22.
   2. Perform welding in accordance with WPS for joints.
   3. Welds Permanently Exposed to View:
      a. Remove burrs, flux, welding oxide air spots, and discolorations.
      b. Make surfaces of such welds reasonably smooth and uniform.
   4. Make exterior welds watertight.
   5. Assign each welder working on Project identification symbol or mark.
      a. Require each welder to mark or stamp this identification symbol at each weld completed.
      b. When used, stamps, are to be low-stress type.
   6. Before testing, apply visible mark , “for UT,” to welds to be subjected to ultrasonic testing (UT) accurately placed on steel at distance of 4 inches away from root of edge preparation.
   7. Groove Welds:
      a. Complete-joint-penetration welds, unless specifically designated otherwise.
   8. Make WPS available to welders and inspectors prior to and during welding process.
      a. Prior to welding, verify joint fit-up by welder for conformance with WPS and AWS D1.1 and D1.8.

F. Supplemental Welding Requirements:
   1. Maximum Preheat and Interpass Temperature:
      a. Maximum preheat and maximum interpass temperature permitted is 550 degrees F, measured at distance of 1 inch from point of arc initiation.

b. This maximum temperature may not be increased by WPS, regardless of qualification testing.

2. Nonfusible Backing:
   a. Use of nonfusible backing materials, including ceramic and copper, is permitted only with satisfactory welder qualification testing performed using type of backing proposed for use and using test plate shown in AWS D1.1 and D1.8, Figure 4.21, except with groove dimensions as provided in WPS and PQR.
   b. For nonfusible weld tabs and short segments of nonfusible backing bars used at ends of welds between shear plates and column faces, or at end of continuity plate welds, special welding personnel and welding procedure qualification testing is not required.
3. Peening, Controlled Cooling, and Post-Weld Heat Treatment (PWHT):
   a. Where peening, controlled cooling, or PWHT are used, perform in accordance with AWS D1.1 and D1.8 with written procedure for their performance incorporated into appropriate WPS.
4. Where insulating blankets are used to control cooling, written procedure and temperature measurements are not required.
5. Application of heat immediately following completion of joint to maintain nominal temperature at or below 550 degrees F is not considered PWHT.
6. Intermix of Filler Metals:
   a. For Demand-Critical Welds in which different weld filler metals are used, supplemental toughness conduct testing as prescribed in FEMA 353, Part I, Appendix C.
7. Wind Velocity Limits:
   a. In Seismic-Load-Resisting-System, in lieu of wind speed limitations in AWS D1.1, do not perform welds using GMAW, FCAW-G, GTAW and EGW methods when wind velocity in immediate vicinity of weld exceeds three miles per hour.
   b. Welding performed within enclosed area, and not subject to drafts may be deemed to satisfy this requirement.
   c. For SMAW, FCAW-S, and SAW processes, do not allow wind to affect appearance of molten weld puddle.
8. Welded Joints of Seismic-Load-Resisting-System conforming to AWS D1.8, Section 6.

G. Welded Joint Details:
1. Backing Bars:
2. Use backing bars in accordance with AWS D1.1 and D1.8.
3. Remove backing bars where required by Contract Documents or AWS D1.1 and D1.8
   a. Heavy Section Splices Requiring Removal of Backing Bars:
      1) Remove backing bars from welded splices of Heavy Sections.
      2) Where fusible backing material is used, backgouge root pass area after backing bar removal, and backwelded until flush or with slight reinforcement.
      3) Grind surface flush and smooth.
   b. Beam-Column Connection Joints Requiring Removal of Backing Bars:
      1) Following removal of backing, remove unsound weld metal at root area and excessive weld discontinuities, and backweld.
      2) Minimize gouging and removal of base metal.

3) Reinforcing fillet weld with minimum leg size of 5/16 inch or root opening plus 1/16 inch.
   a) Provide whichever is larger.
4) Perform MT on fillet weld and immediately adjacent area.

c. When groove weld backing is permitted to remain, provide backing not to exceed 3/8 inch thickness.
   1) For connections of seismic-load-resisting system in which backing is not removed, attach backing to member or plate that does not have its surface prepared for groove weld.
   2) Make attachment by either 1/4 inch fillet or 1/8 inch groove weld along complete bar length on side of bar opposite groove weld.

4. Weld dams are not allowed.
5. Weld Tabs:
   a. Use of Weld Tabs:
      1) Terminate welds at end of joint in manner that will ensure sound welds.
         a) Use weld tabs for this purpose, whenever necessary.
      2) Extend weld tabs beyond edge of joint distance equal to minimum of part thickness, but not less than 1 inch.
      3) Orient weld tabs parallel to joint preparation and to weld direction.
      4) Nonfusible weld tabs may be used in applications and locations where qualified in accordance with AWS D1.1 and D1.8, Section 4.
      5) Heavy Section Joint Weld Tab Removal and Finish:
         a) Welded tension splices in Heavy Sections: Remove weld tabs and grind Extra Smooth.
      6) SLRS Beam-Column Connection Weld Tab Removal and Finish:
         a) Remove weld tabs of SLRS connections.
         b) Removal may be performed by air carbon arc cutting (CAC-A), grinding, chipping, or thermal cutting to within 1/8 inch of base metal surface.
         c) For continuity plate weld tabs, removal within 1 inch of plate edge is adequate.
         d) Control process to minimize removal of base metal except for that material immediately adjacent to weld.
         e) Finish edges where weld tabs have been removed Extra Smooth.
         f) In SLRS connections, repair gouges deeper than 1/16 inch at locations of removal of weld tabs by welding according to specified requirements for Deep Gouges.
         g) Weld filler metal requirements for Demand-Critical Welds apply.
         h) provide smooth transition at contour of weld at ends, free of gouges and sharp corners.
         i) Minimum radius at corner need not be provided.
         j) Following weld tab removal, finishing, and completion of necessary repairs, inspect exposed ends of weld using magnetic particle testing (MT).
6. Weld Toes:
   a. Provide smooth transition between weld and base metal, whether for groove welds or fillet welds.
   b. As-welded profile is adequate provided it satisfies criteria of AWS D1.1, Section 5.24.

7. Weld Access Holes:
   a. Meet dimensional, surface finish, and testing requirements of AISC 360 Chapter J1.6 and AWS D1.1, except as otherwise required by Contract Documents.
   b. Where height of weld access hole exceeds quantity k-tf+1-1/2 inch, or where length of weld access hole exceeds 4 tf (where k and tf are defined in AISC 360), welded reinforcement is required.
      1) Notify Architect for specific instruction.
   c. At welded flange joints that are part of Seismic Load Resisting System, use weld access hole detail shown in Figure 6.2 of AWS D1.8 unless section is Heavy Section.
   d. Provide SLRS access hole conforming to AWS D1.8, Section 6.9.2.
   e. Inspect SLRS weld access holes using magnetic particle testing (MT) or liquid penetrant testing (PT) and be free of cracks.
      1) When welded gouge repair has been performed, perform magnetic particle testing (MT).
8. Web Weld Details: Provide minimum clear distance of 1/2 inch between weld access hole and fillet welds connecting shear plate and beam web.
9. Sequence Welding for Moment Connection of Bottom Beam Flange to minimize residual stresses in joint
10. Weave Passes: Weave passes are not permitted in groove welds in SLRS column continuity plate details.
    a. Column Continuity Plate Details:
       1) When backing bars are used and remain in place, provide reinforcing fillet weld between backing bar and column flange.
       2) No fillet weld should be placed between backing bar and continuity plate.
       3) Weld terminations near end of column flange tips may be completed using weld tabs.
          a) Remove weld tabs.
          b) Conform to AWS D1.8 Sections 6.10.3 and 6.10.4.
          c) Following finishing, inspect edge using MT.
          d) Terminate fillet weld between continuity plate and column web approximately 1/4 inch from each end of joint.
11. Tack Welds in SLRS Protected Zones:
    a. Tack welds in SLRS Protected Zones are permitted only where they are incorporated into required weld.

H. Heavy Sections:
   1. Refer to AISC 360 Chapter A3.1c for materials requirements.
   2. Applicability of Provisions: Requirements of AISC 360 for Group 4 and 5 shapes apply to Heavy Sections as defined in this Section.
   3. Access Hole Requirements:
      a. Access holes conforming to requirements of AISC 360, Chapter J1.6.
      b. Weld access holes must be preheated to minimum of 150 degrees F prior to thermal cutting and ground to Extra Smooth finish.
      c. Inspect holes for cracks using either penetrant testing (PT) or magnetic particle testing (MT).
      d. Optionally, weld access holes may be made by drilling and saw-cutting without grinding, but PT or MT of cut surface is still required.
   4. Welding:
      a. Minimum preheat and interpass temperature as specified in AISC 360, Chapter J2.

b. Remove weld tabs and backing bars and grind to Extra Smooth finish, with reinforcement not to exceed 1/8 inch at transition slope not to exceed 1:10.
c. Refer to AISC 360 J2 for preheat requirements and J1.5 for weld tab and backing bar removal requirements.

5. Splices:
   a. Conform to requirements of AISC 360, Chapter J1.5

I. Camber:
1. Provide camber as indicated on Contract Drawings in accordance with AISC 360 Chapter M2.1.

J. Welded Connectors:
1. Install in accordance with AWS D1.1 and D1.8 and manufacturer's recommendations.
2. No porosity or evidence of lack of fusion between end of stud and steel member is permitted.

K. Repair of Discontinuities in Protected Zone of Seismic-Load-Resisting System.
1. Tack Welds:
   a. Tack welds are permitted only when they are incorporated into required weld.
2. Repair of Discontinuities:
   a. When erection aids within Protected Zone cannot be avoided, Structural Engineer’s approval of aid’s placement, use, and repair method is required.
   b. Conform to AWS D1.8 Section 6.15.4.
3. Air Carbon Arc Cutting and Thermal Cutting:
   a. Air carbon arc cutting (CAC-A) and thermal cutting is permitted in Protected Zone with prior approval of Structural Engineer for removal of backing bars and weld tabs, as specified.
4. Repair gouges in members and connections in Seismic-Load-Resisting System according to specified requirements.
   a. Weld filler metal requirements for Seismic-Load-Resisting System apply, unless otherwise noted.

L. Surface Finish
1. Flush Surfaces:
   a. Finish welds in butt joints required to be flush, so as not to reduce thickness of thinner base metal or weld metal by more than 1/16 inch, or 5 percent of material thickness, whichever is less.
   b. Remaining reinforcement not to exceed 1/32 inch in height.
      1) Remove reinforcement where weld forms part of faying or contact surface.
      2) Blend reinforcement smoothly into plate surfaces with transition areas free from undercut.
2. Finish Methods and Values:
   a. Chipping and gouging may be used, provided these methods are followed by grinding.
   b. Where surface finishing is required, finish surface Extra Smooth, unless otherwise noted or specified.
   c. Measurement of surface finish values by visual appearance or tactile comparison is acceptable.

M. Repair of Gouges:
1. Gouges are not permitted in areas requiring AESS finish surface, or where specifically prohibited by AWS D1.1 and D1.8 or this Section.
2. Repair of Gouges:
    a. Meet following requirements, unless otherwise noted:
    b. Shallow Gouges:
        1) Remove gouges up to 3/16 inch deep by grinding per D1.1, or to radius of not less than 3/8 inch.
3. Deep Gouges:
    a. Repair gouges deeper than 3/16 inch by welding.
    b. Prior to welding, grind gouges to provide smooth contour with radius not less than 3/8 inch.
    c. Preheat repair area to temperature between 400 degrees F and 550 degrees F, measured at point of welding approximately one minute after removal of heating source, or preheat in accordance with AWS D1.1 Annex XI for high restraint.
        1) Follow written repair WPS for application.
        2) Following completion of welding, grind area flush and smooth, with fairing of welded surface to adjoining surfaces where applicable, and inspect using magnetic particle testing (MT).
4. Transitional slope after gouge removal not to exceed 1:5.

N. Weld Acceptance Criteria:
1. In accordance with AWS D1.1 and D1.8.
2. Identify regions of welds that cannot be inspected and record, and notify Structural Engineer.

2.04 SHOP FINISHES

A. Galvanizing:
1. Provide hot dip galvanize coating in accordance with ASTM A 153 for exterior bolts, fasteners, and hardware when indicated.
2. Perform galvanizing after fabrication, including but not necessarily limited to, shearing, punching, bending, forming, assembling, and welding in largest units practicable.
3. Remove projections, barbs, and icicles after galvanizing.
4. Repair abraded galvanized surfaces not indicated to be painted as specified in "Execution"
5. Do not galvanize items indicated or specified to receive organic zinc-rich epoxy shop primer.
    a. This includes AESS and other steel components exposed in final Work.

B. Shop Prime Painting:
1. Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar, or indicated to be galvanized.
2. Paint embedded steel which is partially exposed on exposed portions and initial 2 inches of embedded areas only.
    a. Do not paint surfaces which are to be welded
    b. Do not paint surfaces or components where indicated to be galvanized.
3. Preparation:
    a. Clean surfaces of mill scale, grease, dirt and foreign matter by sandblasting or wire brushing with power tool.
        1) Prepare surfaces according to SSPC-SP 2 as minimum.

2) Prepare surface specified to receive organic zinc-rich primer according to SSPC- SP6.

4. Contact Surfaces:
   a. Clean immediately prior to assembly and leave unpainted.
      1) Heavily coat machine finished surfaces with tallow or other similar removable viscous coating to prevent corrosion.
5. Priming:
   a. Apply one coat primer, minimum 3.0 mils dry film thickness.
   b. Prime steel parts not in contact but inaccessible for priming after erection with two coats of primer, minimum total of 6.0 mils dry film thickness.
   c. Thoroughly work primer into joints, angles, and open spaces.
6. Touch-up of Shop Coat:
   a. Clean abraded, burned, and otherwise damaged spots and exposed bolts in accordance with SSPC-SP 11 and spot prime with one coat of specified primer.
7. Rusting:
   a. Remove and replace shop prime coat showing evidence of rusting over 25 percent of surface after erection.

C. Shop Cleaning and Prime Painting of Architecturally Exposed Structural Steel (AESS):
   1. Clean surfaces just prior to painting by dry blast in accordance with SSPC-SP6.
   2. Fill small pit marks in otherwise smooth, sound surfaces with metallic compound, finish flush and smooth.
   3. Apply one coat of specified two component zinc-rich epoxy primer to produce minimum dry film thickness of 3.0 to 5.0 mils per coat after fabrication and cleaning, except to field weld areas
      a. Apply two coats to areas that will be inaccessible after fabrication or installation.

D. Field Finish for Architecturally Exposed Structural Steel (AESS):
   1. Clean surfaces in accordance with SSPC-SP 2 or SP 3 as required and apply touch up primer as necessary.
   2. Comply with requirements of Section 09 9600 for color top coat.

2.05 LEED REQUIREMENTS

A. Credit EQ – Low Emitting Materials:
   1. Paints and Coatings

B. Credit MR:
   1. BPDO – Sourcing of Raw Materials:
      a. Provide percentage of recycled content, both post-consumer and pre-consumer.
      b. Provide distance between Project Site and extraction site.
      c. Provide distance between Project Site and final manufacturing location.

PART 3 EXECUTION

3.01 INSPECTION

A. Examine units of Work to be placed and verify that anchor rods have been installed properly and have sufficient bolt and thread elevation.

B. Inspect AESS members upon delivery for twist, kinks, gouges, or other imperfections that may result in rejection of appearance of member.
   1. Coordinate remedial action with fabricator prior to erecting steel.

C. Do not begin erection before unsatisfactory conditions have been corrected.

3.02 ERECTION

A. General Requirements:
   1. Erect structural steel in accordance with AISC 360 Chapter M, AISC 303, and AWS D1.1 – Structural Steel Welding Code as applicable to Statically Loaded Structures.
   2. Requirements for bolted and welded joints specified in Part 2 of this Section also apply to field connections unless otherwise noted.
   3. Erection Tolerances:
      a. Do not exceed erection tolerances specified in AISC 303, Section 7.
      b. Where more restrictive tolerances are necessary to properly install other building systems and components then adopt more restrictive tolerances.
   4. Where erection requires performing work of fabrication on Project Site, conform to applicable standards for fabrication.

B. Field Cutting or Alteration:
   1. Field cutting, alteration, or repair of structural steel members or of connections will not be permitted without prior review and approval by Structural Engineer.
   2. Repair structural elements with fabrication errors or that do not satisfy tolerance limits.
      a. Submit drawings showing reasons for, and details of, proposed corrective Work.

C. Set anchor rods in conformance with Section 7.5 of AISC 303.

D. Temporary Shoring and Bracing:
   1. Provide shoring and bracing as needed until permanent lateral-support is in place and complete.
   2. Contractor is responsible for identifying need for temporary shoring and bracing.

E. Erection Procedures:
   1. Control erection procedures and sequences to avoid problems caused by temperature differentials and weld shrinkage, and other sources of expansion and contraction.

F. Field Assembly:
   1. Clean bearing surfaces and surfaces to be in permanent contact before assembling members.
   2. Do not fasten splices of columns and other members with bearing joints designated on Drawings before abutting surfaces have been brought completely into contact.
   3. Bolted Construction:
      a. Installation of high-strength bolts conforming to ASTM A325 for slip-critical or snug-tightened type joints, as applicable, in accordance with AISC 348.
         1) Provide washer under:

a) Head or nut of high strength bolts.
b) Element being turned during tightening.

2) Tension bolts in welded connections after completion of welding.

b. At bolted joints designated as Slip-Critical or that require Pretension, use Twist-off-Type Tension-Control bolt assemblies or Direct Tension Indicators.

c. Do not use flame cutting to align bolt holes except as permitted by AISC 348 specifications.
1) Ream holes that must be enlarged to admit bolts.
2) Do not enlarge holes to diameter greater than 1 inch.
3) When reaming beyond 1/32 inch, drill or ream to next larger hole size and use next larger size bolt.

4. Remove mill scale from column in area where beam flanges will be welded to column.

G. Gas Cutting:
1. Use of flame cutting torch is generally prohibited and will only be permitted after Architect's prior written approval and only where metal cut will not carry stress during cutting, and cut surfaces will not be visible.
2. When thermal cutting is permitted, perform cutting with mechanically guided torch or torch controlled using guide bar.

H. Remove and repair galvanized surface as required for field welding in accordance with ASTM-A780, A2; required thickness is 100 micro-inches.
1. Touch up with specified zinc-rich coating.
2. Extend repair material at least three inches beyond edges of damaged areas.

I. Protected Zone:
1. Attachments to structural steel in Protected Zone, other than spot welding of metal deck to beams and welding of metal studs to braces as shown on Structural Drawings, are not allowed.

3.03 FIELD QUALITY CONTROL

A. Owner's Testing Agency Requirements:
a. Verify proper anchor rod group location, elevation, and orientation prior to placement of concrete foundations, and subsequent to placement of concrete foundations prior to arrival of structural steel.
2. Perform field welding inspection and testing in accordance with requirements in Part 2 of this Section for shop fabrication, unless otherwise noted.
3. Inspect and test high strength bolted joints in accordance with AISC 348.
4. Sample and test bolt assemblies that include direct tension indicators, on daily basis to verify proper indication of deformation with required bolt tension for each size and lot.
5. Inspect erected structural steel as required to establish conformity of Work with reviewed shop drawings and Contract Drawings.
6. Perform testing and inspection of welded stud connectors in accordance with requirements of AWS D1.1 and D1.8.
a. No evidence of tearing or cracking of weld section after performance of bend test.
7. Inspect structural steel to verify that Protected Zones of members of Seismic-Load-Resisting System are free of damage and attachments not approved by Structural Engineer.

8. Forward copies of test and inspection reports to Owner, Architect, Structural Engineer, Contractor, and DSA.

3.04 FIELD PAINTING AND TOUCH-UP

A. Field Touch-Up of Primer:
   1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, resulting from Work of this Section in accordance with SSPC-SP 11 and spot prime, with same paint used for shop prime painting.
   2. Apply by brush or spray to provide minimum dry film thickness of 2.0 mils.

A. Repair of Galvanized Surfaces:
   1. Repair areas damaged by welding, cutting, or during handling, transport or erection in accordance with ASTM A 780 by application of multiple coats of galvanizing repair paint, to dry film thickness of 8 mils.
   2. Perform touch up using specified zinc-rich coating.
   3. Extend repair material at least three inches beyond edges of damaged areas.

3.05 CLEANING

A. After erection, thoroughly clean surfaces of foreign or deleterious matter such as dirt, mud, oil, or grease that would impair bonding of concrete, or other finishes as applicable.

END OF SECTION 05 1200

SECTION 05 3000

METAL DECKING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Metal Floor Decking as indicated.
   2. Metal Roof Decking as indicated.
   3. Accessory items include but are not necessarily limited to:
      a. Metal Closure strips.
      b. Flexible Closure Strips
      c. Shear Connectors.

B. Related Sections:

1.	Section 01 4100:	Regulatory Requirements; current Code edition.
2.	Section 01 4500:	Quality Control.
3.	Section 03 3000:	Cast-i-Place Concrete; concrete for roof deck.
4.	Section 05 1200:	Structural Steel Framing
5.	Section 07 5416:	Thermoplastic Polyolefin (TPO) Membrane Roofing
6.	Section 07 6200:	Sheet Metal Flashing and Trim.
7.	Section 07 9200:	Joint Sealants
8.	Section 09 9100:	Painting; finish painting of metal deck.

C. Related Requirements:
   1. Refer to respective Sections of Divisions 22, 23, and 26 for plumbing items, mechanical equipment, and electrical equipment scheduled to installed on Roof for coordination with roof openings and penetrations.

1.02 REFERENCES

A. Comply with requirements of California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.

B. ASTM International (ASTM):
   1. ASTM A 36 – Standard Specification for Carbon Structural Steel
   2. ASTM A 108 – Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished
   3. ASTM A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   4. ASTM A 780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
   5. ASTM D 746 – Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact
   6. ASTM D 1056 – Standard Specification for Flexible Cellular Materials—Sponge or Expanded Rubber

C. American Welding Society (AWS):
   1. AWS D1.1 – Structural Welding Code-Steel
   2. AWS D1.3 – Structural Welding Code-Sheet Steel

D. American Iron and Steel Institute (AISI):
   1. AISI Specification for Design of Cold-Formed Steel Structural Members.

E. Steel Deck Institute (SDI):
   1. SDI Design Manual for Floor Decks and Roof Decks.
   2. ANSI/SDI RD-2017 – Standard for Steel Roof Deck

F. International Code Council (ICC) Evaluation Reports:
   1. ICC-ES Report ESR-1414
   2. ICC-ES Report ESR-1735
   3. ICC-ES Report ESR-2408

G. International Association of Plumbing and Mechanical Officials (IAMPO):
   1. Uniform Evaluation Reports (UES):
      a. IAPMO UES ER-0161
      b. IAPMO UES ER-2018

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications and installation instructions for each product specified.
      a. Include manufacturer's certification as may be required to show compliance with these specifications.
   2. Furnish following as applicable:
      a. ICC ES Reports for each metal deck type.
      b. IAMPO UES Reports for each metal deck type.

B. Shop Drawings:
   1. Detailed drawings showing layout and types of deck panels, anchorage details and every condition requiring closure panels, supplementary framing, special jointing or other accessories.
      a. Indicate manufacturer's name, metal gage, and deck section properties.

1.04 QUALITY ASSURANCE

A. General:
   1. Metal decking steel conforming to requirements of strengths and properties of standards specified.

B. Testing:
   1. Perform testing and inspection in accordance with requirements specified in Section 05 1200.

C. Codes and Standards:
   1. Comply with provisions of referenced codes and standards.
   2. Qualify welding processes and welding operators in accordance with "Welder Qualification" procedures of AWS D1.1 and D1.3

D. Identification of Metal Decking Steel:
   1. Conforming to standards specified in Section 01 4500.
   2. Furnish sufficient evidence from fabricator to Architect attesting to compliance with specified requirements.

3. Unclassified or unidentified decking is not permitted.
   a. Furnish deck manufacturer's certified mill analyses and test reports for each heat covering decking having F_y of 33 Ksi or less.
   b. For decking having F_y greater than 33 Ksi, testing laboratory shall perform one tension and elongation test and one bend or flattening test for each gage

E. Unidentifiable Steel:
1. Steel which is not readily identifiable as to grade from markings and test records is not permitted.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. ASC Steel Deck, West Sacramento, CA

B. United Steel Deck Inc., Summit, NJ

C. Verco Decking, Inc., a Nucor Company, Phoenix, AZ

D. Vulcraft Group/Nucor Corporation, Florence, SC

E. Members of Steel Deck Institute (SDI), or approved equal:
1. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:
   a. Submit items listed in “Submittals” Article and as specified in Section 01 3300, for evaluation of proposed system.
   b. Complete project shop drawings for similar project may be submitted for evaluation purposes, however shop drawings specific to this Project will be required from successful bidder.
   c. Tests shall have been made for identical systems within ranges of specified performance criteria.

2.02 MATERIALS

A. Structural Steel:
1. Domestically manufactured and fabricated in United States of America (USA).

B. Metal Decking:
1. Roll-formed sheets conforming to ASTM A 653, with G90 zinc coating.
2. Section properties conforming to applicable provisions of latest edition of AISI – Specification for the Design of Cold-Formed Steel Structural Members.

C. Miscellaneous Steel Shapes:
1. Conforming to ASTM A 36 for steel shapes not covered in Section 05 1200.

D. Shear Connectors:
1. Headed Stud Type:
   a. Conforming to ASTM A 108, Grade 1015 or 1020, cold finished carbon steel:
      1) Dimensions complying with AISC specifications.
2. Nelson fluxed shear connector studs, or approved equal.

E. Flexible Closure Strips:
   1. Vulcanized, closed-cell, expanded chloroprene elastomer, complying with ASTM D 1056, Grade SCE No. 41.
   2. Brittleness Temperature: Minus 40 degrees F, ASTM D 746.
   3. Flammability Resistance: Self-extinguishing.

F. Sheet Metal Accessories:
   1. Sheet steel, minimum yield strength of 33,000 psi, not less than 0.0359 inch thickness, of same material and finish as deck, profile indicated or required for application.
   2. Furnish with ASTM A 653, G90 zinc coating.

G. Metal Closure Strips:
   1. Fabricate metal closure strips of galvanized sheet steel of same quality as deck units, but not less than nominal 0.0359 inch (20 gage) thick before coating.
   2. Form to configuration required to provide tight-fitting closures at open ends and sides of decking.

H. Joint Sealing Material:
   1. Non-skinning, gun-grade, bulk compound as recommended by deck manufacturer.
   2. Comply with requirements of Section 07 9200.

2.03 FABRICATION

A. Form deck units of sections designed to support required live load between supporting members
   1. Provide decking in lengths to span over three or more supports with flush, with interlocking side laps, 2-1/2 inches minimum end bearing, and 1-1/2 inches minimum side bearing, unless otherwise indicated.

B. Floor Deck Units:
   1. Provide fluted sections of metal thickness, depth, and width as shown.

C. Roof Deck Units - General:
   1. Provide G90 galvanized non-vented deck configurations complying with SDI – Roof and Floor Deck Specifications, of metal thickness, depth and width as shown.

D. Provide deck units complying with ICC ES Reports as follows:
   1. ICC-ES Report ESR-1414 or ESR-1735, for steel decks without concrete fill.
   2. ICC-ES Report ESR-1735 or ESR-2408, for steel decks with concrete fill.

E. Roof Sump Pans:
   1. Fabricate from single piece of 14 gage galvanized sheet steel with level bottoms and sloping sides to direct water flow to drain unless otherwise shown.
   2. Provide sump pans of adequate size to receive roof drains and with bearing flanges not less than 3 inches wide.
   3. Recess pans not less than 1-1/2 inch below roof deck surface, unless otherwise shown or required by deck configuration.

F. Metal Closure Strips:
   1. Fabricate metal closure strips of galvanized sheet steel of same quality as deck units, but not less than nominal 0.0359 inch (20 gage) thick before coating.
   2. Form to configuration required to provide tight-fitting closures at open ends and sides of decking.

G. Welding:
   1. Provide materials and methods in accordance with recommendations of steel decking manufacturer.
   2. Hold decking tight to supporting elements with screws or other means for proper welding or crimping of decking edges.
   3. Conform to AWS D1.3, and to patterns and weld types indicated, with welds free from sharp edges and protrusions.
   4. Field coat welds and abraded surfaces at completion with anodic type galvanizing repair paint.

2.04 PERFORMANCE REQUIREMENTS:

A. Calculate properties of deck sections on basis of effective design width as limited by provisions of AISI specifications.
   1. Provide deck section properties not less than those specified, including section modulus and moment of inertia per foot of width.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install metal deck units and accessories in accordance with manufacturer's recommendations, final shop drawings, and as specified.

B. Do not start placement of deck units before supporting members are installed.
   1. Place deck units on supporting steel framework and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened.
   2. Lap ends not less than what is specified in this Section.
   3. Do not stretch or contract side-lap interlocks.

C. Place deck units flat and square, secured to adjacent framing without warp or excessive deflection.

D. Do not place deck units on concrete supporting structure until concrete has cured properly and is dry.

E. Coordinate and cooperate with structural steel erector in locating decking bundles to prevent overloading of structural members.

F. Do not use deck units for storage or working platforms until permanently secured in position.

G. Fastening Deck Units:
   1. Permanently fasten deck units to steel supporting members as noted on Structural Drawings.
   2. Fasten side laps between supports as indicated on Drawings.

H. Cutting and Fitting:
   1. Cut and fit deck units and accessories around other work projecting through or adjacent to decking.
   2. Provide neat, square and trim cuts.

I. Reinforcement at Openings:
   1. Provide additional metal reinforcement and closure pieces as required for strength, continuity of decking and support of other work shown.

J. Shear Stud Connectors:
   1. General:
      a. Ensure that steel surfaces where shear stud connectors are to be installed are free of loose mill scale, heavy rust and paint.
         1) When shear studs are to be welded through metal decking, ensure that top surface of supporting structural steel is unpainted and free of dirt and debris before metal decking is installed.
            a) Remove shop primer as necessary.
         2) Remove water in decking flutes so that it does not become entrapped between metal decking and structural steel.
         3) Install metal decking so that bottom ribs are in continuous contact with top of structural steel member.
            a) Flatten embossments as necessary to achieve full contact.
      b. Shear studs welded through metal decking may replace equivalent diameter plug weld.
      c. Do not permit placement of reinforcing steel, temperature mesh and other materials which will interfere with shear stud installation.
      d. Do not install shear studs on steel surfaces that are wet.
   2. Welding:
      a. Weld automatic end welded studs in accordance with manufacturer's recommendations in such manner as to provide complete fusion between end of stud and plate.
      b. There should be no porosity or evidence of lack of fusion between welded end of stud and plate.
      c. Stud shall decrease in length during welding approximately 1/8 inch for 5/8 inch diameter and under, and 3/16 inch for over 5/8 inch diameter.
      d. Perform welding using only qualified welders approved by welding inspector.
   3. Inspection and Testing:
      a. Type and capacity of welding equipment shall be checked and approved by welding inspector.
      b. Perform inspection of shop and field welding in accordance with CBC, Part 2, Section 2231A.5 with following modifications:
         1) At beginning of each day's work make minimum of two test stud welds with equipment to be used, to metal which is same as actual work piece.
            a) Subject test studs to 90 degree bend test by striking them with heavy hammer.
         2) Replace studs bent to 90 degree by adjacent new studs.
         3) In addition, test two studs per beam by bending 15 degree from vertical.
            a) Studs shall show no signs of weld failure.
         4) After test, weld section shall not exhibit tearing out or cracking.

K. Roof Sump Pans:
1. Place over openings provided in roof decking and weld to top decking surface.
2. Space welds not more than 12 inches on center with at least one weld at each corner.
3. Cut opening in bottom of roof sump to accommodate drain size indicated.
a. Coordinate with Plumbing Drawings for correct pipe size.

L. Closure Strips:
1. Provide metal closure strips at open uncovered ends and edges of roof decking, and in voids between decking and other construction.
a. Weld into position to provide complete decking installation.
2. Provide flexible closure strips instead of metal closures, at Contractor's option, wherever their use will ensure complete closure.
a. Install with adhesive in accordance with manufacturer's instructions.

M. Roof Insulation Support:
1. Provide metal closure strips for support of roof insulation where rib openings in top surface of roof decking occur adjacent to edges and openings.
2. Weld closure strips into position.

3.02 FIELD QUALITY CONTROL

A. Install steel decking under continuous inspection according to CBC Chapter 22A.

3.03 FIELD PAINTING AND TOUCH-UP

A. Field Touch-Up Painting:
1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, resulting from Work of this Section, and paint exposed areas with same paint used for shop prime painting.
2. Apply by brush or spray to provide minimum dry film thickness of 2.0 mils.

B. Repair of Galvanized Surfaces:
3. Repair areas damaged by welding, cutting, or during handling, transport or erection in accordance with ASTM A 780 by application of multiple coats of galvanizing repair paint, to dry film thickness of 8 mils.
4. Perform touch up using specified zinc-rich coating.
5. Extend repair material at least three inches beyond edges of damaged areas.

C. Touch-Up Painting:
1. After decking installation, wire brush, clean, and touch-up scarred areas, welds, and rust spots on top and bottom surfaces of decking units and supporting steel members.
2. Painted Surfaces:
a. Clean field welds, and abraded areas.
b. Touch-up with primer and finish paint.
3. Galvanized Surfaces:
a. Clean field welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A 780.

3.04 CLEANING

A. Remove and legally dispose of rubbish, debris, and waste materials off Project Site, complying with requirements of Section 01 7419.

3.05 PROTECTION

A. Protect Work until Substantial Completion.

END OF SECTION 05 3000

SECTION 05 4000

COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Cold-formed metal framing for:
      a. Exterior steel stud walls
      b. Roof rafters framing
      c. Ceiling joist framing
      d. Deflection Track
      e. Bridging, bracing, clips, and accessories
      f. Headers

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 05 1200: Structural Steel Framing
   3. Section 05 5000: Metal Fabrications
   4. Section 09 2216: Non-Structural Metal Framing
   5. Section 09 2400: Portland Cement Plaster
   6. Section 09 2900: Gypsum Board; glass mat exterior gypsum sheathing board.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.

B. ASTM International (ASTM):
   1. ASTM A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM A 780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   3. ASTM C 954 – Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
   4. ASTM C 955- Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases.
   5. ASTM C 1007 – Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories.
   6. ASTM C 1513 – Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.

C. American Iron and Steel Institute (AISI):
   1. AISI-S100 – North American Specification for the Design of Cold-Formed Steel Structural Members, current edition.
   2. AISI-S110 – Standard for Seismic Design of Cold-Formed Steel Structural Systems, current edition.

3. AISI-S200 – Standard for Cold-Formed Steel Framing – General Provisions, current edition with Commentary.
4. AISI-S201 – North American Standard for Cold-Formed Steel Framing-Product Data, current edition.
5. AISI-S211 – Standard for Cold-Formed Steel Framing – Wall Stud Design, current edition with Commentary
6. AISI-S212 – Standard for Cold-Formed Steel Framing - Header Design, current edition with Commentary.
7. AISI-S213 – Standard for Cold-Formed Steel Framing – Design, current edition with Commentary.

D. American Welding Society (AWS):
1. AWS D1.1 - Structural Welding Code - Steel.
2. AWS D1.3 - Structural Welding Code - Sheet Steel.

E. International Code Council Evaluation Service (ICC-ES):
2. ICC ES Reports (ESR):
a. ICC ES Report No. ESR-3016 .
b. ICC ES Report No. ESR-3064P.
c. ICC ES Report No. ESR-2620

F. Steel Framing Industry Association (SFIA):
3. Technical Guide for Cold-Formed Steel Framing Products.
4. Intertek Code Compliance Research Report CCRR-0224

G. Certified Steel Stud Association (CSSA).

H. Steel Stud Manufacturers Association (SSMA).
1. Product Technical Guide.

1.03 SUBMITTALS

A. Product Data: Manufacturer's product literature, data sheets and installation recommendations for specified products.

B. Sustainable Design Submittals:
1. Recycled Content: Certify recycled content of metal stud and track; indicate recycled content percent and whether pre-consumer or post-consumer.
2. Regional Materials: Certify materials extracted, processed, and manufactured within 500 mile radius of Project Site.

1.04 QUALITY ASSURANCE

A. Manufacturer’s Qualifications:
1. Current member of SFIA, CSSA, or SSMA, with current Code Compliance Certification
2. Provide full time quality control over fabrication and erection complying with applicable codes, ordinances, rules and regulations of authorities having jurisdiction.

B. Installer Qualifications: Minimum 2 years experience in performing Work of this Section on similar projects.

C. Welding:
   1. Comply with AWS D1.1 and AWS D1.3.
   2. Qualify welding processes and welding operators in accordance with AWS "Standard Qualification Procedure".

D. Pre-Installation Conference:
   1. Convene at Project Site 2 weeks prior to beginning Work of this Section.
   2. Attendees include, but are not limited to:
      a. Owner, Architect, Structural Engineer, Contractor, and framing system installer.
   3. Review and discuss Project requirements, substrate conditions, and manufacturer's installation instructions.

1.05 DELIVERY, STORAGE AND HANDLING

A. Store materials protected from exposure to rain and other harmful weather conditions, at temperature and humidity conditions per ASTM C 955.

B. Handle products in accordance with manufacturer’s instructions and AISI NASPEC.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, provide cold-formed metal framing by current members of one of following:
   1. Certified Steel Stud Association (CSSA):
      a. Comply with ICC ES Legacy Report No. ESR-3016
   2. Steel Stud Manufacturers Association (SSMA):
      a. Comply with ICC ES Legacy Report No. ESR-3064P.
   3. Steel Framing Industry Association (SFIA):
      a. Intertek Code Compliance Research Report CCRR-0224

2.02 MATERIALS

A. Galvanized Steel:
   1. Meet or exceed requirements of ASTM A 653.
   2. Coating Class:
      a. G60 per ASTM C 955.
   3. Recycled Content: Minimum 35 percent, with minimum 19.8 percent classified as post consumer and minimum 14.4 percent classified as pre-consumer.

B. Stud Punch-Outs:
   1. Minimum 10 inches between end of member and near edge of web punch-out and 24 inches on center thereafter, per ASTM C 955.

2.03 COMPONENTS

A. Manufactured from prime mill certified steel.
   1. Re-rolled steel without mill certificate is not acceptable.

B. Cold-Formed Structural Studs:
   1. Galvanized steel C-studs complying with ASTM C 955.

2. Flange length, web depth, minimum material thickness, and minimum yield strength as indicated on Drawings.

C. Structural Track:
1. Cold-formed galvanized steel runner tracks complying with ASTM C 955.
2. Flange length, web depth, minimum material thickness, and minimum yield strength as indicated on Drawings.

D. Deflection Track:
1. Cold-formed deep leg runner slip track.
2. Leg length, minimum material thickness, and minimum yield strength as indicated on Drawings.
3. Web: Design to accommodate stud width for single track or interior track width for double track system.

E. Standard Clip Angles:
1. Minimum thickness: As indicated on Drawings.
2. Minimum yield strength: 50 ksi.

F. U-Channel (CRC Cold Rolled Channel):
1. As indicated on Drawings.

G. Furring Channels:
1. As indicated on Drawings.

H. Header:
1. Outer Member: Flange length, web depth, minimum material thickness, and minimum yield strength as indicated on Drawings.
2. Inset Member: Flange length, web depth, minimum material thickness, and minimum yield strength as indicated on Drawings.

2.04 ACCESSORIES

A. Framing Accessories:
1. Complying with ASTM C 955
2. Provide following as required:
a. Flat strapping for X-bracing.
b. Flat strapping and bridging for lateral bracing.
c. Gusset plates.
d. Flat steel sheets.

B. Fasteners:
1. Self-drilling, self-tapping screws complying with ASTM C 1513.

C. Touch-Up Paint:
1. Complying with ASTM A 780.

2.05 FABRICATION

A. Framing components may be preassembled into panels prior to erection.

B. Fabricate panels square, with components attached to prevent racking and minimize distortion during lifting and transport.

C. Cut framing components square for attachment to perpendicular members or as required for angular fit against abutting members.

D. Plumb, align, and securely attach studs to flanges of both upper and lower runners.
   1. Refer to requirements in Section 09 2216 for interior, non-load bearing walls where studs do need to be attached to upper or lower runners.

E. In doubled jamb studs and doubled headers not accessible for insulating, provide insulation equal to thicknesses specified elsewhere.

F. Splices in members other than top and bottom runner track are not permitted.

G. Provide temporary bracing required until erection is completed.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect supporting substrates and structures for proper conditions for installation and performance of cold-formed structural framing.

B. Verify that attachment surfaces are plumb, level, and in proper alignment to accept cold-formed structural framing.

3.02 INSTALLATION – NON-AXIAL LOAD-BEARING WALLS

A. Securely anchor runners to supporting structure as indicated on Drawings.

B. Stud Spacing:
   1. As indicated on Drawings.

C. Install jack studs or cripples below window sills, above window and door heads, and elsewhere to furnish support.

D. Provide lateral bracing by use of gypsum board, gypsum sheathing, steel sheets, or by horizontal straps or cold-rolled channels; conform to AISI-S100 NAS.

E. Make provisions for vertical movement where indicated on Drawings.

F. Perform handling and lifting of prefabricated panels in manner to prevent distortion in members.

3.03 INSTALLATION – JOISTS

A. Joist Spacing:
   1. As indicated on Drawings.

B. Align joist bearing at foundation walls by means of shims or non-setting grout.

C. Locate joists or load distribution member directly over bearing studs at top of bearing walls.

D. Provide web stiffeners at reaction points or points of concentrated loads or where indicated on Drawings.

E. Install joist bridging where indicated on Drawings.

F. Install additional joists under parallel partitions when partition length exceeds one-half joist span and around floor and roof openings that interrupt one or more spanning members, unless otherwise indicated.

G. Install end blocking where joist ends are not otherwise restrained from rotation.

END OF SECTION 05 4000

SECTION 05 5000

METAL FABRICATIONS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Miscellaneous metal fabrications as shown.
   a. Includes items fabricated from iron and steel shapes, plates, and bars which are not part of other metal systems specified elsewhere.
2. Work includes, but is not necessarily limited to:
   a. Anchor bolts not specified elsewhere.
   b. Miscellaneous steel framing and supports.
      1) Includes framing and supports for counter tops.
   c. Miscellaneous steel trim
   d. Metal Ladders:
      1) Exterior Ladders:
         a) High Parapet Access Ladder.
      2) Interior Ladders:
         a) Roof Access
         b) Elevator Pit
   e. Metal stairs.
   f. Steel pipe and tube handrails and railing systems
      1) Includes perforated metal infill panels.
   g. Metal Gate at Trash Enclosure.
3. Finishes

B. Related Sections:
1. Section 01 4100: Regulatory Requirements; current Coded Edition.
2. Section 03 3000: Cast-in-Place Concrete: concrete stair fill.
3. Section 05 0513: Shop-Applied Coatings for Metal; powder coating on Perforated metal panels.
4. Section 05 4000: Cold-Formed Metal Framing; load bearing steel stud framing
5. Section 07 1813: Pedestrian Traffic Coatings; coating on concrete stair treads.
6. Section 07 7233: Roof Hatches; ladder safety posts and safety railing system.
7. Section 09 2216: Non-Structural Metal Framing; backing and mounting reinforcement for cabinets and equipment items.
8. Section 09 9100: Painting; shop priming and field painting of exposed metal work not indicated to receive shop-applied or high performance coatings.
9. Section 09 9600: High Performance Coatings; shop priming and field painting of exposed steel components where indicated.

C. Related Requirements:
1. Items furnished, but not installed under this Section:
   a. Inserts and Anchorages:

1) Furnish inserts and anchoring devices which must be set in concrete for installation of sign and stair support framing.

b. Provide setting drawings, templates, instructions and directions for installation of anchorage devices.

c. Coordinate delivery with other work to avoid delay.

1.02 REFERENCES

A. California Code of Regulations, Title 24, California Building Code (CBC), Part 2, Volumes 1 and 2, current edition,
1. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.

B. ASTM International (ASTM):
1. ASTM A 36 – Standard Specification for Carbon Structural Steel
2. ASTM A 53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
3. ASTM A 123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
4. ASTM A 153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
5. ASTM A 283 – Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates
6. ASTM A 307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60000 PSI Tensile Strength
7. ASTM A 500 – Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes
8. ASTM A 501 – Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing
9. ASTM A 780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
10. ASTM A 1008 – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable
11. ASTM A 1011 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
12. ASTM B 209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
13. ASTM B 221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
14. ASTM C 1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)

C. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
1. ASCE/SEI 7– Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

D. American Welding Society (AWS):
1. AWS D1.1 – Structural Welding Code – Steel.
2. AWS D1.3 – Structural Welding Code – Sheet Steel.
3. AWS QC1 – Standard for AWS Certification of Welding Inspectors.

E. American Institute of Steel Construction (AISC):
   1. AISC 360 – Specification for Structural Steel Buildings.

F. American Iron and Steel Institute (AISI):
   1. AISI S100 – North American Specification for the Design of Cold-Formed Steel Structural Members.

G. American National Standards Institute (ANSI):
   1. ANSI ASC A14.3 - American National Standards For Ladders - Fixed - Safety Requirements

H. Aluminum Association (AA):
   1. Aluminum Design Manual, current edition
   2. CA-92 – Care of Aluminum
   3. DAF-45 – Designation System for Aluminum Finishes

I. National Association of Architectural Metal Manufacturers (NAAMM):
   1. AMP 500 – Metal Finishes Manual

J. American Galvanizers Association, Inc. (AGA):
   1. AGA - Inspection of Hot-Dip Galvanized Steel Products

K. The Society for Protective Coatings (SSPC):
   1. SSPC-SP 1 – Solvent Cleaning.
   2. SSPC-SP 2 – Hand Tool Cleaning.
   3. SSPC-SP 3 – Power Tool Cleaning.
   4. SSPC-SP 6 – Commercial Blast Cleaning.
      a. Shop preparation only.
   5. SSPC-SP 11 – Power Tool Clean to Bare Metal
      a. Field preparation only for welds and damaged shop primer.

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications, anchor details, and installation instructions for products to be used in fabrication of miscellaneous metal, including paint products.
   2. Product Data for Specified Shop Primer System:
      a. Material List:
         1) Provide inclusive list of required coating materials Identify material by manufacturer's catalog number and general classification.
      b. Manufacturer's Information:
         1) Provide manufacturer's technical information, including label analysis and instructions for handling, storing, and applying coating material proposed for use.

B. Shop Drawings:
   1. For fabrication and erection of miscellaneous metal assemblies.
      a. Include plans and elevations at not less than 1/2 inch to 1 foot scale.
      b. Provide large scale construction details of various parts, including, but not necessarily limited to:
         1) Methods of joining.
         2) Thickness of metals.

3) Profiles of surfaces.
4) Reinforcing, anchorage, and accessory items.

c. Include details of sections and connections at not less than 3 inch to 1 foot scale.

2. Include information regarding concealed and exposed joints, welds, and fastenings.
3. Provide templates for anchor or bolt installation by others.

C. Samples:
1. As requested by Architect.

1.04 QUALITY ASSURANCE

A. Design Criteria:
1. Design Work to support normally imposed loads and conform to AISC, AISI, and ASCE/SEI 7 requirements.

B. Standards:
1. Conform to applicable provisions and performance referenced standards where indicated.

C. Field Measurements:
1. Take field measurements prior to preparation of shop drawings and fabrication, where possible.
2. Do not delay job progress; allow for trimming and fitting wherever taking field measurements before fabrication might delay Work.

D. Qualifications:
1. Fabricator Qualifications:
a. Successfully engaged for minimum of 5 years in manufacture of metal fabrications work, similar to to that specified and indicated for this Project.
b. Fabricator qualifications are subject to Owner and Project Inspector’s review and approval before subcontract is awarded.
2. Qualifications for Welding Work:
a. Qualify welding procedures and welding operators in compliance with AWS Qualification requirements of AWS D1.1.
b. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, when pertinent, has undergone recertification.
c. When recertification of welders is required, retesting will be Contractor's responsibility.
3. Welding Inspector Qualifications:
a. Welding Inspectors:
1) Trained and thoroughly experienced in inspecting welding operations.
2) Qualified as Certified Welding Inspectors (CWI) in accordance with AWS D1.1, AWS D1.3, and AWS QC1.
4. Welder Qualifications:
a. Qualify welders, welding operators, and tackers in accordance with AWS D1.1.

E. Shop Assembly:
   1. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly.
   2. Disassemble units only as necessary for shipping and handling limitations.
   3. Clearly mark units for reassembly and coordinated installation.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle packaged materials in original containers with seals unbroken and labels intact until time of use.

B. Discharge materials carefully and store on clean concrete surface or raised platform in safe, dry area.

C. Electrode Requirements:
   1. Package weld filler metals conforming to requirements of AWS D.1.1.
      a. FCAW Electrodes: Received in undamaged moisture-resistant containers.
      b. Protect electrodes against contamination and injury during shipment and storage.
      c. When removed from protective packaging and installed on machines, take care to protect electrodes and coatings from deterioration or damage.

1.06 PROJECT CONDITIONS

A. Scheduling and Sequencing:
   1. Ensure timely fabrication of items to be embedded or enclosed by other Work.
   2. Furnish information and assistance required for locating embedded items and be responsible for proper locations.

B. Field Measurements:
   1. When possible, verify dimensions by field measurement before fabrication.
   2. Established Dimensions:
      a. Where field measurements cannot be made without delaying Work, indicate established dimensions on shop drawing submittal and proceed with fabrication.
      b. Contractor will be responsible for holding established dimensions.

1.07 WARRANTY

A. Pipe Railing Warranty:
   1. Manufacturer’s standard warranty, agreeing to repair or replace components of pipe railings that fail in materials or workmanship within specified warranty period.
      a. Failures include, but are not necessarily limited to:
         1) Structural failures.
         2) Deterioration of metals, metal finishes, and other materials, beyond normal weathering.
      b. Warranty Periods:
         1) Two years
         2) Five year finish warranty for railings scheduled to receive high performance coating specified in Section 09 9600.

B. Manufacturer's Limited Warranty for Prefabricated Aluminum Ladders:
   1. Warranty Period:
      a. 5 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MATERIALS AND COMPONENTS – GENERAL

A. Metal Surfaces – General:
   1. For fabrication of miscellaneous metal work which will be exposed to view, only use materials which are smooth and free of surface blemishes
   2. Do not use materials having exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, rolled trade names, roughness, oil canning, stains, discoloration or other imperfections.

B. Steel Plates, Shapes and Bars:
   1. Conforming to ASTM A 36.

C. Steel Sheets:
   1. Conforming to ASTM A 1011, Grade C.

D. Steel Pipe:
   1. Type S, Grade B
   2. Black finish unless galvanizing is required.
   3. Standard Weight (Schedule 40), unless otherwise shown or specified.
   4. Conforming to ASTM A 53.

E. Steel Tube:
   1. As noted on Drawings.
   2. HSS Shapes:
      a. Conforming to ASTM A 500.
      b. Manufactured (rolled and seam welded) in USA

F. Structural Steel Sheet:
   1. Cold-rolled conforming to ASTM A 1008, Class 1.
   2. Hot-rolled, conforming to ASTM A 1011.
   3. Grade required for design loading.

G. Steel Plates:
   1. For cold forming or bending:
   2. Conforming to ASTM A 283, Grade C.

H. Perforated Metal:
   1. Carbon Steel, Cold Rolled, Mill Finish.
      a. Thickness:
         1) 16 Gauge (.0598 inch)
      b. Round Holes:
         1) Size (Diameter): 3/16 inch
         2) Pattern: 3/16 inch round on 1/4 inch staggered centers
         3) Arrangement: 60 degree staggered centers.
         4) Holes Per Square Inch (HPSI): 18.47
         5) Straight rows parallel to length of sheet.
         6) Margins parallel to width of sheet.

a) Sheared through both ends of sheet.
7) Margins parallel to length of sheet:
a) Minimum solid both sides
8) End Pattern:
a) Sheared through both ends.
9) Open Area: 51 percent
c. Weight: 1.25 lbs./square foot
d. Item 16311416 as manufactured by McNichols Company, Cerritos, CA
1. Angle Edging:
a. Carbon Steel, Cold Rolled, Mill Finish.
1) 1/16 inch x 1 inch x 16 Gage (0.0598 inch thick)
b. Install angle edging on four sides of perforated metal panels with mitered corners.
c. Tack weld angle to back of perforated metal panel prior to applying powder coated finish.
d. Refer to Drawing details for additional miscellaneous components for complete installation.

I. Aluminum Members:
1. Alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish:
a. 6061-T6 or 6063-T5 aluminum alloy
1) Conforming to:
a) ASTM B 221 for extrusions
b) ASTM B 209 for sheet/plate.

J. Welding Electrodes and Filler Metal:
1. Carbon Steel:
a. Use electrodes recommended by AWS.

K. Fasteners:
1. Use fasteners made of same basic metal as fastened metal, unless otherwise indicated.
a. Do not use metals which are corrosive or incompatible with materials joined.
b. Do not use exposed fasteners except where unavoidable.
1) Match finish of metal surrounding fastener.
2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.
3. Select fasteners for type, grade and class required.
4. Steel Bolts and Nuts:
a. Regular hexagon head type, ASTM A 307, Grade A; with hex nuts.
5. Lag Bolts:
a. Square head type
1) Conforming to ASME B 18.2.1
6. Machine Screws:
a. Cadmium plated steel
1) Conforming to ASME B 18.6.3
7. Wood Screws:
a. Flat head carbon steel
1) Conforming to ASME B 18.6.1
8. Plain Washers:
a. Round, carbon steel

1) Conforming to ASME B 18.21.1

9. Lock Washers:
   a. Helical spring type carbon steel
      1) Conforming to ASME B 18.21.1
10. Expansion Bolts:
   a. Concrete Anchorage:
      1) Hilti Kwik Bolt TZ2
         a) Conforming to ICC ESR-4266
   b. Masonry Anchorage:
      1) Hilti Kwik Botl TZ2
         a) Conforming to ICC ESR-4561

L. Anchors and Inserts:
   1. Furnish inserts for setting in concrete and provide other anchoring devices as required for installation of fabricated metal items.

M. Nonshrink Nonmetallic Grout:
   1. Factory premixed, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.
   2. Provide one of following or grout specifically recommended by manufacturer for types of applications indicated:
      a. Masterflow 713 Plus; BASF Building Systems
      b. Sealtight 588 Grout; W.R. Meadows
      c. Five Star Grout; Five Star Products, Inc.
      d. SikaGrout 212; Sika Corporation.

N. Shop Primer for Ferrous Metal:
   1. Carbozinc 859 VOC Organic Zinc-Rich Epoxy Primer by Carboline Company, Hydro-Zinc 94-H20 by Tnemec Company, or approved equal; VOC compliant.
   2. Coordinate selection of primer with finish paint requirements in Section 09 9600.
      a. Primer and finish coat materials for exposed steel are required to be complete system by one manufacturer
   3. Prime painting with specified shop primer is required of structural steel, exposed or concealed, except where indicated otherwise.

O. Galvanizing:
   1. Provide zinc coating for those items shown or specified to be galvanized, as follows:
      a. Conform to ASTM A 123:
         1) For galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8 inch thick and heavier.
         2) For galvanizing assembled steel products.
      b. Conform to ASTM A 153:
         1) For galvanizing iron and steel hardware.
   2. Perform galvanizing after fabrication with Work assembled in as large sections as can be handled.
   3. Remove projections, barbs, and icicles after galvanizing.
   4. Galvanizing Repair Paint:
      a. Organic zinc rich paint complying with ASTM A 780 or SSPC-Paint 20, with dry film containing not less than 94 percent zinc dust by weight.
   5. Do not galvanize exposed steel and components indicated or specified to receive zinc-rich primer and high performance paint system.

P. Isolation Between Dissimilar Materials:
   1. Provide single-component, inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
      a. VOC compliant.
   2. Elasto-Deck BT as manufactured by Pacific Polymers, div. ITW Polymers Sealants North America, or equivalent product acceptable to Architect.

Q. Joint Sealant:
   1. Comply with requirements of Section 07 9200 and following.
      a. Nonsag, nonstaining, silicone sealant complying with ASTM C 920.
      b. Of type and grade required to seal joints in formed metal
      c. As recommended in writing by formed metal manufacturer or fabricator.

2.02 FABRICATION – GENERAL

A. Fabricate items to comply with requirements indicated, including those for quality, thickness and finish of material as well as those indicating dimensions and details.
   1. Use heavier metal gages, stiffeners or metal backing as required to produce surface flatness, free of "oil-canning", and to impart sufficient strength for use indicated.
   2. When not otherwise indicated, provide following minimum thickness of metal and comply with SMACNA recommendations for fabrication and installation details:
      a. Sheet Steel: 16 gage.
      b. Galvanized Sheet Steel: 16 gage.
   3. Work to dimensions shown or accepted on shop drawings, using proven details of fabrication and support.
   4. Use type of materials shown or specified for various components of Work.

B. Use hot-rolled steel bars for work fabricated from bar stock, unless shown or specified to be fabricated from cold-finished or cold-rolled stock.

C. Supply as part of this Section, miscellaneous small parts of material thinner than 10 gage, or items specifically called out, when such supply is normal and accepted part of Work.

D. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
   1. Ease exposed edges to radius of approximately 1/32 inch, unless otherwise shown.
   2. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing Work.

E. Form sheet metal items in maximum lengths and keep joints to minimum.
   1. Do not exposed cut edges of sheet metal except as indicated.
   2. Fold back exposed ends of unsupported sheet metal to form 1/2 inch wide hem on concealed side, or ease exposed edges with backing to radius of approximately 1/32 inch.
   3. Form items with flat, flush surfaces, true to line and level, and without cracking and grain separation at bends.

F. Continuously weld joints and seams except where other methods of joining are indicated:
   1. Grind welds smooth and flush on exposed surfaces.
   2. Comply with AWS recommendations.
   3. Use filler metals and welding procedures which will blend with and match color of sheet metal being joined and will avoid discoloration at welds.

G. Provide type of anchorage shown.
   1. Coordinate with supporting structure.
   2. Fabricate and space anchoring devices as shown and as required to provide adequate support for intended use.

H. Cut, reinforce, drill and tap miscellaneous metal work as required to receive finish hardware and similar items.

I. Fabricate joints which will be exposed to weather in manner to exclude water or provide weep holes where water may accumulate.

J. Welding Procedures:
   1. Procedures are to:
      a. Assign responsibility to person or position.
      b. Contain enough detail to be useful to workforce without reference to governing specifications.
      c. Be dated and indicate person or position that has authority to maintain procedure.
   2. Welding Procedure Specifications (WPS):
      a. Conform to requirements of AWS D1.1.
      b. Submit Welding Procedure Specifications (WPS) and Procedure Qualification Records (PQR) as required by AWS D1.1, to be used on Project to Owner's Testing Agency.
         1) Owner's Testing Agency will review and approve WPS.
         2) Use forms provided in Annex E of AWS D1.1 or equivalent.
   3. Procedures need not act as work instructions.
   4. Weld Sequence Procedures:
      a. Submit written procedures indicating field welding sequences for each type of connection with multiple field-welded joints, and sequence of such connections to be field-welded at each level.
   5. Weld Shrinkage and Distortion Control Plan:
      a. Where shrinkage is likely to cause distortion or other problems, submit mitigation plan.
      b. Contractor is responsible for determining conditions requiring Weld Shrinkage and Distortion Control Plan.

2.03 FABRICATIONS – MISCELLANEOUS METAL

A. Manufacture or fabricate items to sizes, shapes and dimensions required.
   1. Furnish malleable iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

B. Miscellaneous Framing and Supports:
   1. Provide miscellaneous steel framing and supports which are not part of structural steel framework, as required to complete Work.

2. Fabricate miscellaneous units to sizes, shapes and profiles shown or, where not shown, of required dimensions to receive adjacent other work to be retained by framing.
3. Except as otherwise shown, fabricate from structural steel shapes and plates and steel bars, of welded construction using mitered joints for field connection.
4. Cut, drill and tap units to receive hardware and similar items.
5. Equip units with integrally welded anchor straps for casting into poured concrete or building into masonry wherever required.
6. Except as otherwise shown, space anchors 24 inches on center and provide minimum anchor units of 1-1/4 by 1/4 by 8 inch steel straps.

C. Miscellaneous Steel Trim:
1. Provide shapes and sizes as required for profiles shown.
2. Except as otherwise noted, fabricate units from structural steel shapes and plates and steel bars, with continuously welded joints and smooth exposed edges.
3. Provide cutouts, fittings and anchorages as required for coordination of assembly and installation of other work.
4. Galvanize miscellaneous steel trim where indicated.

D. Metal Ladders at Elevator Pit:
1. Fabricate ladders for locations shown, with dimensions, spacing, details and anchorages indicated.
2. Comply with requirements of ANSI A 14.3, except as otherwise indicated.
3. Unless otherwise shown, provide 1/2 by 2-1/2 inch continuous structural steel flat bar side rails with eased edges, spaced 18 inches apart.
4. Provide 3/4 inch diameter solid structural steel bar rungs, spaced 12 inches on center.
5. Fit rungs in centerline of side rails, plug weld and grind smooth on outer rail faces.
6. Support each ladder at top and bottom and at intermediate points spaced not more than 5 feet on center
7. Use welded or bolted steel brackets, designed for adequate support and anchorage, and to hold ladder clear of wall surface with minimum 7 inch clearance from wall to centerline of rungs.
8. Return top of rails to wall or structure as indicated.
9. Hot-dip galvanize ladders, brackets, and fasteners, unless indicated to be painted.

E. Ship's Ladders:
1. Designed for use with roof hatches as specified in Section 07 7233.
    a. Provide with heavy duty aluminum top and bottom brackets for fixed, permanent installation.
2. Construction:
    a. Ladder:
        1) Width:
            a) 21-7/8 inches overall.
            b) 18-3/8 inches clear.
        2) Mounting Brackets:
            a) Minimum of 2 wall mounting brackets.
                i Provide additional brackets as required.
            b) 2 floor brackets
        3) Height: Up to 18 feet.

b. Side Rails:
1) 3 inches wide x 1/8 inch wall thickness.
c. Rungs:
1) Tubular aluminum extrusions.
a) 1-1/4 inch square with deep serrated surface.
b) 18-3/8 inches long.
2) Mounted at 12 inches on center.

3. Finish:
a. Manufacturer's standard mill finish.
4. Product and Manufacturer:
a. Model 501 as manufactured by O'Keeffe's, Inc., Brisbane, CA, or approved equal.

F. High Parapet Access Ladder.
1. Tubular Rail High Parapet Access Ladder with Platform and Return
a. Provide with 3/16 inch thick heavy duty extruded aluminum brackets for fixed, permanent installation.
2. Construction:
a. Ladder:
1) Ladder Width: 24 inches
2) Overall Width: 25-3/4 inches.
3) Overall Height: 16 feet – 0 1/2 inch.
b. Rungs:
1) Extruded Aluminum Serrated Rungs: 1-1/4 inch square.
c. Platform:
1) Aluminum Channel Frame: 1 inch x 3 inches x 1/8 inch
2) Treads: Serrated aluminum: 1-1/4 inch deep x 4-1/8 inches wide.
3. Incidental Materials:
a. Provide safety caps and other incidental materials as required for compete installation.
4. Product and Manufacturer:
a. Model 503 as manufactured by O'Keeffe's, Inc., Brisbane, CA, or approved equal.

G. Pipe Bollards:
1. Fabricate pipe bollards from galvanized steel pipe of diameters indicated on Drawings.
a. Use pipe conforming to ASTM A 53; Type S; Grade B, Schedule 40.
b. Galvanized coating complying with ASTM A 123.
2. Finish Painting:
a. OSHA Safety Yellow in accordance with requirements of Section 09 9100.

H. Trash Enclosure Gates:
1. Fabricate of galvanized steel shapes and galvanized metal decking.
a. Conform to details, profiles and dimensions shown.
2. Gate Hardware:
a. Hinges:
1) 8 by 6 inch extra heavy weight, full mortise, 5 knuckle ball bearing, steel with stainless steel pin
a) Welded to gate and frame.
2) McKinney No. T4A3786 or approved equal.

b. Cane Bolt:
1) 24 inch long by 5/8 inch diameter.
a) Type 316 stainless steel with black finish.
b) Model 6096-24316 by Hoover Fence Company or approved equal.
c. Locking Slide Bolt:
1) Rockwood Surface Bolt:
a) Bolt Length: 8 inches.
b) Finish: Satin Stainless steel.
c) Model ROC-582-8

3. Finish:
a. Field paint entire gate assembly, excluding stainless steel hardware, as specified in Section 09 9100.

2.01 FABRICATION – METAL STAIRS

A. Form steel stairs from materials of size, thickness, and shapes indicated, but not less than that needed to comply with performance requirements indicated.
1. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support.

B. Form exposed work true to line and level with accurate angles and surfaces and straight sharp edges.
1. Form bent metal corners to smallest radius possible without causing grain separation or otherwise impairing Work.

C. Shear and punch metals cleanly and accurately.

D. Remove sharp or rough areas on exposed surfaces.
1. Ease exposed edges to radius of approximately 1/32 inch, unless otherwise indicated.

E. Weld corners and seams continuously to comply with following:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
2. Obtain fusion without undercut or overlap.
3. Remove welding flux immediately.
4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing, and welded surface matches contours of adjoining surfaces.

F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners wherever possible.
1. Use exposed fasteners of type indicated or, were not indicated, Phillips flat- head (countersunk) screws or bolts.
2. Locate joints where least conspicuous.

G. Shop Assembly:
1. Preassemble in shop to greatest extent possible to minimize field splicing and assembly.
2. Use connections that maintain structural value of joined pieces.
3. Clearly mark units for field assembly and coordinated installation.

H. Fabricate joints that will be exposed to weather in manner to exclude water or provide weep holes where water may accumulate.

I. Construct stairs to conform to sizes and arrangements shown.
   1. Join pieces together by welding unless otherwise indicated.
   2. Provide complete stair assemblies including metal framing, hangers, columns, struts, clips, brackets, bearing plates, and other components necessary for support of stairs and platforms and as required to anchor and contain stairs on supporting structure.

J. Stair Framing:
   1. Fabricate stringers of structural steel channels, or plates, or combination thereof.
   2. Provide closures for exposed ends of stringers.
   3. Construct platforms of structural steel channel headers and miscellaneous framing members.
   4. Bolt or weld headers to stringers and framing members to stringers and headers, fabricate and join so that bolts, when used, do not appear on finish or surfaces.

K. Metal Pan Risers, Subtreads, and Subplatforms:
   1. Shape metal pans for risers and subtreads to conform to configuration shown.
   2. Provide thicknesses of structural steel sheet for metal pans indicated but not less than that required to support total design loading.
   3. Form metal pans of uncoated cold-rolled steel sheet or hot-rolled or cold-rolled carbon steel sheet
   4. Directly weld risers and subtreads to stringers; locate welds on side of metal pans to be concealed by concrete fill.
   5. Attach extruded abrasive nosings to pan risers.
      a. Make nosings full width of tread flush with tread surfaces.
   6. Attach risers and subtreads to stringers by means of brackets made of steel angles or bars.
      a. Weld brackets to stringers and attach metal pans to brackets by welding.

L. Provide subplatforms of configuration and construction indicated, of same metal as risers and subtreads and in thicknesses required to support design loading.
   1. Weld subplatform to platform framing members.

M. Stair Tread Nosing:
   1. Fabricate units with extruded aluminum base, sizes, and configurations indicated with abrasive filler material bonded and locked into channels in base.
   2. Provide abrasive grit of aluminum oxide, silicone carbide, or combination of both.
   3. Color:
      a. As selected by Architect.
   4. Manufacturers:
      a. Basis-of-Design:
         1) Design of stair tread nosing is based on Type T-24 as manufactured by American Safety Tread Co., Inc.
            a) Heat treated aluminum alloy 6063-T6.
            b) Filled with mixture of virgin aluminum oxide and silicone carbine abrasive granules in epoxy binder.

b. Subject to compliance with specified requirements, provide named product or as manufactured by one of following:
   1) Ampstep Products, LLC.
   2) Safe-T-Metal Company, Inc.
   3) Wooster Products Inc.

5. Provide types for use on concrete filled steel stairs.
   a. Provide nosing full length of step for concrete filled steel pan stairs.
6. Provide anchors for embedding units in concrete, either integral or applied to units, as standard with manufacturer.
7. Color of Fill: As selected by Architect.

N. Stair Tread Finish:
1. Refer to Section 07 1813 for traffic coating application on stair treads where scheduled or indicated on Drawings.

2.02 FABRICATION – STEEL PIPE HANDRAIL AND RAILING SYSTEM

A. Fabricate pipe handrails and railing systems to dimensions and details shown, with smooth bends and welded joints ground smooth and flush.
1. Comply with requirements of CBC Section 11B-505 and as indicated for design, finish, member sizes, including wall thickness of pipe, post spacing, and anchorage, but not less than that required to support structural loads.
2. Handrail Gripping Surfaces:
   a. Make continuous along their length.
   b. Do not allow handrails to be obstructed along their tops or sides.
   c. Do not permit bottom of handrail gripping surface to be obstructed for more than 20 percent of its length.
   d. Provide gripping surfaces and adjacent surfaces free of sharp or abrasive elements.
   e. Extend gripping surfaces beyond and in same direction of ramp run in accordance with CBC Section 11B-505.10.
3. Railings:
   a. Use nominal 1-1/4 inch N.P.S. (1.660 inch O.D.) Schedule 40 steel pipe for railings.
   b. Use heavy weight 1-1/4 inch N.P.S. (1.660 inch O.D.) Schedule 80 steel pipe for posts.
   c. Where modifications to existing railings are made, use pipe size matching existing.
4. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.
   a. At tee and cross intersections, cope ends of intersecting members to fit contour of pipe to which end is joined, and weld all around.
   b. Form changes in direction of handrails and rails by welding in prefabricated flush elbow fittings.
   c. Form simple and compound curves by bending pipe in jigs to produce uniform curvature for each repetitive configuration required; maintain cylindrical cross section of pipe throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of pipe.

B. Brackets, Flanges, Fittings, and Anchors:
1. Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnections of pipe and attachment of handrails and railing systems to other work.

2. Furnish inserts and other anchorage devices for connecting handrails and railing systems to concrete work.
3. Close exposed ends of pipe by welding 3/16 inch thick steel plate in place or with prefabricated fittings, except where clearance of end of pipe and adjoining wall surface is 1/4 inch or less.

C. Accessories for Steel Handrails and Railing Systems:
1. General:
   a. Provide miscellaneous ferrous metal fittings, including flanges, end closures, and anchors for interconnections of pipe, and attachment of handrails to other work.
      1) Provide galvanized ferrous metal fittings, brackets, fasteners, and sleeves for use with galvanized railing systems.
      2) Provide non-galvanized ferrous metal fittings, brackets, and fasteners for railings specified to be shop primed and field painted.
   b. Provide inserts and other anchorage devices for connecting handrails and railing systems to concrete or masonry construction.
      1) Galvanize anchors embedded in concrete or masonry construction.
2. Close exposed ends of pipe by welding 3/16 inch thick steel plate in place or with prefabricated fittings, except where clearance of end of pipe and adjoining wall surface is 1/4 inch or less.
3. Wall Brackets:
   a. Provide wall brackets for anchoring handrails to wall.
      1) Mill finish steel.
         a) Field paint after installation to match handrail.
         b) Galvanized finish to match galvanized handrail
   b. Projection from Wall: 2-1/2 inches
   c. Mounting:
      1) Three countersunk flat head wood screws.
         a) Provide with galvanized expansion sleeves for anchoring in concrete and masonry. construction
      2) Secure railings in fittings to prevent rotation of railing.
   d. Product and Manufacturer:
      1) Model RB14025 by Wagner Companies, or approved equal.

D. Post Sleeves:
1. Provide galvanized steel sleeves as detailed, for anchoring railing posts in concrete.

E. Modifications to Existing Railing System:
1. Make modifications to existing railings as required to make railings compliant with accessibility requirements.
2. Refer to details as indicated on Drawings.

2.03 FINISHES

A. Comply with NAAMM Metal Finishes Manual for recommendations relative to application and designations of finishes, as applicable.
1. Protect mechanical finishes on exposed surfaces by application of strippable, temporary protective covering prior to shipment.
2. Variations in appearance of abutting or adjacent pieces are not acceptable when they are within 1/2 of range of approved samples.
   a. Noticeable variations in same piece are not acceptable.

b. Variations in appearance of other components are acceptable when they are within range of approved samples and are assembled or installed to minimize contrast.

3. Apply heavy coat of specified isolation material to metal surfaces in contact with concrete or dissimilar materials.
   a. Do not apply on exposed surfaces.

B. Preparations of Surfaces:
1. Thoroughly clean mill scale, rust, dirt, grease, and other foreign matter from ferrous metal prior to galvanizing.
2. Where hand cleaning methods are not adequate, clean in accordance with SSPC SP 1, SSPC SP 2, SSPC SP 3, or SSPC SP 6, as required.
3. Completely eliminate burrs, rough spots and pitting from normally exposed ferrous metal items.

C. Shop Painting:
1. Apply specified shop primer to uncoated surfaces of miscellaneous metal work, except members or portions of members to be embedded in concrete surfaces and edges to be field welded, and galvanized surfaces, unless otherwise specified.
2. Immediately after surface preparation, brush or spray on primer in accordance with manufacturer's instructions, and at rate to provide uniform dry film thickness of 2.0 mils for each coat.
   a. Use painting methods which will result in full coverage of joints, corners, edges, and exposed surfaces.
3. Apply one shop coat to fabricated metal items, except apply 2 coats of paint to surfaces inaccessible after assembly or erection.
4. Where shop primer is removed or damaged by assembly procedures, touch up abraded areas with specified primer.

D. Galvanized Finish:
1. Where specified, galvanize items after fabrication.
2. Conform to requirements for galvanizing as specified in “Materials and Components” Article.
3. Where galvanizing is removed by assembly procedures, touch up abraded areas with zinc-rich paint.
4. Unless noted otherwise, galvanize exposed fasteners required to secure items to in-place construction.
5. Galvanize items that will be concealed in final construction or embedded in concrete or masonry construction.
6. Do not galvanize items indicated or specified to receive organic zinc-rich epoxy shop primer.

E. Aluminum Finish:
1. Comply with requirements of AA DAF-45 for specified aluminum finishes.

2.04 STRUCTURAL PERFORMANCE REQUIREMENTS

A. Stair Framing:
1. Capable of withstanding stresses resulting from loads specified as well as stresses resulting from railing system loads.

B. Steel Stairs and Treads:
   1. Capable of withstanding concentrated load of 300 lbf Applied at center of tread span.

C. Steel Stair Platforms:
   1. Capable of withstanding uniform load of 100 lbf per square foot of projected plan area.

D. Steel Handrails and Railing Systems:
   1. Apply each load to produce maximum stress in each of respective components of each metal fabrication.
      a. Comply with ASCE/SEI 7.
   2. Designed to resist concentrated load of 200 lbf applied vertically downward and horizontally in perpendicular direction at any point on top rail.
   3. Uniform load of 50 lbf per linear foot applied in any direction.
   4. Concentrated and uniform loads above are not to be assumed to act concurrently.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas to receive Work and verify that setting conditions and dimensions are correct to receive items.
   1. Do not start installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Field Measurements:
   1. Perform sheet metal work in cooperation with other trades.
   2. Where possible, verify size, location and placement of miscellaneous sheet metal work prior to fabrication.
   3. Coordinate field measurements and shop drawings with fabrication and shop assembly.

B. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as concrete inserts, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete construction.
   1. Coordinate delivery of such items to Project Site.

3.03 INSTALLATION – GENERAL

A. Cutting and Fitting:
   1. Perform cutting, drilling and fitting required for installation of miscellaneous metal fabrications.
   2. Fit exposed connections accurately together to form tight hairline joints.
   3. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations.
   4. Grind joints smooth and touch-up shop paint coat.
   5. Do not weld, cut or abrade surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

B. Placement:
   1. Set Work accurately in location, alignment and elevation, plumb, level, true and free of rack, measured from established lines and levels.
   2. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.
   3. Galvanize exposed fasteners to secure to in-place construction.
   4. Fasten work tightly to prevent rattle or vibration.
   5. Do not tighten fasteners through finish alone without spacer washers.
   6. Use nonshrink grout mixed in accordance with manufacturer's direction for setting frames, plates, sills, bolts and similar items.
   7. Locate and place sheet metal items plumb, level and in alignment with adjacent work.
   8. Tolerances:
      a. Offset from true horizontal, vertical and design location:
         1) Not to exceed 1/16 inch in 10 feet of length for any component, non-cumulative.
      b. Maximum offset from true alignment between abutting components:
         1) Not to exceed 1/32 inch.

C. Use concealed anchorages where possible.
   1. Provide brass or lead washers fitted to screws where required to protect sheet metal surfaces.
   2. Provide concealed gaskets, flashings, sealants, and fillers and install as Work progresses to make installations weathertight or sealed.

D. Form tight joints with exposed connections accurately fitted together.
   1. Provide reveals and openings for sealants and joint fillers, as indicated.

E. Protect non-ferrous metal surfaces from corrosion or galvanic action by application of heavy coating of specified isolation coating material on concealed contact surfaces of dissimilar materials, before assembly and installation, where there is possibility of corrosive or electrolytic action.

F. Field Welding:
   1. Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, and methods used in correcting welding work.

G. Installation of Ship’s Ladder’s:
   1. Verify clear floor space required for ship’s ladders in installed position.
   2. Install ship’s ladders in accordance with manufacturer’s installation instructions
   3. Install flush handrails on both sides of ladder side rails.

3.04 INSTALLATION – STEEL PIPE RAILING AND HANDRAIL

A. Adjust railings prior to anchoring to ensure matching alignment at butting joints.
   1. Interconnect railing and handrail members by butt-welding or welding with internal connectors, at fabricator's option, unless otherwise indicated.
   2. Space posts not more than 8 feet on centers, unless otherwise shown.
   3. Plumb posts in each direction.

B. Secure posts and rail ends to building construction as follows:
   1. Anchor posts in concrete by means of pipe sleeves set and anchored into concrete.
      a. Provide sleeves of galvanized, standard weight, steel pipe, not less than 6 inches long, and having inside diameter not less than 1/2 inch greater than outside diameter of inserted pipe post.
      b. Provide steel plate secured to bottom of sleeve of width and length not less than 1 inch greater than outside diameter of sleeve.
         1) After posts have been inserted into sleeves, fill annular space between post and sleeve solid with specified non-shrink grout.
         2) Cover anchorage joint with round steel flange welded to post.
   2. Anchor rail ends into concrete with steel round flanges welded to rail ends and anchored into wall construction with lead expansion shields and bolts.

3.05 FIELD PAINTING AND TOUCH-UP

A. Field Painting:
   1. Application of high performance finish to following exposed items is specified in Section 09 9600:
      a. Exposed railings, brackets, and fittings.

B. Touch-up Painting:
   1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint in accordance with SSPC-SP 11, and paint exposed areas with same material as used for shop painting.
   2. Apply by brush or spray to provide minimum dry film thickness of 2.0 mils.

C. Repair of Galvanized Surfaces:
   1. Repair areas damaged by welding, cutting or during handling, transport or erection in accordance with ASTM A 780 by application of multiple coats of galvanizing repair paint, to dry film thickness of 8 mils.

D. Repair of Finished Surfaces:
   1. Repair finishes damaged by cutting, welding, soldering and grinding operations required for shop fitting and jointing.
   2. Restore finishes so that there is no evidence of corrective work.
   3. Return items which cannot be refinished in field to shop, make required alterations, and refinish entire unit or provide new units, at fabricator's option.

3.06 CLEANING

A. Remove protective devices only when items will be safe from other construction operations or removal is required to permit related Work.

3.07 PROTECTION

A. Protect metal work from damage to surface, profile, and shape.

END OF SECTION 05 5000

SECTION 06 1053

MISCELLANEOUS CARPENTRY

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Carpentry work not specified elsewhere and generally intended for support of other work.
   2. Wood furring.
   3. Miscellaneous blocking, grounds, and nailers.
   4. Electrical/Telephone Backing Panels

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 06 4000: Architectural Woodwork
   3. Section 08 1400: Wood Doors

C. Related Requirements:
   1. Refer to Division 26 sections for additional requirements for electrical/telephone backing panels.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.

B. ASTM International (ASTM):
   1. ASTM F 1667 – Standard Specification for Driven Fasteners, Nails, Spikes, and Staples.

C. National Institute of Standards and Technology (NIST):
   1. Voluntary Product Standard PS 1 – Structural Plywood.
   2. Voluntary Product Standard PS 2 – Performance Standard for Wood Structural Panels.
   3. Voluntary Product Standard PS 20 – American Softwood Lumber Standard

D. APA – The Engineered Wood Association (APA):
   1. E30 – Engineered Wood Construction Guide
   2. E445 - PRP-108 – Performance Standards and Qualification Policy for Structural-Use Panels.

E. West Coast Lumber Inspection Bureau (WCLIB):
   1. Standard Grading Rules No. 17, current edition.

F. Western Wood Products Association (WWPA):
   1. Standard Grading Rules for Western Lumber.

G. American Wood Preservers Association Standards (AWPA):
   1. AWPA Use Category System.
      a. AWPA Use Category UC3 Above Ground (Exterior).
         1) AWPA UC3B Above Ground Exposed – for wood and wood-based materials used in exterior construction and not in contact with ground.
      b. AWPA Use Category UCF Fire Retardant.
         1) AWPA UCFB Fire Retardant Exterior – for wood and wood-based materials intended for fire protection and used in exterior construction that is not in contact with the ground or with foundations.

H. UL, LLC (UL):
   1. Fire Hazard Classification – FR-S

1.03 SUBMITTALS

A. Wood Treatment Data:
   1. General:
      a. Obtain from chemical treatment manufacturer.
      b. Include chemical treatment manufacturer's instructions for handling, storing, installing, and finishing treated material:
   2. Preservative Treatment – General:
      a. Include certification by treatment plant stating type of solution and pressure process used, net amount of preservative retained, and compliance with applicable standards.
   3. Waterborne Preservative Treatment:
      a. Include certification that moisture content of treated wood was reduced to levels specified prior to shipment to Project Site.
   4. Fire-Retardant Treatment:
      a. Include certification by treating plant that treated wood complies with specified requirements.
   5. Include warranty of chemical treatment manufacturer for each type of treatment.

1.04 QUALITY ASSURANCE

A. Wood Product Quality Standards:
   1. Lumber Standards:
      a. Comply with West Coast Lumber Inspection Bureau (WCLIB).
   2. Plywood Standard:
      a. Comply with Voluntary Product Standard PS 1.
   3. Factory-mark each piece of lumber and plywood with type, grade, mill and grading agency, except omit marking from surfaces to be exposed with transparent finish or without finish.

B. Single-Source Responsibility for Fire Retardant Treated Wood:
   1. Obtain each type of fire-retardant-treated wood product from one source and by single producer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Storage:
   1. Keep materials under cover and dry.
   2. Protect against exposure to weather and contact with damp or wet surfaces.
   3. Stack material above ground level on uniformly spaced supports to prevent deformation.
   4. For material pressure treated with waterborne chemicals, place spacers between each bundle for air circulation.

1.06 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Maintain uniform moisture content of lumber at not more than 19 percent before, during, and after installation.

1.07 SEQUENCING

A. Sequencing and Scheduling:
   1. Coordinate details with other Work supporting, adjoining or fastening to miscellaneous carpentry Work.

B. Coordination:
   1. Fit carpentry work to other work; scribe and cope as required for accurate fit.
   2. Correlate location of furring, nailers, blocking, grounds and similar supports to allow proper attachment of other work.
   3. Cooperate with other trades, especially concrete, and metal fabrications to prevent duplication of rough hardware furnished.

PART 2 PRODUCTS

2.01 LUMBER – GENERAL

A. Standards:
   1. Furnish lumber manufactured to comply with PS 20 – American Softwood Lumber Standard, with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

B. Grade Stamps:
   1. Furnish lumber with each piece factory marked with grade stamp of inspection agency that indicates grading agency, grade, species, moisture content at time of surfacing, and mill.

C. Sizes:
   1. Provide nominal sizes indicated, complying with PS 20, except where actual sizes are specifically noted as being required.

D. Surfacing:
   1. Dressed lumber, S4S, unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED CONDITIONS

A. Species: Wood species listed by PS 20.

B. Moisture Content: S-DRY, KD 19 or MC 19 (19 percent maximum moisture content).

C. Grade: No.2, or standard grade.

D. Grade: No.3, or utility grade.

2.03 PLYWOOD

A. Identify each panel with appropriate trademark of APA.
   1. Meet requirements of latest edition of NIST Voluntary Product Standard PS 1 and Voluntary Product Standard PS 2

B. Panel Size, Thickness, and Grade:
   1. At least equal to that indicated.

C. Electrical/Telephone Backing Panels:
   1. Fire-retardant plywood with exterior glue containing no urea formaldehyde.
   2. Grade: C-D Plugged, Exposure 1,
   3. Thickness: As indicated, but not less than 1/2 inch nominal.
   4. Coordinate with Division 26 Sections.

2.04 FASTENERS

A. Nails, Wire, Brads, and Staples:
   1. Conforming to ASTM F 1667.

B. Screws:
   1. Select material, type, size, and finish required for each use.
   2. Comply with ASME B18.6.1 for applicable requirements.

C. Bolts:
   1. Conforming to ASTM A 307, Grade A.
   2. With hex nuts and flat washers conforming to ASTM A 563.

2.05 PRESERVATIVE WOOD TREATMENT BY PRESSURE PROCESS

A. Obtain preservative-treated lumber complying with AWPA Standard C2.
   1. Mark each treated item with AWPB or SPIB Quality Mark Requirements.
   2. Coat surfaces cut after treatment to comply with AWPA M4.

B. Above-Ground Wood Treatment:
   1. Pressure treat with waterborne preservatives to minimum retention of 0.25 pcf.
   2. Kiln-dry interior dimension lumber after treatment to 19 percent maximum moisture content.
   3. Treat wood items indicated and in following circumstances:
      a. In contact with roofing, flashing, or waterproofing.
      b. In contact with masonry or concrete.
      c. Within 18 inches of grade.

C. Ground Contact Wood Treatment:
   1. Pressure treat with waterborne preservatives to minimum retention of 0.40 pcf.

2.06 FIRE-RETARDANT TREATMENT BY PRESSURE PROCESS

A. Identify treated wood with appropriate classification marking of Underwriters Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

B. Dimension Lumber:
   1. Comply with AWPA C20.
   2. Treatment Types:
      a. Interior Type A for protected wood.
      b. Exterior Type for wood exposed to weather.

C. Plywood:
   1. Comply with AWPA C27.
   2. Treatment Types: Interior Type A for protected wood.

D. Inspect each piece after drying and discard damaged or defective pieces.

PART 3 EXECUTION

3.01 INSTALLATION – GENERAL

A. Discard units of material with defects that impair quality of miscellaneous carpentry and in sizes that would require excessive number or poor arrangement of joints.

B. Cut and fit miscellaneous carpentry accurately.
   1. Install members plumb and true to line and level.

C. Coat cut edges of preservative-treated wood to comply with AWPA M4.

D. Securely fasten miscellaneous carpentry as indicated and according to applicable codes and recognized standards.

E. Countersink nail heads on exposed carpentry work and fill holes.

F. Use fasteners of appropriate type and length.
   1. Predrill members when necessary to avoid splitting wood.

3.02 WOOD GROUNDS, NAILERS, AND BLOCKING

A. Install where shown and where required for screeding or attachment of other work.
   1. Cut and shape to required size.
   2. Coordinate location with other work involved.

B. Attach to substrates as required to support applied loading.
   1. Countersink bolts and nuts flush with surfaces, unless otherwise indicated.

3.03 WOOD FURRING

A. Install at spacing indicated, with closure strips at edges and openings.
   1. Shim with wood as required for tolerance of finished Work.

B. Furring to Receive Plywood Paneling:
   1. Install 1 by 3 inch furring at 2 feet on center, horizontally and vertically.
   2. Select furring strips for freedom from knots that could cause bent-over nails and damage to paneling.

C. Furring to Receive Gypsum Board:
   1. Install 1 by 2 inch furring at 16 inches on center, vertically.

END OF SECTION 06 1053

SECTION 06 4000

ARCHITECTURAL WOODWORK

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Decorative Laminate Casework
   2. Casework hardware and accessories.
   3. WI Certified Seismic Installation Program (CSIP) for DSA-approved casework anchorage.

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 05 5000: Metal Fabrications; fabricated steel supports for countertops.
   3. Section 06 1053: Miscellaneous Carpentry; miscellaneous wood blocking.
   4. Section 07 9200: Joint Sealants; mildew-resistant sealant for damp or wet areas.
   5. Section 08 1400: Wood Doors
   6. Section 09 9100: Painting; paintable caulk at dry areas.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
   1. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.

B. Woodwork Institute (WI):
   1. North American Architectural Woodwork Standards (NAAWS) 4.0
      a. NAAWS Section 10-Casework
      b. WI Certified Seismic Installation Program (CSIP) for DSA-approved casework anchorage.

C. ASTM International (ASTM):
   1. ASTM E1333 – Standard Test Method for Determining Formaldehyde Concentrations in Air and Emission Rates from Wood Products Using Large Chamber.
   2. ASTM F 1667 – Standard Specification for Driven Fasteners: Nails, Spikes, and Staples

D. The American Society of Mechanical Engineers (ASME):
   1. ASME B18.6.1 – Wood Screws (Inch Series)

E. Forest Stewardship Council (FSC):
   1. FSC STD-01-001 V5-2 EN – FSC Principles and Criteria for Forest Stewardship.

F. South Coast Air Quality Management District (SCAQMD):
   1. Rule 1168 – Adhesive and Sealant Applications

1.03 SUBMITTALS

A. Product Data:
   1. For each type of product indicated including finishing

B. Shop Drawings:
   1. Showing location of each item, dimensioned plans and elevations, large-scale details, attachment devices, and other components.
   2. Furnish WI Certified Compliance Label on first page of shop drawings.
   3. Comply with NAAWS Section 1, Submittals; indicate NAAWS grades.
   4. Show plans, elevations, ends, cross-sections.
   5. Show details and location of anchorages and fitting to floors, walls, and base.
      a. Include layout of units with relation to surrounding walls, doors, windows, and other building components.
   6. Coordinate shop drawings with other work involved.

C. Certified Compliance Requirements:
   1. Certified Compliance Certificate:
      a. Before delivery of casework to Project Site, provide WI Certified Compliance Certificate certifying that products fully meet requirements of WI Grade(s) specified.
   2. Certified Compliance Label:
      a. Apply WI Certified Compliance Label to each elevation of casework and solid surface top. .
   3. WI Certified Compliance Certificate for Installation:
      a. Upon completion of installation, provide WI Certified Compliance Certificate indicating products installed, and Certifying that installation of these products fully meets requirements of Grade(s) specified.
   4. Fees charged by WI for Certified Compliance Program are responsibility of millwork manufacturer and installer.
      a. Include fees in bid.

D. Samples:
   1. Decorative Laminate:
      a. Four 5 inch by 8 inch samples each of decorative laminate surfacing and cabinet liner required in Work.
   2. Edge Banding:
      a. Four 6 inch long samples of edge banding for selection of color, design and finish.
   3. Solid Surface:
      a. Four minimum 6 inch by 6 inch sample in specified gloss.
      b. Cut sample and seam together for representation of inconspicuous seam.
   1. Exposed cabinet hardware
      a. One unit of each type and finish.
      b. Furnish at Architect's request.

E. Maintenance Data for Solid Surface Material:
   1. Manufacturer's care and maintenance data, including repair and cleaning instructions.
      a. Maintenance kit for finishes.

2. Include with closeout documents as specified in Division 01 Sections.

1.04 QUALITY ASSURANCE

A. Fabricator/Installer Qualifications:
   1. Current Licensee of WI Certified Compliance Program.
      a. Employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have record of successful in-service performance.

B. Quality Standards:
   1. Except as otherwise shown or specified, comply with specified provisions of Woodwork Institute (WI), North American Architectural Woodwork Standards (NAAWS) 4.0.

C. Apply WI Certified Compliance Label to each casework and countertop unit.
   1. Do not remove WI Certified Compliance labels until casework has been accepted by Architect.

D. Comply with requirements of CBC and WI CSIP for casework attachment and seismic restraint and following:
   1. Before wood or metal stud walls are closed up, provide written WI CSIP report confirming that acceptable backing is installed in locations required for proper casework installation
      a. Identify those locations where backing is missing or improperly located

E. Inspection:
   1. When millwork shop is not licensee of WI Certified Compliance Program, provide for inspections by authorized WI Inspectors complying with following schedule:
      a. Inspection at Manufacturer's Shop: Prior to initial delivery of casework components to Project Site.
      b. Site Conditions:
         1) Prior to delivery of casework components to Project Site, inspect Project Site for compliance with requirements of Section 2 of NAAWS
   2. On-Site Inspections:
      a. Immediately after installation of first casework components.
      b. Immediately after complete installation of casework components.
   3. Provide additional site inspections as required by Architect and Owner, at no cost to Owner, when certified WI inspection reports indicate noncompliance with specified requirements.

F. Identification of Casework:
   1. Casework identified by diamond box symbol with associated descriptive notations and shown on Drawings.
      a. Refer to Casework Design Series (CDS) as established by Woodwork Institute (WI), North American Architectural Woodwork Standards (NAAWS), 4.0
   2. Refer to Drawings A860 – Casework Details, for casework details and designs.

G. Formaldehyde Emissions:
   1. Provide composite wood products/materials containing no added formaldehyde-based resins complying with regulations of California Air Resources Board (CARB) as tested in accordance with ASTM E 1333.

H. Forest Stewardship Certification:
   2. For wood products, provide materials produced from wood obtained from forests certified by FSC-accredited certification body to comply with FSC STD-01-001 V5-2 EN.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver casework as factory-assembled units.

B. Protect casework during transit, delivery, storage and handling to prevent damage, soiling and deterioration.

C. Deliver casework when Project construction is ready for installation.
   1. Provide clean storage area as required by WI NAAWS, Section 2 – Care and Storage.

1.05 PROJECT CONDITIONS

D. Environmental Conditions:
   1. Obtain and comply with woodwork manufacturer's and installer's coordinated advice for optimum temperature and humidity conditions for woodwork during its storage and installation.
   2. Do not install woodwork until these conditions have been attained and stabilized so that woodwork is within plus or minus 1.0 percent of optimum moisture content from date of installation through remainder of construction period.

E. Field Measurements:
   1. Before proceeding with fabrication of casework required to be fitted to other construction, obtain accurate field measurements and verify dimensions and shop drawing details as required for accurate fit.
      a. Show recorded measurements on final shop drawings.
   2. When possible, coordinate manufacturing schedule with construction progress to avoid delay of Work.
      a. Where sequence of measuring substrates before fabrication would delay Project, proceed with fabrication (without field measurements) and provide ample borders and edges to allow for subsequent scribing and trimming for accurate fit.

1.09 SCHEDULING

A. Coordinate fabrication, delivery, and installation with Contractor and other applicable trades.

PART 2 PRODUCTS

2.01 MATERIALS

A. Provide materials complying with requirements of Architectural Woodwork Standards and NAAWS quality grade indicated, unless otherwise indicated.
   1. High Pressure Decorative Laminate (HPDL), complying with NEMA LD 3.

B. High Pressure Decorative Laminate Manufacturers:
   1. Subject to compliance with specified requirements, provide high pressure decorative laminates by one of following:
      a. Formica Corp.
      b. Laminart.
      c. Nevamar Corp.
      d. Wilsonart International
   2. Colors and Patterns: As scheduled.

C. Core Material for High Pressure Decorative Laminate:
   1. Industrial Grade Medium Density Fiberboard (MDF) complying with ANSI A208, Grade 130.
      a. Manufactured with synthetic resin binder system.
      b. Certified as Class 1 Flame Retardant panel in accordance with ASTM E 84.
   2. Thickness: Minimum
      a. 3/4 inch and up to 1-1/8 inches thick, as indicated on Drawings.
   3. Product and Manufacturer:
      a. Medite FR by Roseburg Forest Products Company, Springfield, OR, or approved equal.
   4. Average physical properties for 3/4 panels, based on 5 panel average, when tested in accordance with ASTM D1037:

Technical Data	Imperial
Density	50 lb/ft^3
Internal Bond	130 lb/in^2
Modulus of Rupture	4,000 lb/in^2
Modulus of Elasticity	450,000 lb/in^2
Modulus of Hardness	1200 lbf, Janka ball
Screw Holding, Face	250 lb
Screw Holding, Edge	200 lb
Thickness Tolerance	±0.005 inches
Thickness Swell	10 percent
Linear Expansion	0.3 percent
Flame Spread Rating	Class 1 (A)
Moisture Content	6 – 9 percent
Formaldehyde Emissions	low as 0.01 ppm

D. Semi-Exposed Surfaces:
   1. Low Pressure Decorative Melamine Overlay.

E. Edge Banding; provide as follows:
   1. High Pressure Decorative Laminate (HPDL):
      a. Same thickness as countertop surface.
         1) For self-edge countertops and tops

2) Top and front edges of splashes.

2. Polyvinylchloride (PVC) Edging:
   a. Chip proof, flame resistant and impervious to moisture.
      1) Door Edges and Drawer Front Edges: Minimum 3 mm thickness
      2) Exposed Edges of Boxes: Minimum 0.08 mm thickness
3. Colors: As scheduled or selected by Architect.

F. Adhesive:
1. Type 1 adhesive, fully waterproof.
   a. Use for adhesive bonded materials.
   b. Use adhesives complying with SCAQMD Rule 1168.

G. Solid Hardwood Trim:
1. For Painted Finish:
   a. NAAWS Premium Grade, Natural Yellow Birch or Yellow Poplar, plain sawn.

H. Miscellaneous Materials:
1. Backing for compliance with WI CSIP:
2. Consisting of minimum of either 3 x 6 Flat Douglas Fir, or 16 gage, 50 KSI sheet metal .

2.01 CASEWORK HARDWARE

A. Provide hardware required for complete casework installation.
1. Hinges:
   a. Heavy duty wrap-around, 2-1/4 inch minimum width, offset for overlay door installation
      1) Tight pin butts of 0.083 inch thick steel,
      2) Installed with minimum of five No. 8 full thread screws to jamb and four No. 8 full thread screws to door.
      3) Provide 3 hinges for doors over 48 inches in height.
      4) Rockford Process Control 851 or 852, Stanley HT1592 or approved equal.
   b. Concealed Hinges:
      1) Heavy duty concealed offset for overlay door installation
         a) Installed with minimum of two full thread screws to jamb and two full thread screws to door.
         b) Blum Modul hinge system or Hafele Duomatic hinges 300 Series, or approved equal.
2. Catches:
   a. Two on doors over 36 inches in height, one on doors under 36 inches in height.
   b. Provide elbow catches on companion doors where locks are specified.
3. Surface Pulls:
   a. Stainless steel wire pulls with satin stainless steel finish (630).
      1) Size: 5/16 inch diameter; 4 inch centers.
      2) Engineered Products Company (EPCO) No. MC402-SS 4"; or approved equal.
      3) Provide specified wire pulls on doors and drawers.
4. Door and Drawer Locks:
   a. Surface mounted, pin tumbler type.
   b. 3/4 inch bolt throw, brass construction,

c. BHMA 626 finish, complete with strike.
d. Door Locks: National C8173
e. Drawer Locks: National C1878
f. Provide locks on doors and drawers, unless indicated otherwise.

5. Keying:
   a. Verify keying requirements with Owner prior to start of Work.
   b. For estimate use grandmaster key system.
   c. Number keys and provide 2 keys per lock.
   d. Key locks alike.
6. Chain Stops:
   a. Provide for doors with limited swing.
7. Drawer Guides for Drawers 24 inches wide or less:
   a. 100 pound load-rated, full extension, ball bearing; Accuride 3832E.
8. Drawer Guides for File, Paper Storage, and Heavy-Duty Drawers 42 inches wide or less:
   a. 200 pound load-rated, over travel extension, ball bearing; Accuride 3640A.
9. Heavy-Duty Adjustable Shelf Bracket Assemblies:
   a. Provide following as manufactured by Knape & Vogt Manufacturing Company, or approved equal.
      1) Pilaster: No. 255 AL
      2) Supports: No. 256 AL
      3) Finish: As Scheduled
10. Heavy Duty Adjustable Shelf Bracket Assemblies:
    a. KV No. 183 R-L-C with KV No. 83 standard.
11. Exposed Hardware Finish:
    a. Except where not available, provide exposed hardware with satin stainless steel finish (ANSI/BHMA 630)
    b. Where not available, provide satin chrome (626) or satin aluminum (628) finish.

2.02 ACCESSORIES

A. Grommets:
   1. Round plastic grommet and cap.
      a. Sizes and locations as indicated on Drawings.
         1) When sizes or locations are not indicated, they will be determined by Architect.
   2. Color: As scheduled,
      a. When not scheduled, as selected by Architect.
   3. Acceptable Manufacturers:
      a. Doug Mockett and Company, Wood Technology, or approved equal.

2.03 SOURCE QUALITY CONTROL

A. Single-Source Responsibility for Fabrication and Installation of Architectural Woodwork:
   1. Engage qualified woodworking firm, complying with requirements in “Quality Assurance” Article, to assume undivided responsibility for fabricating, finishing, and installing Work specified in this Section, including providing countertops, backsplashes, and related millwork as specified.

2.04 FABRICATION

A. Quality Standards for Fabrication:
   1. Comply with indicated standards for following types of casework as applicable:
   2. Decorative Laminate Casework:
      a. NAAWS Section 10 – Casework, grades as follows:
         1) Open Cabinets: Premium grade.
         2) Others: Custom grade.
   3. Countertops and Splashes:
      a. Shop Assembly:
         1) Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's printed instructions and technical bulletins.
         2) Form joints between components using manufacturer's standard joint adhesive without conspicuous joints.
            a) Reinforce with strip of solid polymer material, 2 inches wide.
         3) Provide factory cutouts for plumbing fittings and toilet accessories as indicated.
         4) Rout and finish component edges with clean, sharp returns.
            a) Rout cutouts, radii and contours to template.
            b) Smooth edges.
            c) Repair or reject defective and inaccurate work.
      b. Adhere applied splashes to countertops using manufacturer's standard color-matched silicone sealant.
         1) Comply with requirements for Sealant No. 3 as specified in Section 07 9200.

B. Design and Construction Features:
   1. Comply with details shown for profile and construction of casework.
      a. Where not otherwise shown, comply with applicable NAAWS Quality Standards.
   2. Obtain approval of Architect in writing, for proposed deviations.
   3. Construction Style: Style A, frameless.
   4. Construction Type: Type 1.
   5. Door and Drawer Front Style: Flush overlay.
   6. Provide dust panels between lockable drawers.
   7. Recess clip-type shelf standards within open type casework.
   8. Provide 1/2 inch by 6 inch vent slots at 2 feet on center in bottom, over toe paces in sink units.
   9. Apply resilient base to exposed side of exposed ends of fixed base cabinets.
      a. Comply with requirements for resilient base specified in Section 09 6500.

C. Pre-Cut Openings:
   1. Fabricate work with pre-cut openings, wherever possible, to receive hardware, appliances, plumbing fixtures, electrical work and similar items.
   2. Locate openings accurately and use templates or roughing-in diagrams for proper size and shape.
   3. Smooth edges of cutouts and where located in countertops and similar exposures, seal edges of cutouts with water-resistant coating.

D. Edge Banding:
   1. Self-Edge:

a. High pressure decorative laminate of same color and pattern as face surface.

2. Polyvinylchloride Edging:
   a. Machine apply using hot-melt waterproof adhesives under heat and pressure.
   b. Trim and buff corners and edges to eliminate sharp edges.
3. Shelves supported on wall-mounted standards and brackets:
   a. Edge band edges.

E. High pressure decorative laminate faced doors to be 3/4 inch thick.

F. Shelving:
1. Load Capacity, shelving: 50 lbs. per square foot.
2. Maximum load capacity: 200 lbs. per shelf.

G. Tall Cabinet Stiffener (Over 18 inches Deep and 36 inches Wide):
1. 1-1/8 inch square hardwood top stiffener finished to match adjacent surface and secured to top with 1-3/4 inch No. 9 FHWS, 12 inches on center.

H. File Drawers:
1. Sides of File Drawer: 5/8 inch net thickness
2. Bottoms: 3/4 inch hardwood plywood, routed for file follower.
3. Fasten drawer front to drawer with four concealed wood screws.

I. Filler Panels:
1. For spaces of 3 inches or more, use flush type filler panels, with surfaces and edging to match cabinets.

J. Complete fabrication, including assembly, finishing, and hardware application, before shipment to Project Site to maximum extent possible.
1. Disassemble components only as necessary for shipment and installation.
2. Where necessary for fitting at Project Site, provide ample allowance for scribing, trimming, and fitting.

2.05 FASTENERS AND ANCHORS

A. Screws:
1. Select material, type, size, and finish required for each use.
2. Comply with ASME B18.6.1 for applicable requirements.
3. For metal framing supports, provide screws as recommended by metal framing manufacturer.

B. Nails:
1. Select material, type, size, and finish required for each use.
2. Comply with ASTM F 1667 for applicable requirements.

C. Anchors:
1. Select material, type, size, and finish required by each substrate for secure anchorage.
2. Provide nonferrous metal or hot-dip galvanized anchors and inserts on inside face of exterior walls and elsewhere as required for corrosion resistance.
3. Provide toothed steel or lead expansion bolt devices for drilled-in-place anchors.

PART 3 EXECUTION

3.01 PREPARATION

A. Condition woodwork to average prevailing humidity conditions in installation areas before installing.

B. Before installing architectural woodwork, examine shop-fabricated Work for completion and complete Work as required, including back priming and removal of packing.

3.02 INSTALLATION – GENERAL

A. Installation Compliance:
   1. NAAWS Section 10 – Casework, and installation requirements in NAAWS Appendix B.
   2. WI Certified Seismic Installation Program (CSIP) for DSA-approved casework anchorage.

B. Install Work plumb, level, true and straight with no distortions.
   1. Shim as required using concealed shims.
   2. Install to tolerance of 1/8 inch in 8 feet for plumb and level.
      a. With 1/16 inch maximum offset in flush adjoining surfaces.
      b. 1/8 inch maximum offsets in revealed adjoining surfaces.

C. Scribe and cut Work to fit adjoining Work:
   1. Refinish cut surfaces or repair damaged finish at cuts.

D. Install casework without distortion so that doors and drawers will fit openings properly and be accurately aligned.
   1. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation.
   2. Complete installation of hardware and accessory items as indicated.

E. At gypsum board construction, anchor through wall surface to steel backing plates or wood blocking placed in wall as Work of other sections.
   1. Conform to material requirements specified under “Miscellaneous Materials”
   2. Anchorage through gypsum board panels only is not acceptable.

F. Furnish fillers, closures, trim and like as required for complete installation.
   1. Scribe in place wherever required.

3.03 INSTALLATION OF COUNTERTOPS

A. Anchor securely to base units and other support systems as indicated.
   1. Fasten joints in tops with draw-bolt type fasteners let into underside of top.

B. Install countertops with ends flush with exposed ends of base cabinets unless otherwise indicated.

C. Verify opening requirements and make cutouts for sinks, fittings, and equipment.

D. Completely fill joints between splash and walls with specified sealant in accordance with Section 07 9200.

E. Field Jointing:
   1. Where practicable, make in same manner as factory jointing, using dowels, splines, adhesive, and fasteners recommended by manufacturer.
   2. Locate field joints as shown on accepted shop drawings, factory prepared so there is no Project Site processing of top and edge surfaces.

F. Workmanship:
   1. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection.
   2. Provide flush hairline joints in top units using clamping devices.
   3. Use manufacturer's recommended adhesive and holding devices to provide joint widths not more than 1/16 inch wide at each location, completely filled and flush with abutting edges.
   4. Penetration of tops with fasteners is not permitted.
   5. After installation, carefully dress joints smooth, remove surface scratches, clean and polish entire surface.
   6. Provide holes and cutouts as required for built-in equipment and mechanical and electrical service fixtures.
      a. Verify size of openings with actual size of equipment to be used, prior to making openings.
      b. Form inside corners to radius of not less than 1/8 inch.
      c. After sawing, rout and file cut-outs to ensure smooth, crack-free edges.

G. Provide scribe moldings for closures at junctures of top, curb, and splash with walls as recommended by manufacturer for materials involved.
   1. Wet or Damp Locations:
      a. Use mildew resistant one part silicone rubber sealant or chemical resistant, permanently elastic sealing compound specified in Section 07 9200.
   2. Dry Locations:
      a. Use paintable caulk specified in Section 09 9100, unless indicated or directed otherwise

3.04 INSTALLATION OF ACCESSORIES

A. Install in precise manner following manufacturer's directions.
   1. Turn screws to flat seat; do not drive.
   2. Adjust moving parts to operate freely without excessive bind.

3.05 REPAIRING, ADJUSTING, AND CLEANING

A. Repair damaged and defective casework wherever possible to eliminate defects functionally and visually
   1. Where not possible to repair properly, replace casework.
   2. Adjust joinery for uniform appearance.

B. Clean hardware, lubricate, and make final adjustments for proper operation.

C. Clean casework on exposed and semi-exposed surfaces.
   1. Touch-up shop applied finishes to restore damaged or soiled areas.

3.06 PROTECTION

A. Provide protection and maintain conditions, in manner acceptable to manufacturer and installer, that ensures woodwork is without damage or deterioration at time of Substantial Completion.

END OF SECTION 06 4000

SECTION 06 8316

FIBERGLASS REINFORCED PANELS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fiberglass reinforced plastic (FRP) paneling for wall surfaces
   2. Panel trim accessories.

B. Related Sections:
   1. Section 07 9200: Joint Sealants
   2. Section 09 2900: Gypsum Board

1.02 REFERENCES

A. ASTM International (ASTM):
   1. ASTM D2583 – Standard Test Method for Indentation Hardness of Rigid Plastics by Means of a Barcol Impressor.
   2. ASTM D5319 – Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels.
   3. ASTM D5420 – Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact).
   4. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

B. UL, LLC (UL):
   1. UL 2818 – GREENGUARD Certification Program for Chemical Emissions for Building Materials, Finishes and Furnishings.

C. South Coast Air Quality Management District (SCAQMD):
   1. Rule 1168 – Adhesive and Sealant Applications

1.03 SUBMITTALS

A. Product Data:
   1. For each type of product required.

B. Shop Drawings:
   1. Showing layout, profiles and product components:
      a. Include anchorage, accessories, finish colors, patterns and textures.
      b. Indicate location and dimension of joints and fastener attachment.

C. Samples:
   1. Minimum of four, 4 inch square panel samples and 6 inch long trim samples in color and texture specified and scheduled.

D. Certificates:
   1. Product certificates signed by manufacturer certifying materials comply with specified performance characteristics, criteria and physical requirements.

E. Test and Evaluation Reports:
   1. Showing compliance with specified performance characteristics and physical properties.

F. Manufacturer's Installation Instructions:
   1. Manufacturer's Installation Guide for FRP.

G. Qualifications Statements:
   1. For manufacturer and installer.

H. Care and Maintenance Instructions:
   1. For installed products including maintenance methods and precautions against cleaning materials and methods detrimental to finishes and performance.

I. Warranty:
   1. Warranty documents required in this section.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Manufacturer regularly engaged, for minimum of 10 years, in manufacturing of FRP panels of similar type to that specified.
      a. Provide manufacturer's list of successfully completed FRP panel projects, including project name and location, name of architect, and type and quantity of FRP panels furnished.

B. Installer Qualifications:
   1. At least five years experience in the installation of fiberglass reinforced plastic panels.
   2. Experience on at least five projects of similar size, type and complexity as this Project.
   3. Employer of workers for this Project who are competent in techniques required by manufacturer for installation indicated.

C. Preinstallation Meeting:
   1. Conduct preinstallation meeting to review Project requirements, substrate conditions, manufacturer's installation instructions and manufacturer's warranty requirements.

D. Environmental Certification:
   1. GREENGUARD Certification per UL 2818.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project Site in manufacturer's original, unopened, undamaged containers with identification labels intact.
   1. Package sheets on skids or pallets for shipment to Project Site.

B. Store materials in clean, dry area indoors at temperature and humidity conditions in accordance with manufacturer's instructions.
   1. Keep panels out of direct sunlight.
   2. Store on flat, level surface, raised above floor, with adequate support to prevent sagging.
   3. Protect materials and finish during storage, handling, and installation to prevent damage.
   4. Remove foreign matter from face of panel by using soft bristle brush, avoiding abrasive action.

1.06 PROJECT CONDITIONS

A. Ambient Conditions:
   1. Do not begin installation until building is enclosed, permanent heating equipment is in operation, and residual moisture from plaster, concrete, or other wet work has dissipated.
   2. During installation, and within 48 hours prior to installation, maintain ambient temperature and relative humidity within limits required by type of panel adhesive used and recommendation of panel adhesive manufacturer.

1.07 WARRANTY

A. Manufacturer's Warranty:
   1. Manufacturer's standard form in which manufacturer agrees to repair or replace FRP panels that fail within specified warranty period.
      a. Failures include, but are not limited to, substantial defects in material and workmanship, rotting, rusting, corrosion, development of structural surface cracks, or requiring painting or refinishing.
   2. Warranty Period:
      a. Ten years from date of Substantial Completion.

B. Installer's Warranty:
   1. Installer's standard form in which installer agrees to repair or replace FRP panels that fail due to poor workmanship or faulty installation within specified warranty period.
   2. Warranty Period:
      a. Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, provide products by one following, or approved equal:
   1. Fire-X Glasbord (FX) Class A, Wall/Ceiling, by Crane Composites, Inc., Channahon, IL
   2. Standard FRP Class A, by Marlite, Inc., Dover, OH
   3. Series 1200 by Glasteel, div. of Stabilit America, Inc., Moscow, TN

2.02 MATERIALS

A. Fiberglass reinforced plastic panels complying with ASTM D 5319.
   1. Panels: Fiberglass reinforced resin panel, 0.090 inch thick

2. Textured surface one side
3. Color: As selected by Architect, or as scheduled.

B. Fire Test Response Characteristics:
1. Conforming to ASTM E 84, Class A.

C. Surface Burning Characteristics:
1. Determined by testing identical products according to ASTM E 84 by testing agency acceptable to authorities having jurisdiction.
2. Flame-Spread Index: Equal to or less than 25 (Class A).
3. Smoke-Developed Index: Equal to or less than 450

D. Panel Low Emitting Materials:
1. Comply with testing and product requirements of California Department of Health Services standards for Volatile Organic Emissions.

2.03 ACCESSORIES

A. Moldings, Trim and Caps:
1. Panel manufacturer's standard one-piece extruded polypropylene or PVC.
a. Configured to cover panel edges and corners, in color matching panel
2. Inside corner with cove
3. J-cap for exposed edges
4. H-shaped divider, when required.

B. VOC Content of Interior Adhesives and Sealants:
1. Provide adhesives, sealants and sealant primers for use inside building envelope that comply with following limits for VOC content and conforming to SCAQMD Rule 1168:
a. Panel Adhesive:
1) Non-flammable, water resistant type, recommended by panel manufacturer.
2) VOC Content: Maximum 50 g/L
b. Panel Seam Sealant:
1) Two-part urethane sealant as recommended by FRP panel manufacturer.
2) VOC Content: 0.0 g/L.
2. Sealant Color: To match panel color.
3. Refer to Section 07 9200 for additional sealant requirements.

2.04 SOURCE QUALITY CONTROL

A. Obtain fiberglass reinforced panels, moldings, and other accessories from single manufacturer.

2.05 PERFORMANCE CRITERIA

A. Scratch Resistance:
1. Conform to ASTM D 2583, Barcol Hardness of 40.

B. Abrasion Resistance:
1. Taber Abrasion Test using CS-17 abrasive wheels with 1000 g weight.

2. Panels not to exhibit weight loss after 25 cycles of not more than 0.038 percent.

C. Impact Strength:
1. Conform to ASTM D 5420, 12 in-lb showing no visible damage on finish side.

D. Product Identification:
1. Finish side identification and confirmation of meeting Class A interior finish requirements after installation and while in service, without labels.

PART 3 EXECUTION

3.01 EXAMINATION

A. Comply with manufacturer's product data, including product technical bulletins, and installation instructions.

B. Verify that substrates previously installed under other sections are acceptable for product installation in accordance with FRP manufacturer's instructions.
1. Examine substrate surfaces to determine that corners are plumb and straight, surfaces are smooth, sound and uniform, nails or screw fasteners are countersunk, and joints and cracks are filled flush and smooth with adjoining surfaces.
2. Do not begin panel installation until substrate surfaces are in satisfactory condition.

3.02 PREPARATION

A. Clean substrates to remove substances that could impair bond of adhesive, including oil, grease, dirt, dust or other contamination.

B. Condition panels by unpacking and placing in installation space no less than 24 hours before installation.

C. Lay out paneling before beginning installation.
1. Locate panel joints to provide equal panel widths at ends of walls so that trimmed panels at corners are not less than 12 inches wide.

3.03 INSTALLATION

A. Install FRP panels in accordance with manufacturer's instructions at locations indicated on Drawings.
1. Cut and drill panels in accordance with manufacturer's instructions.

B. Install panels with manufacturer's recommended gap for panel field and corner joints.
1. Pre-drill fastener holes in panels, 1/8 inch greater in diameter than fastener.
2. Install panels in full spread of adhesive.
a. For trowel type and application of adhesive, follow adhesive manufacturer's recommendations.

C. Install trim accessories with adhesive and nails or staples.
1. Do not fasten through panels.

D. Sealant:
   1. Fill grooves in trim accessories with sealant before installing panels and bed inside corner trim in bead of sealant.
   2. Remove excess sealant and smears as paneling is installed.
      a. Clean with solvent recommended by sealant manufacturer and wipe with clean dry cloths.

3.04 CLEANING

A. Remove temporary coverings and protection of adjacent work areas.

B. Repair or replace any installed products that have been damaged.

C. Clean installed panels in accordance with manufacturer's instructions prior to Owner's acceptance.

D. Remove and lawfully dispose of construction debris from Project Site.

3.05 PROTECTION

A. Protect installed product and finish surfaces from damage during construction

END OF SECTION 06 8316

SECTION 07 1416

COLD FLUID-APPLIED WATERPROOFING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Cold fluid-applied waterproofing system, including, but not limited to, following:
      a. Fluid-applied waterproofing membrane.
      b. Prefabricated composite drainage/protection sheet.

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 03 3000: Cast-in-Place Concrete; finishes for waterproofing.
   3. Section 07 9200: Joint Sealants

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.

B. ASTM International (ASTM):
   1. ASTM C836 – Standard Specification for High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane for Use with Separate Wearing Course
   2. ASTM C898 – Standard Guide for Use of High Solids Content, Cold Liquid-Applied Elastomeric Waterproofing Membrane With Separate Wearing Course
   3. ASTM D412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers—Tension
   4. ASTM D751 – Standard Test Methods for Coated Fabrics
   5. ASTM D903 – Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
   6. ASTM D2240 – Standard Test Method for Rubber Property—Durometer Hardness
   7. ASTM D2369 – Standard Test Method for Volatile Content of Coatings
   8. ASTM D4258 – Standard Practice for Surface Cleaning Concrete for Coating
   9. ASTM D4263 – Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method
   10. ASTM D5295 – Standard Guide for Preparation of Concrete Surfaces for Adhered (Bonded) Membrane Waterproofing Systems
   11. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials

1.03 SUBMITTALS

A. Product Data:
   1. Include manufacturer's written instructions for evaluating, preparing, and treating substrate, technical data, and tested physical and performance properties of waterproofing.

1.04 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Qualified installer with at least 3 years experience in Work of type required and approved by manufacturer to install manufacturer's products.

B. Fluid Applied Waterproofing Material:
   1. Liquid applied, single component, moisture cured polyurethane, designed to form seamless, flexible rubber membrane impervious to moisture.
   2. Provide primary materials which are products of one manufacturer for each type of material required for Work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials and products in labeled packages.
   1. Store and handle liquid materials in their original undamaged containers in clean, dry, protected location, and within temperature range in strict compliance with manufacturer's instructions and recommendations.
   2. Protect from damage from sunlight, weather, excessive temperatures and construction operations.
      a. In cool temperatures, store the material for several hours at room temperature to facilitate mixing and application.
   3. Remove damaged material from Project Site and dispose of in accordance with applicable regulations.
   4. Remove and replace liquid materials that cannot be applied within their stated shelf life.

1.06 PROJECT CONDITIONS

A. Environmental Limitations:
   1. Apply waterproofing within range of ambient and substrate temperatures recommended by waterproofing manufacturer.
   2. Do not apply waterproofing to damp or wet substrate, when relative humidity exceeds 85 percent, or when temperatures are less than 5 degrees F above dew point.

1.07 WARRANTY

A. Special Warranty:
   1. Manufacturer's standard form, signed by manufacturer and installer, and agreeing to repair or replace waterproofing that does not comply with requirements or that does not remain watertight for period of five years after date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design:
   1. Design for cold fluid-applied waterproofing system is based on Elasto-Deck B.T., as manufactured by Pacific Polymers, division of ITW Polymers Sealants North America.

B. Products:
   1. Subject to compliance with specified requirements and acceptance by Architect, provide named product or one of following:
      a. Anti-Hydro International, Inc.: A-H Seamless Membrane
      b. BASF Building Systems: Sonoshield HLM 5000
      c. Carlisle Corporation, Carlisle Coatings & Waterproofing Div.: Carlisle CCW-525
      d. Colloid Environmental Technologies Company (CETCO): LDC 60
      e. United Coatings: Elastall 1000

2.02 WATERPROOFING MATERIALS

A. Fluid Applied Waterproofing Membranes:
   1. Liquid applied, single component, moisture cured polyurethane, designed to form seamless, flexible rubber membrane impervious to moisture. that meet or exceed performance requirements of ASTM C 836 and other ASTM standards as shown in following table.
   2. Provide material for spray application, unless indicated otherwise
      a. Provide Trowel Grade for detailing
   3. Type I for horizontal surfaces
   4. Type II for vertical surfaces
   5. Color: Black

B. Physical Properties of Membrane:
   1. Hydrostatic Pressure Resistance, ASTM D 751: 94 psi, Type II only
   2. Water Vapor Transmission, ASTM E 96, (Procedure B) water method: 0.72 grains/hr/q. ft.
   3. Moisture vapor transmission, after decay test: 1.563 grains/hr/q. ft., Type II only
   4. Adhesion to Concrete, ASTM D 903:
      a. Type I: 14.9 lb/in.
      b. Type II: 19 lb/in
      c. No peel/film break
   5. Elongation, ASTM D 412: 700 percent, ±10 percent
   6. Tensile Strength, ASTM D 412:
      a. Type I: 300 psi ±10 percent
      b. Type II: 436 psi
   7. Hardness, ASTM D 12240 (Shore A):
      a. Type I: 40 ±5
      b. Type II: 35 ±5
   8. Tackfree Time, at 7rF and 55% RH: 12 to 16 hours
   9. Recoat Time, at 77°F and 55% RH: 16 to 24 hours
   10. Percent Solids, ASTM D 2369:
      a. Type I:
         1) By Weight: 86 ±2
         2) By Volume: 78 ±2
      b. Type II:
         1) By Weight: 82 ±2
         2) By Volume: 77 ±2
   11. Recovery, ASTM D 412:
      a. Type I: 98 percent
      b. Type II: 96 percent

C. Prefabricated Drainage Composite:
   1. Designed to promote positive drainage while serving as protection course.
   2. Horizontal Surfaces:
      a. SITEDRAIN DS-188 Drainage Composite.
         1) Thickness: 0.4 inch (3/8 inch)
         2) Compressive Strength: 18,000 psf.
   3. Manufacturer:
      a. American Wick Drain or approved equal.

D. Miscellaneous Materials:
   1. Tape and other accessories specified or acceptable to manufacturer of fluid applied waterproofing membrane.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine conditions of substrates and other conditions under which Work is to be performed and notify Contractor, in writing, of circumstances detrimental to proper completion of Work.
   1. Do not proceed with Work until unsatisfactory conditions are corrected.

3.02 SURFACE PREPARATION

A. Conform to requirements of ASTM D 5295 and following:
   1. Clean and prepare substrate according to manufacturer's written recommendations.
      a. Provide clean, dust-free, and dry substrate for waterproofing application.
   2. Verify that substrate is visibly dry and free of moisture. Test for capillary moisture by plastic sheet method according to ASTM D 4263.

B. Remove grease, oil, bitumen, form-release agents, paints, curing compounds, and other penetrating contaminants or film-forming coatings from concrete.

C. Remove fins, ridges, and other projections and fill honeycomb, aggregate pockets, and other voids.
   1. Fill form tie rod holes with concrete and finish flush with surrounding surface.
   2. Repair holes greater than 1/2 inch in depth and 1/4 inch in diameter deep and finish flush with surrounding surface.
   3. Remove scaling to sound, unaffected concrete and repair exposed area.

D. Prepare vertical and horizontal surfaces at terminations and penetrations through waterproofing and at expansion joints, drains, and sleeves according to ASTM C 898 and manufacturer's written instructions.
   1. Apply double thickness of waterproofing and embed a joint reinforcing strip in preparation coat when recommended by waterproofing manufacturer.
   2. Fill form tie rod holes with concrete and finish flush with surrounding surface.

E. Prepare, treat, rout, and fill joints and cracks in substrate according to ASTM C 898 and waterproofing manufacturer's written instructions.
   1. Grind irregular construction joints to suitable flush surface.
   2. Remove dust and dirt from joints and cracks complying with ASTM 04258 before coating surfaces.

3.03 WATERPROOFING APPLICATION

A. Apply waterproofing according to ASTM C 898 and manufacturer's written instructions.

B. Apply one or more coats of waterproofing to obtain seamless membrane free of entrapped gases, with average dry film thickness of 60 mils and minimum dry film thickness of 50 mils.

C. Install protection course with butted joints over nominally cured membrane before starting subsequent construction operations and backfilling.

3.04 CURING, PROTECTING, AND CLEANING

A. Cure waterproofing according to manufacturer's written recommendations, taking care to prevent contamination and damage during application stages and curing.

B. Protect waterproofing from damage and wear during remainder of construction period.

C. Clean spillage and soiling from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 1416

SECTION 07 1616

CRYSTALLINE WATERPROOFING

PART 1 GENERAL

1.01 SUMMARY

A. Cementitious crystallizing waterproofing for interior walls and floor slabs with non-active leaks
   1. Provide at Elevator pit walls and pit slab

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 03 3000: Cast-in-Place Concrete; for formwork, waterstops, and finishing concrete walls and slabs to receive waterproofing.
   3. Section 07 9200: Joint Sealants; for elastomeric and preformed sealants in concrete walls and floors.
   4. Section 14 2100: Electric Traction Elevators
   5. Section 14 2400: Hydraulic Elevators

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.

B. ASTM International (ASTM):
   1. ASTM C 33 – Standard Specification for Concrete Aggregates
   2. ASTM C 109 – Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50-mm] Cube Specimens)
   3. ASTM C 144 – Standard Specification for Aggregate for Masonry Mortar
   4. ASTM C 150 – Standard Specification for Portland Cement
   5. ASTM C 321 – Standard Test Method for Bond Strength of Chemical-Resistant Mortars
   6. ASTM C 348 – Standard Test Method for Flexural Strength of Hydraulic-Cement Mortars
   7. ASTM C 596 – Standard Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement
   8. ASTM D 4258 – Standard Practice for Surface Cleaning Concrete for Coating
   9. ASTM D 4259 – Standard Practice for Abrading Concrete
   10. ASTM D 4260 – Standard Practice for Liquid and Gelled Acid Etching of Concrete

C. US Army Corps of Engineers (USACE):
   1. CE CRD-C 48 - Standard Test Method for Water Permeability of Concrete

1.03 SUBMITTALS

A. Product Data:
   1. For each type of product specified.

1.04 QUALITY ASSURANCE

A. Applicator Qualifications:
   1. Experienced applicator who has completed crystalline waterproofing similar in material, design, and extent to that indicated for this Project, whose work has resulted in application with record of successful in-service performance.

1.05 PROJECT CONDITIONS

A. Proceed with waterproofing work only after:
   1. Pipe sleeves, vents, curbs, inserts, drains, and other projections through substrate to be waterproofed have been completed.
   2. Concrete and masonry substrate defects, including honeycombs, voids, and cracks, have been repaired to provide sound substrate free of forming materials, including reveal inserts.

B. Ambient Conditions:
   1. Proceed with waterproofing work only when temperature is maintained at 40 degrees F or above during Work and cure period and space is well ventilated and kept free of water.

1.06 WARRANTY

A. General Warranty:
   1. Special warranty specified in this Article does not deprive Owner of other rights Owner may have under other provisions of Contract Documents, is in addition to, and runs concurrent with, other warranties made by Contractor under requirements of Contract Documents.

B. Special Warranty:
   1. Written warranty, signed by applicator and countersigned by Contractor, agreeing to repair or replace waterproofing that does not comply with requirements or that fails to perform as required, and to maintain watertight conditions within specified warranty period.
   2. Warranty includes responsibility for removing and replacing other work that conceals crystalline waterproofing.
   3. During warranty period, repairs and replacements required because of unusual weather phenomena and other events beyond Contractor's or applicator's control are to be completed by Contractor or applicator and paid for by Owner at prevailing rates.
   4. Revise warranty to period as required and verify availability.
      a. Period below is maximum included with manufacturer's published data.
   5. Warranty Period:
      a. Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design:
   1. Design for crystalline waterproofing system is based on Xypex as manufactured by Xypex Chemical Corporation.

B. Products:
   1. Subject to compliance with specified requirements, provide named product or one of following:
      a. Anti-Hydro International, Inc.: Hydro Cap
      b. Aquafin Building Products Systems: Aquafin-IC (I ntegraCoat)
      c. BASF Building Systems: Tegraproof
      d. Conproco Corporation: Conpro Seal
      e. The Euclid Chemical Company: Hey'Di K-11
      f. Koster-American Corporation: Koster NB-1

2.02 MATERIALS

A. Portland Cement: ASTM C 150, Type I.

B. Slurry-Coat Aggregate: ASTM C 144, sand.

C. Trowel-Coat Aggregate: ASTM C 33, fine aggregate.

D. Water: Potable.

E. Cementitious Crystalline Waterproofing:
   1. Blend of Portland cement, specially treated sand, and active chemicals formulated to penetrate by capillary action into concrete and to chemically react with free lime in presence of water to develop crystalline growth within concrete capillaries, producing impervious, dense, waterproof concrete with properties meeting or exceeding following criteria:
      a. Permeability:
         1) 30 feet when tested according to CE CRD-C 48.
      b. Compressive Strength:
         1) 9,000 psi at 28 days when tested according to ASTM C 109
      c. Flexural Strength:
         1) 6,000 psi at 28 days when tested according to ASTM C 348.
      d. Bond Strength:
         1) 690 psi at 14 days when tested according to ASTM C 321.

F. Patching Compound:
   1. Ready-mixed cementitious waterproofing and repair mortar for filling and patching tie holes, honeycombs, reveals, and other imperfections with properties meeting or exceeding following:
      a. Compressive Strength:
         1) 7,600 psi at 28 days when tested according to ASTM C 109.
      b. Flexural Strength:
         1) 710 psi at 28 days when tested according to ASTM C 348.
      c. Shrinkage:
         1) Minus 0.093 percent at 28 days and plus 0.073 percent at 90 days when tested according to ASTM C 596.

G. Plugging Compound:
   1. Cementitious, ready-mixed, efflorescence-free, surface waterproofing compound with hydrophobic properties that requires only addition of water.
   2. Is resistant to water and moisture but is vapor permeable for standard applications (vertical, overhead and horizontal surfaces not exposed to vehicular traffic):

a. With properties meeting or exceeding following criteria:
   1) Permeability:
      a) 30 feet when tested according to CE CROC 48.
   2) Compressive Strength:
      a) 6,000 psi at 28 days when tested according to ASTM C 109.
   3) Flexural Strength:
      a) 1,000 psi at 28 days when tested according to ASTM C 348.
   4) Bond Strength:
      a) 300 psi at 14 days when tested according to ASTM C 321.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine walls, floors, and other surfaces where waterproofing is to be applied with applicator present, for:
   1. Compliance with requirements
   2. Surface preparation, cleaning, and other conditions affecting waterproofing performance.
   3. Proceed with application only after unsatisfactory conditions have been corrected.
   4. Application of waterproofing indicates acceptance of surfaces and conditions.

3.02 PREPARATION

A. Protect other work from dripping or splatter from crystalline waterproofing during application.
   1. Provide temporary enclosure to confine operation, to prevent polluting air, and to ensure adequate ambient temperatures and ventilation conditions for application.

B. Stop active water leaks with plugging and patching compounds according to waterproofing manufacturer's written instructions.

C. Schedule cleaning and surface preparation so dust and other contaminants from cleaning and preparation process will not fall on wet, newly coated surfaces.

D. Surface Preparation of Concrete:
   1. Comply with waterproofing manufacturer's written instructions and requirements indicated below to ensure that waterproofing bonds to concrete surfaces.
   2. Clean concrete surfaces according to ASTM D 4258 by using one or combination of procedures as needed to effectively remove efflorescence, chalk, dust, dirt, mortar spatter, grease, oils, curing compounds, and form release agents.
   3. Prepare scratch and float finished concrete by etching with 10% muriatic (hydrochloric) acid solution according to ASTM D 4260.
   4. Prepare smooth-formed and trowel-finished concrete by mechanical abrading or abrasive-blast cleaning according to ASTM D 4259.
   5. Concrete Joints: Clean reveals according to waterproofing manufacturer's written instructions.

E. Mask-off surfaces adjoining areas to receive waterproofing treatment where surface damage or discoloration might result from application of waterproofing.
   1. Do not allow crystalline waterproofing or crystalline compound to migrate into reveals or annular spaces intended for resilient sealants or gaskets, such as joint spaces between pipes and pipe sleeves, unless indicated to be filled with sealant.

F. At cracks in concrete, remove loosened chips and cut square reveal approximately 1 inch deep.

3.03 APPLICATION

A. Comply with waterproofing manufacturer's written instructions, unless more stringent requirements are indicated.

B. Mix waterproofing components according to waterproofing manufacturer's written instructions.

C. Protect adjacent surfaces.
   1. Dampen wall surface with water before applying waterproofing.

D. Apply waterproofing coating evenly and fill voids and pores of substrate with waterproofing slurry.
   1. Keep tools clean and free from build-up.

E. Apply number of coats at rates recommended by manufacturer for each coat.
   1. After allowing previous coat to cure, dampen wall before applying additional coats.

F. Mist-cure waterproofing for two to three days immediately after application as recommended by manufacturer.

G. Waterproofing Treatment Extensions:
   1. Apply treatment to columns that are integral with walls to be treated, and extend treatment onto interior, nontreated walls that intersect exterior, treated walls, for a distance of 24 inches for cast-in-place concrete.
   2. Where floors (but not walls) are treated, extend treatment 12 inches high onto exterior walls and onto both exterior and interior columns.
   3. Unless otherwise indicated, extend treatment to every surface of substrate in area indicated for treatment, including pipe trenches, pipe chases, pits, sumps, and similar offsets and features.

3.04 PROTECTION

A. Protect applied crystalline waterproofing from rapid drying, severe weather exposure, and water accumulation.
   1. Maintain completed Work in moist condition for not less than seven days by covering with impervious sheeting or by other curing procedures recommended by waterproofing manufacturer.

END OF SECTION 07 1616

SECTION 07 1813

PEDESTRIAN TRAFFIC COATINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fluid applied, High Solids, Low VOC, waterproof, pedestrian traffic coating on following surfaces:
      a. Concrete stair fill at metal stair treads and landings.

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 03 3000: Cast-in-Place Concrete; concrete stair fill.
   3. Section 05 5000: Metal Fabrications; metal stairs, cast-in-place nosings.
   4. Section 07 9200: Joint Sealants; other sealant requirements.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
   1. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.

B. ASTM International (ASTM):
   1. ASTM D412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension
   2. ASTM D471 – Standard Test Method for Rubber Property—Effect of Liquids
   3. ASTM D624 – Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers
   4. ASTM D903 – Standard Test Method for Peel or Stripping Strength of Adhesive Bonds
   5. ASTM D2047 – Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
   6. ASTM D2240 – Standard Test Method for Rubber Property—Durometer Hardness
   7. ASTM D2369 – Standard Test Method for Volatile Content of Coatings
   8. ASTM D4060 – Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
   9. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.

C. South Coast Air Quality Management District (SCAQMD):
   1. Rule 1168 – Adhesive and Sealant Applications

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's product data and installation instructions for each product to be used.

B. Samples:
   1. Coating colors for review and acceptance by Architect.
      a. Minimum 2 inch by 4 inch sample of fully cured traffic coating, prepared on rigid base indicating color and texture.

C. Care and maintenance instructions.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Manufacturer of coating systems having minimum of 5 years experience in manufacture of fluid applied traffic coatings.

B. Applicator Qualifications:
   1. Qualified in writing by manufacturer, having minimum of 5 years experience in application of fluid applied traffic coatings.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project Site in sealed, undamaged containers.
   1. Identify each container with material name, date of manufacture, and lot number.

1.06 ENVIRONMENTAL CONDITIONS

A. Install coating materials under following conditions:
   1. Substrate surface temperatures are above 40 degrees F, and lower than 110 degrees F.

1.07 WARRANTY/GUARANTEE

A. Warranty completed installation against defects of material and workmanship for period of 5 years, beginning on date of Substantial Completion of pedestrian traffic coating system and inspection by manufacturer prior to, during, and after installation.
   1. Consult ITW Polymers Sealants North America, Inc. for warranty requirements prior to system installation.

PART 2 PRODUCTS

2.01 PRODUCTS

A. Pedestrian Traffic Coating:
   1. Basis-of-Design:
      a. Design of pedestrian traffic coatings is based upon ELASTO-DECK 6500PT, traffic coating system as manufactured by Pacific Polymers, division of ITW Polymers Sealants North America, Inc.

2.02 MATERIAL

A. Two component, aliphatic, high solids, low VOC, elastomeric, traffic coating system consisting of following:
   1. Primer:
      a. Pacific Polymers, ELASTO-POXY Primer, WB epoxy primer.
   2. Coating:
      a. Pacific Polymers, Inc., ELASTO-DECK 6500 liquid applied, two component, flexible, low odor polyurea deck coating.
   3. Color: Concrete Gray

B. Aggregate:
   1. 20 mesh Monterey sand, or as recommended by coating manufacturer to provide slip-resistant surface per CBC Section 11B-302 and ASTM D 2047.

C. Sealant:
   1. Permathane SM7108, one-part self-leveling or gun grade, non-staining, polyurethane sealant manufactured by ITW Polymers Sealants North America, Inc.
   2. Comply with additional requirements in Section 07 9200.

D. Flashing Tapes:
   1. Perma-Glas Mesh
   2. Tie-Tex 272 polyester tape.

E. Contrasting Stripe:
   1. Provide contrasting stripe of same material at stair treads and landings where indicated.
   2. Omit contrasting stripe when stairs are fabricated with cast in nosings as specified in Section 05 5000.

2.03 TECHNICAL DATA

Property	Test Method	Results
Pot Life (@ 75° F)		20 minutes
Cure Time (@ 75° F)		48 hours minimum
Viscosity at 77°F (25°C)	Brookfield Viscometer	35 +5 poises
Weight per Gallon A Component B Component		 10.5 lbs. 8.60 lbs.
Percent Solids Content	ASTM D 2369	98% (weight) 98% (volume)
Hardness (Shore A/D)	ASTM D 2240	90-95A (40D)
Percent Elongation	ASTM D 412	300% ±10 percent

Property	Test Method	Results
Adhesive Peel Strength on Primed Concrete	ASTM D 903	35 pli cohesive failure
Water Absorption	ASTM D 471	1.2 percent by weight
Moisture Vapor Transmission	ASTM E 96	3.9 perms
Abrasion Resistance	ASTM D 4060 30 mil dry mil film on 4" x 4" metal CS17 wheel, 1000 rev, 1000 gram weight	2 mg. wt. loss.
Tear Resistance	ASTM D 624	280 pli ± 10 percent
VOC Content		< 25 grams/liter
UV Stability	Q Panel Weather-O-Meter	2000 hrs. No discoloration No physical damages

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine Substrates:
   1. Ensure surfaces are dry and clean and free of contamination, including water, curing compounds, hardeners, bond-breakers, and paint.
   2. Remove loose surface material, grease, oil, dirt, and contaminants.

3.02 PREPARATION

A. Surfaces Indicated to Receive Pedestrian Traffic Coating:
   1. Grind concrete surfaces where necessary to remove high spots, previous coatings, and uneven surfaces.
   2. Conform to requirements of SSPC-SP 13/NACE No. 6 – Surface Preparation of Concrete, as applicable.

B. Seal cracks with traffic coating and reinforce by imbedding 4 inch wide strip of flashing tape in wet coating, brushed evenly over seam in width of approximately 5 inches.

3.03 APPLICATION

A. General:
   1. Apply specified material to concrete filled stair treads.
   2. Provide contrasting color strip at landing and each tread, complying with CBC Section 11B-504.4.1, unless indicated otherwise.

B. Application Procedure:
   1. Prime surfaces at rate of 200-250 square feet per gallon in accordance with manufacturer's recommendations.
   2. Lightly stir Component A (pigmented side) for 2-3 minutes using jiffy blade to evenly distribute pigments.
   3. Pour Component B into Component A.
      a. Mix thoroughly using jiffy mixing blade attached to low speed drill to uniform color without streaks.
      b. Mix 2-3 minutes.
   4. Once mixed, immediately pour coating onto surface of substrate.
   5. Use squeegee to evenly apply coating, then back roll using roller to break air bubbles.
   6. Apply coating (Base coat) to primed substrate at rate of 80 square feet per gallon.
      a. Allow for overnight cure.
   7. Apply broadcast coat at rate of 80 square feet per gallon and while coating is in fluid condition, broadcast aggregate to refusal.
      a. Allow for overnight cure.
   8. Apply final top coat at rate of 80 square feet per gallon.
   9. Allow to cure minimum of 72-96 hours before allowing traffic onto finished system.
   10. Apply bead of specified sealant at edges of coating where it abuts stringers and riser.

3.04 CLEANING

A. Clean stains from adjacent surfaces with approved cleaner.

B. Remove construction barricades, debris and other items of work, including empty containers, from Project Site.
   1. Comply with requirements in Section 01 7419

C. Remove foreign matter from finished coating surfaces.

END OF SECTION 07 1813

SECTION 07 2100

BUILDING INSULATION

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Thermal blanket/batt insulation in exterior wall construction.
   2. Sound attenuation blanket/batt insulation in interior partitions.

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 06 1053: Miscellaneous Carpentry
   3. Section 07 5416: Thermoplastic Polyolefin (TPO) Membrane Roofing; roof insulation
   4. Section 07 8400: Firestopping; fire-protective (safing) insulation.
   5. Section 09 2900: Gypsum Board; acoustical sealant.

C. Related Requirements:
   1. Refer to Division 21 through 23 Sections for piping and HVAC insulation requirements.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, current edition:
   1. Part 2, California Building Code (CBC), Volumes 1 and 2.
   2. Part 6, California Energy Code, current edition.

B. ASTM International (ASTM):
   1. ASTM C 423 – Test Method for Sound Absorption Coefficient by the Reverberation Room Method.
   2. ASTM C 518 – Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter.
   3. ASTM C 665 – Specification for Mineral Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.
   4. ASTM E 84 – Test Method for Surface Burning Characteristics of Building Materials.
   5. ASTM E 136 – Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's product literature and installation instructions for each type of insulation required.

B. Certified Test Reports:
   1. Include with product data, copies of certified test reports showing compliance with specified performance values, including R-values, characteristics, and perm ratings.

C. Quality Certification:
   1. Manufacturer's certification stating insulating materials comply with Standards for Insulating Material.

1.04 QUALITY ASSURANCE

A. Standard:
   1. Provide products complying CBC Chapter 7, Section 707 and Part 12, Chapter 12-13, Standards for Insulating Materials.

B. Recycled Content: Provide glass-fiber insulation with recycled content so postconsumer recycled content plus one-half of pre-consumer recycled content is not less than 10 percent.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to Project Site and store in safe, dry place, with labels intact and legible at time of installation.

B. Protect insulation from physical damage and from becoming wet or soiled.
   1. Comply with manufacturer's recommendations for handling, storage and protection during installation.
   2. Do not install insulation that has become wet or soiled.
      a. Immediately remove wet or soiled materials from Project Site.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Inorganic mineral or glass fibers formed into flexible resilient blankets/batts of definite dimension and controlled density as manufactured by one of following:
   1. CertainTeed Corp., Insulation Group, Malvern, PA
   2. Knauf Insulation, Shelbyville, IN
   3. Johns Manville, Denver, CO
   4. Owens Corning Insulating Systems, LLC, Toledo, OH
   5. Rockwool, Byhalia, MS

2.02 THERMAL INSULATION

A. Blankets/batts, with reflective (foil-faced) vapor retardant membrane facing complying with ASTM C 665, Type III, Class B, Category 1:
   1. Surface Burning Characteristics, ASTM E 84:
      a. Flame spread index of 75 or less
      b. Smoke developed index of 150 or less.
   2. Permeability, ASTM E 96: Foil - 0.05 Perms
   3. Provide Type III in exterior walls where indicated.
   4. Foil-Faced Batts by Johns Manville, or approved equal

B. Provide thermal insulation with material only “R" value as follows:
   1. Exterior wall cavities: R-19
   2. Nominal Thickness: 6 inches

C. Sag Wires: 18 gage steel wires.

2.03 SOUND ATTENUATION INSULATION

A. Wall Cavity:
   1. Unfaced g(lass fiber insulation blankets/batts, complying with ASTM C 665, Type I.
   2. Blankets/batts without membrane facing in manufacturer's standard lengths and widths as required, conforming to following:
      a. Surface Burning Characteristics, ASTM E 84:
         1) Flame spread index of 10 or less
         2) Smoke developed index of 10 or less.

B. Provide sound attenuation insulation in interior partitions conforming to following:
   1. Nominal 6 inches thick, minimum, friction fit.
   2. NRC Rating of 1.0 on E-405 mounting.
   3. Provide sound attenuation insulation to produce STC Ratings indicated on Drawings.

2.04 ACCESSORIES

A. Provide accessory materials, not specifically described but required for complete and proper installation, as selected by Contractor, subject to approval of Architect.
   1. Provide metal clips, impaling pins and washers, hardware, zinc-coated wires, furring channels, and other items for anchoring insulation to substrates as required and recommended by insulation manufacturer.

PART 3 EXECUTION

3.01 INSPECTION AND PREPARATION

A. Inspect substrate and conditions under which insulation work is to be performed.

B. Clean substrates of substances harmful to insulations, including removal of projections which might interfere with installation.

C. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's instructions for particular conditions of installation in each case.
   1. Where printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with Work.

B. Extend insulation full thickness as shown over entire surface to be insulated.
   1. Cut and fit insulation tightly around pipes, conduits and penetrations.
   2. Remove projections which interfere with placement.
   3. Friction-fit sound attenuation insulation in metal deck flutes as indicated on Drawings.
      a. Acoustic sealant is specified in Section 09 2900.

C. Apply single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

1. Maintain total insulation integrity over entire area to be insulated, including areas between closely spaced members.

D. Apply insulation units to substrate by method indicated, complying with manufacturer's recommendations.
   1. Where specific method is not indicated, use mechanical anchorage to provide permanent placement and support of units.
   2. Prevent insulation from sagging during and after installation by installing adequate sag wires.

E. Make insulation continuous at corners and overlaps.
   1. Fit tightly against adjoining insulation and frames.
   2. Extend insulation from floor to ceiling or above as indicated.
   3. Avoid gaps, bulges or extreme compression.
      a. Do not compress insulation in excess of 10 percent.

F. Set vapor barrier faced units with vapor barrier to warm side of construction
   1. Do not obstruct ventilation spaces
   2. Tape joints and ruptures in vapor barriers, and seal each continuous area of
      a. insulation to surrounding construction to ensure vapor-tight installation.
   3. Set reflective foil-faced units accurately with air space in front of foil as shown.
      a. Provide 0.75 inch air space where possible.

3.03 CLEANING

A. Remove and legally dispose of rubbish, debris, and waste materials off Project Site.
   1. Comply with requirements of Section 01 7419.

3.04 PROTECTION

A. Protect installed insulation from harmful weather exposures and from possible physical abuse, by temporary covering or enclosure, where installation of concealing work is delayed.
   1. Installer to advise Contractor of exposure hazards, including possible sources of deterioration and fire hazards.

END OF SECTION 07 2100

SECTION 07 2726

FLUID APPLIED AIR AND WATER BARRIER MEMBRANE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Materials and installation for liquid-applied, vapor permeable air and water resistive barrier system.

B. Related Sections:

1.	Section 01 4100:	Regulatory Requirements; current Code edition.
2.	Section 01 3300:	Submittal Procedures; general LEED submittal requirements.
3.	Section 01 3329:	Sustainable Design Reporting / LEED Requirements; specific LEED submittal requirements.
4.	Section 07 4216:	Aluminum Plate Panel System
5.	Section 07 4243:	Aluminum Composite Panel System
6.	Section 07 9200:	Joint Sealants
7.	Section 09 2400:	Portland Cement Plaster

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.

B. ASTM International (ASTM):
1. ASTM C 1305 – Standard Test Method for Crack Bridging Ability of Liquid-Applied Waterproofing Membrane
2. ASTM D 412 – Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers - Tension
3. ASTM D 1970 - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection (Self Sealability Test)
4. ASTM D 2370 – Standard Test Method for Tensile Properties of Organic Coatings
5. ASTM D4541 – Standard Test Method for Pull-Off Strength of Coatings using Portable Adhesion Testers
6. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials
7. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials
8. ASTM E 331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference
9. ASTM E 1354 – Standard Test Method for Heat and Visible Smoke Release Rates for Materials and Products Using an Oxygen Consumption Calorimeter
10. ASTM E 2178 – Standard Test Methods for Air Performance of Building Materials

11. ASTM E 2357 – Standard Test Method for Determining Air Leakage of Air Barrier Assemblies
12. ASTM G 154 – Standard Practice for Operating Fluorescent Ultraviolet (UV) Lamp Apparatus for Exposure of Nonmetallic Materials

C. American Association of Textile Chemists and Colorists (AATCC):
1. AATCC-127 Water Resistance: Hydrostatic Pressure Test

D. National Fire Protection Association (NFPA):
1. NFPA 285 – Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load Bearing Wall Assemblies Containing Combustible Components.

1.03 SUBMITTALS

A. Product Data:
1. Manufacturer's technical datasheets, installation instructions, and warranty.
2. Installer qualifications.

B. Samples:
1. Upon request of Architect.

C. LEED Submittals:
1. Product Data for low emitting materials used for adhesives and sealants, including printed statement of VOC content and manufacturer's receipts or proof of purchase.
   a. Include documentation of compliance with requirements for low-emitting materials as specified in Section 01 3329.
   b. Product Certificates and Laboratory Test Reports:
2. Regional Materials: Certify materials extracted, processed, and manufactured within 100 mile radius of Project Site.

D. Environmental Certifications:
1. Certificates for EQ Low-Emitting Materials:
   a. Interior Adhesives and Sealants applied on Site.

1.04 QUALITY ASSURANCE

A. Installer Qualifications:
1. Installer familiar with and experienced in installation of products specified in this Section.

B. Pre-Installation Meeting:
1. Convene prior to commencing Work of this Section, in accordance with requirements of Section 01 3119.
2. Attendees:
   a. Include Contractor, certified installer, air barrier manufacturer’s representative, Owner’s representative and Architect.
3. Review air barrier requirements and installation, special details, mockups, air leakage and bond testing, air barrier protection, and Work scheduling that covers air barriers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturers original, unopened, undamaged containers with identification labels intact.

B. Store in original, unopened containers out of direct sun

1.06 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Do not apply air barrier membrane on surfaces to be coated when temperature is below 0 degrees or above 110 degrees F, or when moisture is present on surface unless approved in writing by manufacturer.

1.07 WARRANTY

A. Provide manufactures material warranty.
   1. Ensure manufacturers installation guidelines, specifications, details, and warranty requirements are met.
   2. Warranty Period:
      a. 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Basis-of-Design:
   1. Design for fluid applied membrane air barrier system is based on R-Guard Cat 5 Rain Screen, as manufactured by PROSOCO Inc., Lawrence, KS.

B. Subject to compliance with specified requirements, provide named product or comparable product by following:
   1. GE Elemax 2600 AWB, as manufactured by Momentive Performance Materials, Inc., Waterford, NY.

C. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:
   1. Submit items listed in Article 1.04 and as specified in Section 01 3300, for evaluation of proposed system.
   2. Complete project shop drawings for similar project may be submitted for evaluation purposes, however shop drawings specific to this Project will be required from successful bidder.
   3. Copy of manufacturer's material warranty.

2.02 MATERIALS

A. Fluid Applied Air Barrier:
   1. R-Guard Cat 5 Rain Screen.

B. Liquid Flashing (Detail Sealant/Adhesive):
   1. Provide one of following:
      a. R-Guard FastFlash.
      b. R-Guard Joint and Seam.

2. Comply with requirements of Section 07 9200.

C. Water-based primer for raw gypsum board edges:
1. R-Guard PorousPrep, as required for performance of Work.

D. Transition Membrane:
1. R-Guard FastFlash.
2. R-Guard ThruWall.
3. R-Guard SureSpan EX.

E. Pre-Cured Silicone:
1. R-Guard SureSpan EX.

2.03 PERFORMANCE

A. UV Exposure: Provide air barrier membrane system that will not tear or lose effectiveness when exposed to weather during construction, for up to 12 months. Air Barrier must be formulated for continuous, intermittent UV exposure under ventilated cavity, rain screen.

B. Application Temperature: 0 degrees to 110 degrees F.

C. Performance Properties:

Property	Value	Test Method
Air Permeance – tested at 1.57 psf (75 Pa)	Less than or equal to 0.0004 cfm/ft²	ASTM E 2178
Assembly Air Leakage - tested at 1.57 psf (75 Pa)	Less than or equal to 0.04 cfm/ft²	ASTM E 2357
Water Resistance	Pass	AATCC - 127
Water Penetration	No water penetration observed at the joints	ASTM E 331
Water Vapor Permeance	DFT greater or equal to 10 perms	ASTM E 96
Self Sealability around Nails	Pass	ASTM D 1970
Crack Bridging Ability	Pass	ASTM C 1305
Pull of Strength (concrete)	Greater or equal to 18 psi or substrate failure	ASTM D 4541
Pull of Strength (fiberglass mat faced gypsum sheathing)	Greater or equal to 18 psi or substrate failure	ASTM D 4541
Tensile Strength	Greater than or equal to 100 psi	ASTM D 412
Elongation	Greater than or equal to 250 percent	ASTM D 412
Multi-Story Wall Assembly Burn Test	Passed in assembly tested and acceptable for use in various wall assemblies per engineering analysis	NFPA 285

Property	Value	Test Method
Surface Burning	Flame Spread Index: Less than or equal to 25 Smoke Developed Index: Less than or equal to 450 NFPA Class A	ASTM E 84
Oxygen Consumption (Cone) Calorimeter	Effective Heat of Combustion: 9.8 MJ/kg Peak Heat Release Rate: 97 kW/m^2 Total Heat Release: 5.6 MJ/m^2	ASTM E 1354

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Surfaces must be clean, dry, and free of contaminants that may interfere with proper bonding of materials per manufacturer's published data sheets and installation guidelines.

B. Clean laitance and other contaminations where necessary to provide stable clean surface for application.

C. Mask off adjoining surfaces not covered by air barrier to prevent spillage and overspray affecting other construction.

D. Remove grease, oil, bitumen, form release agents, paints, curing compound, and other penetrating containments or film forming coatings from concrete.

E. Sheathing joints must be treated per manufacturer's published product data sheets and installation guidelines.

F. Spot over and under drive fasteners with liquid flashing.

3.02 INSTALLATION

A. Transition/Detailing Treatment:
   1. Install appropriate materials to treat sheathing joints, expansion joints, drift joints, rough openings, transitions, terminations, penetrations and similar surface irregularities.
   2. Ensure installation is performed in accordance with manufacturers published installation guidelines.
   3. Sheathing joints less than 3/8 inch may be treated with liquid flashing. per manufacturers installation guidelines. Utilize liquid flashing and backer rod for joints measuring greater than 3/8 inch and less than 1 inch, per manufacturer's installation guidelines.
   4. Inside or Outside Corners:
      a. Ensure liquid flashing or reinforcement extends per the manufacturer's minimum requirement onto each angle change.
      b. Liquid flashing installed per manufacturers installation guidelines.

5. Rough Openings.
   a. Ensure liquid flashing materials extends per the manufacturer's minimum requirement onto the vertical wall and into rough opening.
   b. Install flashing per manufacturers installation guidelines.
6. Pipe or Duct Penetrations may be treated with liquid flashing applied around entire perimeter and properly tooled, per manufacturer's installation guidelines.
7. Treat static joints greater than 2 inches, expansion joints and drift joints with transition membrane per manufacturer's published installation guidelines.

B. Fluid Applied Membrane Air Barrier Installation:
1. Apply air barrier to required mil thickness per manufacturer's published instructions.
2. Touch up or repair damaged air barrier per manufacturer's published product data sheets or instruction guidelines.
3. Ultimate cure and tack-free of specified product is dependent upon temperature and humidity.

3.03 CLEANING AND PROTECTION

A. Protect air barrier system from damage during application and remainder of construction period.

B. Should damage occur, repair per manufacturers installation guidelines.

C. Clean spills, stains, and soiling from construction that would be exposed in completed Work.
1. Use cleaning agents and procedures recommended in writing by manufacturer of affected construction.

D. Remove masking materials after installation.

END OF SECTION 07 2726

SECTION 07 5416

THERMOPLASTIC POLYOLEFIN (TPO) MEMBRANE ROOFING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Thermoplastic Polyolefin (TPO) Membrane Roofing System:
      a. Extent of Work is indicated on Drawings and by provisions of this Section.
      b. Work is defined to include roofing, flashing, stripping, and roofing accessories integrally related to roofing installation.

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 03 3000: Cast-in-Place Concrete; roof deck.
   3. Section 05 3000: Metal Decking
   4. Section 06 1053: Miscellaneous Carpentry; wood blocking and nailers.
   5. Section 07 6200: Sheet Metal Flashing and Trim.
   6. Section 07 9200: Joint Sealants

C. Related Requirements:
   1. Refer to Divisions 22 and 23 Sections for roof drains, mechanical curbs, and roof penetrations.
   2. Refer to Division 26 Sections for roof mounted electrical equipment and conduit roof penetrations.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, current edition.
   1. Part 2, California Building Code (CBC), Volumes 1 and 2.
      a. Chapter 15 – Roof Assemblies and Rooftop Structures.
   2. Part 6, California Energy Code

B. ASTM International (ASTM):
   1. ASTM C 473 – Standard Test Methods for Physical Testing of Gypsum Panel Products
   2. ASTM C 518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus
   3. ASTM C 1177 – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing
   4. ASTM C 1289 – Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
   5. ASTM C 1371 – Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers
   6. ASTM C 1549 – Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer
   7. ASTM D 1079 – Standard Terminology Relating to Roofing and Waterproofing
   8. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials

9. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials
10. ASTM E 1980 – Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces

C. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
1. ASCE/SEI 7 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

D. Factory Mutual Global (FMG):
1. FM Approval 4435 – Approval Standard for Edge Systems Used with Low Slope Roofing Systems.

E. National Roofing Contractors Association (NRCA):
1. NRCA Roofing Manual.

F. UL, LLC (UL):
1. UL 790 – Standard for Standard Test Methods for Fire Tests of Roof Coverings.

G. American National Standards Institute and Single Ply Roofing Institute (ANSI/SPRI):
1. ANSI/SPRI ES-1 – Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
   a. Testing and Certification Listing of Shop Fabricated Edge Metal and Coping.
   b. Only required for fabricated item procedures.

H. American National Standards Institute (ANSI)/Cool Roof Rating Council (CRRC):
1. ANSI/CRRC S100 – Standard Test Methods for Determining Radiative Properties of Materials.

I. South Coast Air Quality Management District (SCAQMD):
1. Rule 1168 – Adhesive and Sealant Applications

1.03 DEFINITIONS

A. Roofing Terminology:
1. Refer to following publications for definitions of roofing work related terms in this Section:
   a. ASTM D 1079
   b. NRCA Glossary in NRCA Roofing Manual
   c. Roof Consultants Institute (RCI):
      1) Glossary of Building Envelope Terms
   d. Refer to Section 07 6200 for sheet metal terminology and techniques.

1.04 DESIGN CRITERIA

A. General:
1. Install roofing membrane system to remain watertight; resist specified wind uplift pressures, thermally induced movement, and exposure to weather without failure.
2. Comply with ASCE/SEI 7 and following:
   a. Building Height: 40 feet.

b. Exposure Category: C
c. Wind Speed Velocity: 105 mph.
d. Building Risk Category: IV

B. Material Compatibility:
1. Provide roofing materials compatible with one another under conditions of service and application required, as demonstrated by roofing system manufacturer based on testing and field experience.

C. Comply with current code requirements based on authority having jurisdiction.

D. Wind Uplift Pressure:
1. Provide roofing system systems identical to that have been successfully tested by qualified testing and inspecting agency to resist wind uplift pressure calculated in accordance with ASCE/SEI 7:
a. Confirm following with Structural Drawings:
1) Field Prime Uplift Pressure: -27.50 psf.
2) Field Uplift Pressure: -47.86 psf.
3) Perimeter Uplift Pressure: -63.14 psf.
4) Corner Uplift Pressure: -86.05 psf.

E. Provide roofing system complying with following requirements:
1. CCR, Title 24, Part 6 – Energy Code
2. Tested in accordance with ANSI/CRRC S100

F. Fire-Test-Response Characteristics:
1. Provide roofing materials with fire-test-response characteristics indicated as determined by testing identical products per test method below by UL, or another testing and inspecting agency acceptable to authorities having jurisdiction.
2. Identify materials with appropriate markings of applicable testing and inspecting agency.
a. Exterior Fire-Test Exposure:
1) Class A; UL 790:
a) F or application and roof slopes indicated

1.05 SUBMITTALS

A. Product Data:
1. Manufacturer’s data sheets for each product to be provided.

B. Detail Drawings:
1. Provide roofing system details of attachment to other Work, including:
a. Base flashings and membrane terminations.
b. Tapered insulation, including slopes.
c. Crickets, saddles, and tapered edge strips, including slopes.
d. Insulation fastening and adhesive patterns.

C. Samples:
1. Provide for each product specified.

D. Installer Certificates:
   1. Confirmation that installer is approved, authorized, or licensed by manufacturer to install roofing system.

E. Maintenance Data:
   1. Refer to Johns Manville's latest published documents.
   2. Furnish to Owner as required under Section 01 7839.

F. Guarantees:
   1. Provide manufacturer's current guarantee specimen.

G. Provide copy of Guarantee Application Confirmation document issued by Johns Manville Roofing Systems prior to roofing system installation, indicating that Project has been reviewed for eligibility to receive specified guarantee and is registered.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Domestic U.S. owned and based manufacturer that has UL listing or accredited testing agency listing for roofing system identical to that used for this Project.

B. Installer Qualifications:
   1. Firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and who is eligible to receive the specified manufacturer's guarantee.

C. Testing Agency Qualifications:
   1. Independent testing agency with experience and capability to conduct testing indicated, and documented according to ASTM E 329.

D. Test Reports:
   1. Roof drain and leader test or submit plumber's verification.
   2. Core cut, if required.
   3. Roof deck fastener pullout test, if required.
   4. Bonded pull test, if required.

E. Source Limitations:
   1. Obtain system components from single source:
      a. Roofing manufacturer guaranteeing roofing system.
      b. Label products used in system by the single source roofing manufacturer issuing guarantee.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storage.

B. Store liquid materials in their original undamaged containers in clean, dry, protected location and within temperature range required by roofing system manufacturer.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources.

1. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials and place equipment in manner to avoid permanent deflection of deck.

1.08 PROJECT CONDITIONS

A. Weather Limitations:
   1. Proceed with installation only when current and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and guarantee requirements.

1.09 GUARANTEE

A. Provide manufacturer's system guarantee equal to Johns Manville's Peak Advantage No Dollar Limit Roofing System Guarantee.
   1. Approved single-source special guarantee includes:
      a. Roofing membrane.
      b. Base flashings.
      c. Roofing membrane accessories.
      d. Roof insulation:
         1) Where occurring on top of concrete deck.
      e. Fasteners and adhesives,
      f. Roof cover board,
      g. Walkway pads
      h. Expansion joints and edge metal products, when provide by roofing system manufacturer.
      i. Other single-source components of roofing system provided by specified manufacturer.
      j. Guarantee Period:
         1) 20 years from date of Substantial Completion.
   2. Insert name of roofing system manufacturer’s representative in appropriate fields when applying for manufacturer’s warranty.

B. Installer’s Guarantee:
   1. Submit roofing Installer's guarantee, including each component of roofing system for following guarantee period:
      a. Guarantee Period:
         1) Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 ROOFING MEMBRANE

A. Thermoplastic Polyolefin (TPO) Roofing Membrane:
   1. Fabric-Reinforced Thermoplastic Polyolefin Sheet:
      a. Conforming to ASTM D 6878.
      b. Uniform, flexible sheet formed from thermoplastic polyolefin, internally fabric or scrim reinforced.
   2. Basis-of-Design:
      a. Design of roofing systems is based upon TPO System as manufactured by Johns Manville, Denver, CO

b. Product: JM TPO
3. Membrane Thickness:
   a. Nominal 80 mils
4. Exposed Face Color: White

B. Specified Roofing System is District Standard.
1. Substitutions are not permitted.

2.02 AUXILIARY ROOFING MATERIALS – SINGLE PLY

A. General:
1. Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with membrane roofing.
   a. Provide liquid-type auxiliary materials complying with VOC limits of SCAQMD Rule 1168.

B. Sheet Flashing:
1. Internally reinforced or scrim reinforced.
2. Product:
   a. JM TPO 60 mil

C. Bonding Adhesive:
1. Water-based bonding adhesive for membrane:
   a. Product:
      1) JM TPO Water Based Membrane Adhesive
2. Solvent-based bonding adhesive for base flashings:
   a. Product:
      1) JM All Season Sprayable Bonding Adhesive
3. Serviceable Installation Ambient Air Temperature: 25 degrees F and rising.

D. Urethane Adhesive:
1. Self-contained two-part, low-rise foam adhesive:
   a. Formulated to adhere fleece-backed membranes to substrate.
2. Product:
   a. JM Two-Part Urethane Insulation Adhesive Canister

E. Liquid Applied Flashing Primer:
1. Single ply liquid flashing primer.
2. Products:
   a. JM SP Liquid Flashing TPO Primer.
   b. JM SP Liquid Flashing Concrete Primer.

F. Metal Termination Bars:
1. Standard predrilled stainless-steel or aluminum bars, with anchors.
2. Product:
   a. JM Termination Systems

G. Fasteners:
1. Factory-coated steel fasteners and metal plates meeting corrosion-resistance provisions in FMG 4470.
   a. Designed for fastening membrane to substrate, acceptable to membrane roofing system manufacturer.
   b. Product:

1) All Purpose Fasteners and High Load Plates.

H. Miscellaneous Accessories:
1. Provide accessories to meet roofing manufacturer's guarantee requirements and to provide complete system.

2.03 WALKWAY PADS AND SAFETY STRIPS

A. Flexible Walkways:
1. Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads.
a. Sourced from membrane roofing system manufacturer.
2. Product:
a. JM TPO Walkpad,

2.04 ROOF COVER BOARD

A. Glass Mat Gypsum Roof Board:
1. Complying with ASTM C 1177.
2. Heavy duty coated glass-mat facer with primed face, water-resistant gypsum substrate for adhered roof applications:
a. Thickness: 1/2 inch
b. Product:
1) DEXcell FA Glass Mat Roof Board

2.05 TAPERED INSULATION

A. Tapered Insulation:
1. Complying with ASTM C 1289, Type II, Class 1, Grade 2 (20 psi).
2. Product:
a. Tapered ENRGY 3.
3. Provide factory-tapered insulation boards fabricated to slope of 1/4 inch per 12 inches, unless otherwise indicated.

2.06 INSULATION ACCESSORIES

A. General:
1. Roof insulation accessories recommended by insulation manufacturer for intended use and compatible with membrane roofing.

B. Provide saddles, crickets, tapered edge strips, and other insulations shapes where indicated for sloping to drain.
1. Fabricate to slopes indicated.
2. Product:
a. Tapered Fesco Edge Strips.

C. Fasteners:
1. Factory-coated steel fasteners and square metal plates meeting corrosion-resistance provisions in FMG 4470.
a. Designed for fastening roof insulation to substrate.
1) Furnished by roofing system manufacturer.
2) Product:
a) All Purpose Fasteners and UltraFast Plate

D. Urethane Adhesive:
   1. Two component polyurethane adhesive:
      a. Formulated to adhere insulation to substrate.
      b. Products
         1) JM Two-Part Urethane Insulation Adhesive Canister

E. Wood Nailer Strips:
   1. Comply with requirements specified in Section 06 1053.

2.07 EDGE METAL COMPONENTS

A. Metal Edge System:
   1. Factory fabricated metal edge system used to terminate roof at perimeter of structure.
   2. Provide product from single-source roofing system supplier that is included in No Dollar Limit guarantee.
   3. Product:
      a. JM TPO-Coated Metal

B. Metal Flashing Sheet:
   1. Refer to Section 07 6200 for metal flashing sheet.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates, areas, and conditions for compliance with requirements affecting performance of roofing system.
   1. General:
      a. Verify that roof openings and penetrations are in place, set and braced and roof drains are securely clamped in place.
      b. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.

B. Concrete Deck:
   1. Verify that concrete curing compounds that will impair adhesion of roofing components to roof deck have not been used.
   2. Verify that concrete substrate is visibly dry and free of moisture.
      a. Ensure general rigidity and proper slope for drainage.
      b. Verify that deck is securely fastened with no projecting fasteners with no adjacent units more than 1/16 inch out of plane relative to adjoining deck.
      c. Unacceptable conditions are to be brought to attention of Architect, Contractor, and Owner’s Representative and shall be corrected prior to installation of roofing system.

3.02 PREPARATION

A. Clean and remove sharp projections, dust, debris, moisture, and other substances detrimental to roofing installation from substrate in accordance with roofing system manufacturer's written instructions.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction.

C. If applicable, prime surface of deck at rate recommended by roofing manufacturer and allow primer to dry.

D. Proceed with each step of installation only after unsatisfactory conditions have been corrected.

3.03 ROOF COVER BOARD INSTALLATION

A. Coordinate installing membrane roofing system components so cover board is not exposed to precipitation or left exposed at the end of the workday.

B. Comply with membrane roofing system manufacturer's written instructions for installing roof cover board.

C. Install cover board with long joints in continuous straight line.
   1. Joints should be staggered between rows, abutting edges and ends per manufacturer’s written instructions.
      a. Fill gaps exceeding 1/4 inch (6 mm) with cover board.
   2. Cut and fit cover board within 1/4 inch of nailers, projections, and penetrations.

D. Trim surface of cover board where necessary at roof drains so completed surface is flush and does not restrict flow of water.
   1. Install tapered edge strips at perimeter edges of roof that do not terminate at vertical surfaces.

E. Adhered Cover Board:
   1. Adhere cover board to substrate as follows:
      a. Install in two-part urethane adhesive according to roofing system manufacturer’s instruction.
      b. Install to resist uplift pressure at corners, perimeter, and field of roof.
      c. No panels larger than 4 feet x 4 feet are allowed.

3.04 ROOFING MEMBRANE INSTALLATION – GENERAL

A. Install roofing membrane in accordance with roofing system manufacturer's written instructions, applicable recommendations of roofing manufacturer and requirements in this Section.

B. Cooperate with testing and inspecting agencies engaged or required to perform services for installing roofing system.

C. Coordinate installing roofing system so insulation and other components of roofing membrane system not permanently exposed are not subjected to precipitation or left uncovered at end of workday or when rain is imminent.
   1. Provide tie-offs at end of each day's work to cover exposed roofing membrane sheets and insulation.
   2. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system.
   3. Remove and discard temporary seals before beginning work on adjoining roofing.

3.05 ADHERED ROOFING MEMBRANE INSTALLATION

A. Install roofing membrane over area to receive roofing in accordance with membrane roofing system manufacturer's written instructions.
   1. Unroll roofing membrane and allow to relax before installing.

B. Accurately align roofing membrane and maintain uniform side and end laps of minimum dimensions required by manufacturer.
   1. Stagger end laps.

C. Water Based Bonding Adhesive for Smooth Backed Membranes:
   1. Apply water-based bonding adhesive to substrate at rate required by manufacturer and immediately install roofing membrane.
   2. Do not apply bonding adhesive to splice area of roofing membrane.

D. Mechanically fasten roofing membrane securely at terminations, penetrations, and perimeter of roofing.

E. Apply roofing membrane with side laps shingled with roof slope, where possible.

F. Seams:
   1. Clean seam areas, overlap roofing membrane, and hot-air weld side and end laps of roofing membrane according to manufacturer's written instructions to ensure watertight seam installation.
   2. Test lap edges with probe to verify seam weld continuity.
      a. Apply lap sealant to seal cut edges of roofing membrane.
   3. Verify field strength of seams minimum of twice daily and repair seam sample areas.
      a. Remove and repair any unsatisfactory sections before proceeding with installation.
   4. Repair tears, voids, and incorrectly lapped seams in roofing membrane that do not meet requirements.

G. Spread sealant or mastic bead over deck drain flange at deck drains and securely seal roofing membrane in place with clamping ring.

3.06 BASE FLASHING INSTALLATION

A. Install sheet flashings and preformed flashing accessories and adhere to substrates per membrane roofing system manufacturer's written instructions.

B. Apply solvent-based bonding adhesive at required rate and allow to partially dry.
   1. Do not apply bonding adhesive to seam area of flashing.

C. Apply single ply liquid applied flashing system per manufacturer’s written instructions.

D. Flash penetrations and field-formed inside and outside corners per manufacturer’s installation instructions.

E. Clean seam areas and overlap and firmly roll sheet flashings into adhesive.
   1. Weld side and end laps to ensure watertight seam installation.

F. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.07 EDGE METAL INSTALLATION

A. Examine substrates and conditions under which sheet metal flashing and trim are to be installed and verify that work may properly commence.
   1. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Provide edge details as indicated on Drawings.
   1. Install in accordance with membrane manufacturer's requirements and SMACNA Architectural Sheet Metal Manual.

C. Join individual sections in accordance with membrane manufacturer's requirements and SMACNA Architectural Sheet Metal Manual.

3.08 WALKWAY INSTALLATION

A. Flexible Walkways:
   1. Install walkway products in locations indicated.
      a. Heat weld and adhere walkway products to substrate according to roofing system manufacturer's written instructions.

3.09 FIELD QUALITY CONTROL

A. Owner or designated representative TO provide on-site observation and inspection during installation.

B. Owner to engage qualified independent testing and inspecting agency to perform roof tests and inspections and to prepare test reports.

C. Final Roof Inspection:
   1. Arrange for roofing system manufacturer's technical representative to inspect roofing installation on completion and submit report to Architect. And Owner.

D. Repair or remove and replace components of roofing system where test results or inspections indicate that they do not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.10 PROTECTION AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period.

B. Correct deficiencies in or remove roofing system that does not comply with requirements:
   1. Repair substrates, and repair or reinstall roofing system to condition free of damage and deterioration at time of Substantial Completion in accordance with warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 5416

SECTION 07 6200

SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Sheet metal flashing and trim, including, but not necessarily limited to:
      a. Roofing sheet metal flashing work.
      b. Reglet and counter flashing assemblies.
      c. Miscellaneous metal flashing and counter flashing as required
      d. Drip flashings.
      e. Other sheet metal items, not necessarily specified, but required to prevent penetration of water into building.

B. Related Sections:
   1. Section 05 0513: Shop-Applied Coatings for Metal
   2. Section 06 1053: Miscellaneous Carpentry; wood blocking and nailers.
   3. Section 07 5416: Thermoplastic Polyolefin (TPO) Membrane Roofing
   4. Section 07 9200: Joint Sealants.
   5. Section 09 9100: Painting; items specified to be field painted.

1.02 REFERENCES

A. ASTM International (ASTM):
   1. ASTM A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   2. ASTM B 69 – Standard Specification for Zinc Sheet.
   3. ASTM C 920 – Standard Specification for Elastomeric Joint Sealants
   4. ASTM D 4586 – Standard Specification for Asphalt Roof Cement, Asbestos-Free.

B. Sheet Metal & Air Conditioning Contractors' National Association (SMACNA):
   1. Architectural Sheet Metal Manual

C. Specialty Steel Industry of North America (SSINA):
   1. SSINA Designer Handbook – Standard Practices for Stainless Steel

D. American National Standards Institute and Single Ply Roofing Institute (ANSI/SPRI):
   1. ANSI/SPRI ES-1 – Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems.
      a. Testing and Certification Listing of Shop Fabricated Edge Metal and Coping.
      b. Only required for fabricated item procedures.

E. South Coast Air Quality Management District (SCAQMD):
   1. Rule 1113 – Architectural Coatings
   2. Rule 1168 – Adhesive and Sealant Applications

1.03 SUBMITTALS

A. Shop Drawings:
   1. Showing fabrication, jointing and securing of metal to form flashings and trim.
      a. Include expansion joint details and waterproof connections to adjoining work and at obstructions and penetrations.
   2. Identify material, thickness, weight and finish for each item and location in Project.
   3. Show Details for:
      a. Forming sheet metal flashing and trim.
         1) Including profiles, shapes, seams and dimensions.
      b. Fastening, joining, supporting and anchoring sheet metal flashing and trim.
         1) Including fasteners, clips, cleats and attachments to adjoining work.

B. Samples:
   1. Each type of sheet metal flashing and trim indicated with factory-applied color finishes.
      a. Minimum of four 6 inch square samples on same metal used for flashings.

1.04 QUALITY ASSURANCE

A. Standards:
   1. Comply with material and installation requirements of SMACNA Architectural Sheet Metal Manual, unless otherwise indicated or specified.

B. General:
   1. Install sheet metal flashing and trim to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failing, rattling, leaking, or fastener disengagement.

1.05 SEQUENCING

A. Coordinate metal flashing and trim work with adjacent work, including, but not necessarily limited to:
   1. Installation of roofing, waterproofing, drains, piping, blocking, nailers, reglets, framing at openings, curbs and parapets.

B. Coordinate installation with interfacing and adjoining construction to provide leakproof, secure, and non-corrosive installation.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver sheet metal flashing materials and fabrications undamaged.
   1. Protect sheet metal flashing and trim materials and fabrications during transportation and handling.

B. Unload, store, and install sheet metal flashing materials and fabrications in manner to prevent bending, warping, twisting, and surface damage.

C. Stack materials on platforms or pallets, covered with suitable weathertight and ventilated covering.

1. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

PART 2 PRODUCTS

2.01 SHEET METAL MATERIALS

A. Galvanized Steel Sheet:
   1. Conforming to ASTM A 653 with G90 coating.
   2. Structural quality, minimum 0.0299 inch thickness (22 U.S. standard gage) unless otherwise indicated.
   3. Conform to requirements for field painting per Section 09 9100, when not indicated to be prefinished.

B. Prefinished Metal:
   1. Galvanized steel sheet conforming to paragraph A.
   2. Coil-Coated Colored Finish:
      a. Fluoropolymer (Kynar resin-based) coating).
      b. Comply with requirements in Section 05 0513 for Metal Finish Type B:
         1) 1 mil dry film thickness, one side.
         2) 0.3 to 0.4 mil on other side.
   3. Use in visually exposed locations.
   4. Color: As selected by Architect

2.02 MISCELLANEOUS MATERIALS AND ACCESSORIES

A. Fasteners:
   1. Same metal as flashing/sheet metal or other corrosion resistant metal as recommended by sheet manufacturer.
   2. Match finish of exposed heads with material being fastened.

B. Reglets:
   1. Metal units of type and profile indicated, compatible with flashing indicated, corrosion resistant.
   2. Fry Reglet Co. "Spring Lok" 2-piece style as indicated; 24 gage galvanized steel.
   3. Provide manufacturer's standard prefabricated corner units.
   4. Use stainless steel washers with neoprene facing.
   5. Equivalent products by MM Systems or Lane-Aire may be used subject to acceptance by Architect.

C. Metal Accessories:
   1. Provide sheet metal clips, straps, anchoring devices and similar accessory unit as required for installation of Work, matching or compatible with material being installed, corrosion resistant, size and gage required for performance.

D. Zinc Drain Pans and Pipe Flashing:
   1. Conforming to ASTM B 69, 99.995 percent pure zinc
      a. ZincJak by Commercial Innovations or approved equal.
   2. Thickness: 0.02 inch
   3. Pipe Flashing:
      a. Interior coated, exterior preprimed
   4. Drain Pans:

a. Pretreated both sides with factory primer topside coating
5. Lead Free Solder for Zinc: SN 100C, Aim Solder
6. Flux for Zinc: No. 17 or No. 70, Superior Flux Mfg. Co.

E. Epoxy Seam Sealer:
1. 2-part noncorrosive metal seam cementing compound, recommended by metal manufacturer for exterior/interior nonmoving joints including riveted joints.

F. Mastic Sealant:
1. Polyisobutylene; nonhardening, nonskinning, nondrying, nonmigrating sealant.

G. Isolation Between Dissimilar Materials:
1. Provide single-component, inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities
a. VOC compliant.
2. Elasto-Deck BT as manufactured by Pacific Polymers, div. ITW Polymers Sealants North America, or equivalent product acceptable to Architect.

H. Roofing Cement:
1. Conforming to ASTM D 4586, asphaltic, compatible with roofing materials.

I. Elastomeric Sealant:
1. Generic type recommended by manufacturer of metal and fabricator of components being sealed
2. Comply with ASTM C 920 and requirements of Section 07 9200.

J. Flashing Compound:
1. Federal Specification SS-C-153, fibrated asphalt plastic cement, compatible with roofing materials.

2.03 FABRICATION

A. Sheet metal work is not necessarily individually described.
1. Descriptions included are major items or those requiring detail.
2. Provide other work, as indicated or necessary.

B. Shop fabricate Work to greatest extent possible.
1. Comply with details shown, applicable requirements of SMACNA Manual, and other recognized industry practices.
2. Fabricate for waterproof and weather-resistant performance; with expansion provisions for running work, sufficient to permanently prevent leakage, damage or deterioration of Work.
3. Form work to fit substrates.
4. Comply with material manufacturer instructions and recommendations for forming material.
5. Form exposed sheet metal work without excessive oil-canning, buckling and tool marks, true to line and levels indicated, with exposed edges folded back to m hems.

C. Seams:
1. Fabricate non-moving seams in sheet metal with flat-lock seams.
2. For metal other than aluminum, tin edges to be seamed, form seams, and solder.

D. Expansion Provisions:
   1. Where lapped or bayonet-type expansion provisions in Work cannot be used, or would not be sufficiently water/weatherproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

E. Separations:
   1. Provide for separation of metal from non-compatible metal or corrosive substrates by coating concealed surfaces at locations of contact, with specified isolation coating or other permanent separation as recommended by manufacturer/fabricator.

F. Counterflashing, Reglets, Copings, and Edgings:
   1. In-stock patterns, conforming substantially to details and design as shown, are acceptable.
   2. Manufacturers: Fry Reglet Corp., Lane-Aire Corp., or approved equal.

PART 3 EXECUTION

3.01 GENERAL

A. Inspect substrates and conditions under which metal flashing and trim will be installed.
   1. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Except as otherwise indicated, comply with manufacturer's installation instructions and recommendations, and with SMACNA Manual.
   1. Anchor units of Work securely in place by methods indicated, providing for thermal expansion of metal units.
      a. Conceal fasteners where possible, and set units true to line and level as indicated.
   2. Install Work with laps, joints and seams which will be permanently watertight and weatherproof.
   3. Use fasteners, solder, welding rods, protective coatings, separators, sealants and other miscellaneous items as required to complete sheet metal flashing and trim system.
   4. Anchor sheet metal flashings in accordance with Factory Mutual Loss Prevention Data Sheet 1-49.
   5. Drive exposed fasteners through steel/neoprene washers.

C. Bed flanges of Work in thick coat of specified isolation coating where required for waterproof performance.

D. Install reglets to receive counter flashing in manner and by methods indicated.
   1. Where shown in concrete, furnish reglets to trades of concrete and masonry work for installation as Work of Sections 03 3000 and 04 2000.
   2. Install counterflashing in reglets, either by snap-in seal arrangement, or by wedging in place for anchorage and filling reglet with mastic or elastomeric sealant, as indicated and depending on degree of sealant exposure.

E. Metal Protections:
   1. Where dissimilar metals will contact each other or corrosive substrates, protect against galvanic action by painting contact surfaces with isolation coating or by other permanent separation as recommended by fabricator or manufacturers of dissimilar metals.

F. Install exposed sheet metal flashing and trim without excessive oil canning, buckling and tool marks.

G. Expansion Provisions:
   1. Provide for thermal expansion of exposed flashing and trim.
   2. Space movement joints at maximum of 10 feet with no joints allowed within 24 inches of corner or intersection.
   3. Where lapped or bayonet-type expansion provisions cannot be used or would not be sufficiently watertight, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with elastomeric sealant concealed within joints.

H. Seal joints with elastomeric or butyl sealant as required for watertight construction.

I. Touch-up abraded areas, where coating has been damaged, with 2 mil coating of paint, specifically recommended by manufacturer for repair of prepainted coatings.

3.02 ROOFING WORK

A. General:
   1. Install sheet metal work and accessories under direct supervision, and to complete satisfaction of roofing installer.
   2. Install Work watertight and weathertight throughout.
   3. Provide for expansion and contraction, free from undue stress in any part of completed Work using lap-type expansion joints bedded in flashing compound.

B. For embedment of metal flashing flanges in roofing or composition flashing or stripping, extend flanges for minimum of 4 inch embedment.

C. Pipe and Conduit Penetrations of Roofing:
   1. Flash with zinc flashing.
   2. Flanges stripped in by roofer.
   3. At short vent pipes, flash per SMACNA, Figure 4-158, with top of flashing turned down 2 inches inside vent pipe.
   4. At pipes extending above roof too far to completely cover with zinc, extend zinc flashing up pipe minimum 8 inches and counterflash with storm collar with draw band per SMACNA, Figure 4-15C.
      a. Seal top of storm collar against pipe with elastomeric sealant.

3.03 CLEANING

A. Clean exposed metal surfaces, removing substances which might cause corrosion of metal or deterioration of finishes.

END OF SECTION 07 6200

SECTION 07 7233

ROOF HATCHES

PART 1 GENERAL

1.01 SUMMARY

A. Factory-fabricated roof hatch units for ladder access:
   1. Related Accessory Components:
      a. Ladder safety post.
      b. Safety railing system

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 05 5000: Metal Fabrications; fixed ladders.
   3. Section 06 1053: Miscellaneous Carpentry; wood blocking and nailers.
   4. Section 07 5416: Thermoplastic Polyolefin (TPO) Membrane Roofing; curb flashing
   5. Section 07 6200: Sheet Metal Flashing and Trim; roof flashing.
   6. Section 09 9600: High Performance Coatings; field painting of roof hatch

1.02 REFERENCES

A. United States Department of Labor.
   1. Occupational Safety and Health Administration (OSHA):
      a. OSHA 29 CFR 1910.23 – Walking -Working Surfaces.

B. State of California – Department of Industrial Relations.
   1. California Code of Regulations (CCR), Title 8 – Industrial Relations
   2. Chapter 4 – Division of Industrial Safety, Subchapter 7 – General Industry Safety Orders (GISO).
      a. Group 1 – General Physical Conditions and Structures, Article 2 – Standard Specifications
         1) Section 3212. Floor Openings, Floor Holes, Skylights and Roofs.

C. National Roofing Contractors Association (NRCA):
   1. NRCA Roofing and Waterproofing Manual

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's technical product data, rough-in diagrams, details, installation instructions and general product recommendations.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Minimum of 5 years experience manufacturing similar products

B. Installer Qualifications:
   1. Minimum of 2 years experience installing similar products

C. Comply with requirements of NRCA Roofing and Waterproofing Manual for installation details.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original packaging.
   1. Inspect product upon receipt and report damaged material immediately to delivering carrier and note such damage on carrier's freight bill of lading.

B. Store materials in dry, protected, well-vented area.

1.06 WARRANTY

A. Manufacturer's Standard Warranty:
   1. Materials free of defects in material and workmanship for period of five years from date of substantial completion.
   2. Should part fail to function in normal use within this period, manufacturer agrees to furnish new part at no charge.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design – Standard Roof Hatch:
   1. Design for roof hatch is based on Type S Roof Scuttle, Model S-50 (aluminum), as manufactured by The Bilco Company, New Haven, CT
   2. Size: 36 inches by 30 inches
   3. Subject to compliance with specified requirements, provide named product or comparable product by one of following manufacturers:
      a. Babcock-Davis Assoc. Inc.
      b. Lane-Aire Mfg. Corp.
      c. Nystrom Building Products

2.02 ROOF HATCHES

A. Provide metal roof hatch units of sizes shown, complete with curbs, anchorage system, gaskets, hardware, and accessories.
   1. Roof hatch is single leaf, pre-assembled from manufacturer.

B. Cover Construction:
   1. Double-wall cover construction consisting of 11 gage aluminum outer skin and 18 gage inner liner, with 1 inch fiberglass insulation core.
   2. Reinforced to support minimum live load of 40 psf with maximum deflection of 1/150th of span and 140 psf wind uplift l.
      a. Provide with 3 inch beaded flange with formed reinforcing members.

C. Operation of Cover
      a. Smooth and easy with controlled operation throughout entire arc of opening and closing.
         1) Not affected by temperature.
      b. Provide for cover to open full 90 degrees.

2. Make hatch weather tight with fully welded corner joints on cover and curb.
    a. Furnish with heavy extruded EPDM rubber gasket bonded to cover interior to ensure continuous seal when compressed to top surface of curb.

D. Curb Construction:
1. Fabricate units with curbs for mounting heights indicated:
    a. Form curb of 14 gage paint bond G-90 galvanized steel with 3-1/2 inch flange.
        1) Provide flange with 7/16 inch diameter holes for securing to roof deck
    b. Equip curb with integral metal cap flashing of same gage and material as curb.
        1) Fully welded at corners, featuring manufacturer's flashing system:
            a) Including stamped tabs, 6 inches on center,
            b) Bent inward to hold single ply roofing membrane securely in place.
2. Curb Insulation:
    a. Rigid, high-density fiberboard.
        1) 1 inch thickness on outside of curb.

E. Lifting Mechanism:
1. Manufacturer provided compression spring operators enclosed in telescopic tubes.
    a. For smooth, easy, and controlled cover operation throughout entire arc of opening and closing.
2. Upper tube is outer tube to prevent accumulation of moisture, grit, and debris inside lower tube assembly.
3. Lower tube interlocks with flanged support shoe, through-bolted to curb assembly for steel construction

F. Hardware for Roof Hatch:
1. Hardware
    a. Provide Heavy duty pintle hinges
    b. Equip cover with spring latch operated by interior and exterior turn handles
    c. Equip Roof hatch with interior padlock hasps.
        1) Padlock furnished by Owner
    d. Latch Strike:
        1) Stamped component bolted to curb assembly.
    e. Cover automatically locks in open position with rigid hold open arm equipped with 1 inch diameter red vinyl grip handle to permit easy release for closing.
    f. Compression Spring Tubes:
        1) Fabricated of anti-corrosive composite material
        2) Other Hardware:
            a) Zinc-plated and chromate sealed.
    g. Bolt cover hardware into heavy gage channel reinforcing welded to .

G. Wood Nailers:
1. Softwood lumber, pressure treated with water-borne preservatives for above-ground use, complying with AWPB LP-2; not less than 1-1/2 inch thick.
    a. Comply with requirements of Section 06 1053.

2.03 LADDER SAFETY POST

A. Provide ladder safety post at each roof hatch.
   1. Furnish ladder safety post pre-assembled from hatch manufacturer.
   2. Model LU-1 as manufactured by The Bilco Company, or approved equal.

B. Performance Characteristics:
   1. Tubular post locks automatically when fully extended.
   2. Provide safety post with following features:
      a. Controlled upward and downward movement.
      b. Release lever to disengage post to allow it to be returned to its lowered position.
      c. Adjustable mounting brackets to fit ladder rung spacing up to 14 inches on center and clamp brackets to accommodate ladder rungs up to 1-3/4 inches in diameter.

C. Post:
   1. Manufacture of high strength square tubing.
   2. Provide pull-up loop at upper end of post to facilitate raising post.

D. Material:
   1. Steel: 14 gage thickness.
      a. G-90 paint bond galvanized.

E. Balancing Spring:
   1. Provide stainless steel spring balancing mechanism to provide smooth, easy, controlled operation when raising and lowering safety post.

F. Mounting Hardware:
   1. Type 316 stainless steel.

G. Finish:
   1. High visibility safety yellow powder coat paint.

2.04 ROOF HATCH RAIL SYSTEM

A. Provide roof hatch rail system at each roof hatch.
   1. Comply with requirements of OSHA 29 CFR 1910.23.
   2. Bil-Guard 2.0 Safety Railing System:
      a. Model RL2-S as manufactured by The Bilco Company, or approved equal.

B. Performance Characteristics:
   1. Provide hatch rail system complying with requirements of OSHA 29 CFR 1910.29.
      a. Meet OSHA strength requirements with factor of safety of two.
   2. Hatch Rail System:
      a. Attach to cap flashing of roof hatch.
      b. Do not penetrate roofing material.
   3. Corrosion resistant construction with five-year warranty.
   4. Hinged Gate:
      a. Ensure continuous barrier around roof hatch.

C. Posts and Rails:
   1. Aluminum Pipe:
      a. Alloy and Temper: 6061-T6
      b. Size: 1-1/4 inch, Schedule 40,
   2. Finish:
      a. High visibility safety yellow powder coat paint.

D. Hardware:
   1. Mounting Brackets:
      a. 3/8 inch thick, extruded aluminum.
   2. Pivoting post guides with compression fittings and latching mechanism:
      a. Cast aluminum.
      b. Hinge:
         1) Self-closing gate hinge and positive latching system.
   3. Self-Closing Hinges and Fasteners:
   4. Type 316 stainless steel.

2.05 EXPOSED METAL FINISHES

A. Finishes:
   1. Factory Finish for Aluminum:
      a. Mill finish.
      b. Do not factory pre-treat or prime.
   2. Primer and finish coats will be applied in field.
      a. Conforming to requirements of Section 09 9600.

PART 3 EXECUTION

3.01 PREPARATION

A. Field Measurement:
   1. Take field measurements of [existing and new] roof hatch openings prior to preparation of shop drawings and fabrication, to ensure proper fitting of Work.
   2. Proceed with fabrication and coordinate installation tolerances as necessary when field measurements might delay Work.

3.01 EXAMINATION

A. Examine substrates and openings for compliance with requirements for installation tolerances and other conditions affecting performance.
   1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 ROOF HATCH INSTALLATION

A. General:
   1. Install products in strict accordance with manufacturer's instructions and recommendations.
      a. Coordinate with substrates to receive roof hatch units as required to ensure that each element of Work performs properly.
      b. Set units level, plumb, and in proper alignment with adjacent work.

c. Anchor units securely to supporting structural substrates, adequate to withstand lateral and thermal stresses as well as inward and outward loading pressures.

B. Testing:
1. Test units for proper function and adjust until proper operation is achieved.
2. Clean and lubricate joints and hardware.

C. Test operate units with operable components.
1. Clean and lubricate joints and hardware.
2. Adjust for proper operation.

3.03 ROOF HATCH RAIL SYSTEM INSTALLATION

A. Hatch rail system is designed to be field assembled.

B. Install in strict accordance with manufacturer’s instructions and approved submittals.
1. Locate units level, plumb, and in proper alignment with adjacent work.
2. Test units for proper function and adjust until proper operation is achieved.
3. Repair or restore finishes damaged during installation so that no evidence remains of corrective work.

3.04 REPAIR, CLEANING, AND PROTECTION

A. Repair finishes damaged during installation.
1. Restore finishes so no evidence remains of corrective work.

B. Clean exposed metal surfaces in accordance with manufacturer's instructions using methods acceptable to the manufacturer which will not damage finish...

C. Clean and lubricate joints and hardware.
1. Protect Roof Hatch and related components until date of Substantial Completion and acceptance by Owner.

END OF SECTION 07 7233

SECTION 07 9200

JOINT SEALANTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Joint sealants required to seal exterior and interior joints to make buildings weather and water tight.

B. Related Sections:
1.
2. Section 03 3000: Cast-in-Place Concrete
3. Section 07 8400: Firestopping; firestopping sealant
4. Section 08 8000: Glazing; sealants for glazing.
5. Section 09 2900: Gypsum Board; acoustic sealant.
6. Section 09 9100: Painting; paintable caulk.

1.02 REFERENCES

A. ASTM International (ASTM):
1. ASTM C 920 – Standard Specification for Elastomeric Joint Sealants.
2. ASTM C 1193 – Standard Guide for Use of Joint Sealants.

B. South Coast Air Quality Management District (SCAQMD):
1. Rule 1168 – Adhesive and Sealant Applications

1.03 SUBMITTALS

A. Product Data:
1. Technical data sheets on sealants, primers and cleaning agents, including procedures for priming and cleaning
2. Furnish following from each sealant manufacturer for sealants to be used on Project:
   a. Product recommendations, including sealant, primer, cleaners, backup and bond breaker
   b. Certification that recommended sealant and related materials meet requirements of this Section
   c. Approval of Contractor's sealant joint details
   d. Certification that installed materials will perform satisfactorily when applied in accordance with the manufacturer's applications instructions and Contractor's details

B. Shop Drawings:
1. Details of each joint type, for each combination of materials and each installation condition, based on recommendations of manufacturer.
2. Indicate following:
   a. Proposed joint size for each condition, designed to accommodate specified tolerances, building movements and deflections

b. Details of dual lines of sealant, indicating vent/weep tube location, zone dams and bridge seals where required.

C. Sealant Testing Services Reports:
1. Conform to requirements of Article 2.04 A.
2. Reports are to identify cleaning agents, primers and procedures used to obtain satisfactory test results.
3. Furnish following from structural sealant manufacturers:
a. Certification that manufacturer has reviewed structural sealant details and tested contact surfaces and finds them suitable for use:
1) With proposed sealant
2) Compatible with and non-staining to surfaces which they will contact.
3) In conformance with requirements of Article 2.01 B and 2.04 A
b. Application instructions for sealant, cleaners, primers and related materials, for each installation condition encountered in Project
1) Include surface preparation, quality control procedures, and evaluation of tests performed under Articles 2.04 A.
2) Certification that sealant supplied for Work is same type and quality as that which was tested.
4. Contractor's quality control documentation specified in Article 1.03 E.
5. Reports on field inspections by manufacturer specified in Article 3.04 A.

D. Samples:
1. Minimum of four, 3 inch long samples of following”
a. Sealant: Each type of sealant exposed to view for material and color required (except black).
b. Backer Rod and Bond Breaker Tape: each type, for material and color.

E. Compatibility Tests:
1. Results of each compatibility test to Architect and Contractor for approval prior to start of sealant Work.

1.04 QUALITY ASSURANCE

A. Use only qualified workers thoroughly skilled and specially trained in techniques of installing sealant, who can acceptably demonstrate to Architect their ability to fill joints solidly and neatly.

B. Compatibility Tests:
1. Prior to start of sealant Work, conduct compatibility tests of sealant for each different sealing condition and substrate for entire Project performed by sealant manufacturer and sealant installer.

C. Pre-Installation Meeting:
1. Arrange meeting when sealant contractor and sealant manufacturers have been selected, but prior to award of contracts.
2. Schedule meeting with Owner and General Contractor
a. Arrange for attendance by sealant contractor and sealant manufacturer’s technical representatives
3. Meeting to include, but not limited to, following:
a. Review of preliminary test results on sealants.
b. Details of sealant joints.

c. Sealant application instruction and training of installers.
d. Scheduling and procedures for periodic field inspections by sealant manufacturers' technical representatives.

4. Record minutes of meeting and promptly distribute copies of minutes to attendees and other interested parties as may be necessary.
   a. Include Architect in distribution of meeting minutes.
5. Record issues resolved during meeting.
   a. Include copies of Drawings and application instructions used in meeting.
   b. Record changes on Drawings and application instructions made at meeting.

D. Pre-installation Field Testing:
1. Field test adhesion of joint sealant material to Project substrates.
2. Verify joint sealant materials will satisfactorily adhere to substrates.
3. Arrange field testing with manufacturer or designated representative.
4. Notify parties minimum 7 days prior to field testing.
5. Field test sealants in accordance with ASTM C 1193, Appendix X-1, Method A – “Field Applied Sealant Joint Hand-pull Tab" in compliance with manufacturer's recommendations.

E. Quality Control Documentation:
1. Establish and administer written procedure for documenting sealant Work, including:
   a. Log in each shipment of sealant received, by lot number and date received
   b. Record dates and results of field tests specified in Article 3.04 C
   c. Log out each lot of sealant installed or rejected, and its ultimate location in Work, when installed.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project Site in original unopened containers bearing manufacturer's name, product designation, date of manufacturer and mixing instructions.

1.06 WARRANTY

A. Warrant sealants against loss of adhesion, loss of cohesion, cracking, or discoloration for period of twenty years; include labor and material to replace defective sealant

PART 2 PRODUCTS

2.01 MATERIALS

A. Sealant Standards – General:
1. Elastomeric Sealant: Manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated, complying with requirements of ASTM C 920, including those referenced for Type, Grade, and Class.

B. Silicone Sealant:
1. Silicone construction sealant, certified by manufacturer to meet following criteria:

a. Has physical properties required for both structural and non-structural uses under installed conditions
b. Has appropriate movement capability for installation conditions
c. Is suitable for interior and exterior application in joint conditions shown
d. Will produce watertight bond and watertight joints
e. Is compatible with other materials which sealant will contact

2. Primer, backup, and bond breaker-products recommended by sealant manufacturer
   a. Primer is required unless manufacturer's installation instructions specifically advise to contrary for certain materials
3. Sealant manufacturer is to recommend use of products which will perform satisfactorily under installation conditions on Work.
   a. Product recommendation is to include sealant, primer, backup, bond breaker, surface preparation, installation methods, and evaluation of tests performed under Article 3.04 A

C. Sealant for Paving Joints:
1. Self-leveling polyurethane, pouring grade, for gun application.
2. Suitable for traffic service
3. Primer, backup, and bond breaker-products recommended by manufacturer

D. Compatibility:
1. Provide joint sealants, joint fillers, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

E. VOC Content of Interior Sealants:
1. Provide sealants and sealant primers for use inside building envelope that comply with following limits for VOC content complying with SCAQMD Rule 1168:
   a. Architectural Sealants: Not more than 250 g/L.
   b. Sealant Primers for Nonporous Substrates: Not more than 250 g/L.
   c. Sealant Primers for Porous Substrates: Not more than 775 g/L

F. Colors:
1. Provide colors as scheduled or selected by Architect for various combinations of materials which form joints.
2. Provide transparent sealant where specified

G. **Sealant No. 1:**
1. Silicone rubber based, one-part, low-modulus, non-acid curing sealant; Type S, Grade NS, Class 100/50.
2. Provide one of following product:
   a. DOWSIL 795 by Dow Performance Silicones.
   b. GE Silpruf SCS2700 by Momentive Performance Materials, Inc.
   c. Pecora 890NST by Pecora Corporation.
   d. Sikasil WS-290 by Sika Corporation.
3. Apply Sealant No.1 to following exterior joints:
   a. Joints between metal frame and cast-in-place concrete, or masonry
   b. Joints between cast-in-place concrete sections
   c. Vertical expansion and control joints
   d. Horizontal ceiling/soffit joints

e. Sills, jambs, and heads of window frames, door frames, louvers and similar openings, and where metal, wood, or other materials abut or join concrete, or each other
f. Other exterior joints

4. Apply Sealant No. 1 to following interior joints:
   a. Hidden metal to metal storefront joints expected to undergo minimal movement
   b. Under door thresholds
   c. Vertical expansion and control joints
   d. Horizontal ceiling/soffit joints

H. **Sealant No. 2:**

1. Two-Component Polyurethane Sealant:
   a. Type M, Grade P, Class 25.
2. Provide one of following products:
   a. Pacific Polymers Elasto-Thane 227/227R by ITW Polymers Sealants North America, Inc.
   b. MasterSeal SL 2 Sealant by BASF Corporation, Construction Systems
   c. DynaTred by Pecora, Corporation.
   d. Sikaflex-2c SL by Sika Corporation
      1) Exterior and interior non-vehicular traffic joints
   e. Sikaflex-2c NS TG by Sika Corporation
      1) Exterior vehicular traffic joints
3. Apply Sealant No.2 to following exterior joints:
   a. Horizontal control and expansion joints in concrete slabs and concrete paving
4. Apply Sealant No.2 to following interior joints:
   a. Horizontal control and expansion joints in concrete slabs and tile flooring.

I. **Sealant No. 3:**

1. Mildew-Resistant One-Part Silicone Rubber Sealant; Type S, Grade NS, Class 25; compounded specifically for mildew resistance and recommended by manufacturer for interior joints in wet areas; passing ANSI A 136.1 test for mold growth.
2. Provide one of following products:
   a. DOWSIL 786 by Dow Performance Silicones.
   b. GE Silicone Sanitary 1702 Sealant by Momentive Performance Materials, Inc.
   c. Pecora 898NST by Pecora Corporation.
   d. Sikasil-M Plus US by Sika Corporation
3. Apply Sealant No. 3 to following interior joints:
   a. Joints between plumbing fixtures and other elements

J. **Sealant No.4:**

1. Silicone rubber based, one-part, medium-modulus, neutral curing sealant; Type S, Grade NS, Class 50.
2. Provide one of following products:
   a. DOWSIL 756 SMS by Dow Performance Silicones.
   b. GE SCS9000 SilPruf NB by Momentive Performance Materials, Inc..
   c. Pecora 864NST by Pecora Corp.
   d. Sikasil WS-605 S by Sika Corporation
3. Apply Sealant No.4 to following exterior joints:
   a. Vertical expansion and control joints in tile and concrete.

b. Horizontal ceiling/soffit joints
c. Other exterior joints where non-staining sealant is required.

2.02 MISCELLANEOUS MATERIALS

A. Joint Primer:
1. Provide type of joint primer recommended by sealant manufacturer for joint surfaces to be primed or sealed.

B. Bond Breaker Tape:
1. Polyethylene tape or other plastic tape as recommended by sealant manufacturer to be applied to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant.
2. Provide self-adhesive tape where applicable.

C. Sealant Backer Rod:
1. Compressible rod stock of polyethylene foam, polyethylene jacketed polyurethane foam, neoprene foam or other flexible, permanent, durable non-absorptive material as recommended by sealant manufacturer for compatibility with sealant.
2. Provide products by one of following, or approved equal.
a. Denver Foam by Backer Rod Mfg. Inc.
b. Sof-Rod by Nomaco, Inc.
c. Sealtight Kool-Rod by W.R. Meadows, Inc.

2.03 SOURCE QUALITY CONTROL

A. Provide sealant materials of each type to be product of one manufacturer throughout Project.

2.04 PERFORMANCE AND TESTING REQUIREMENTS

A. Non-Structural Sealant Tests:
1. Perform testing in accordance with ASTM or other acceptable recognize standards
2. Provide sealant manufacturer's laboratory test results on current production sealant for applicable characteristics and properties listed in ASTM C 920, Section 8
3. Provide sealant manufacturer's laboratory test results on recommended products applied on materials which will form joints in actual building construction
4. Make adhesion tests and bleed/stain tests on each material which forms joints to be sealed
5. Provide tests and information on compatibility of sealant with glazing materials and other accessory materials which may be in contact with sealant
6. Results of manufacturer's tests are to be available with certification specified in 1.03 C and for the preconstruction meeting specified in 1.04 C.
7. Acceptable Test Results:
a. Peel Adhesion Strength:
1) Minimum 15 pounds per linear inch when tested according to ASTM C 794, with results reported after following cure conditions:
2) 7 day dry cure
a) 14 day dry cure

b) 14 day dry plus 1 day wet cure
c) 14 day dry plus 7 day wet cure

b. Bleed/Stain: No visible bleeding or staining on exposed materials in contact with sealants

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine joints, with installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint sealant performance.
   1. Correct improper conditions.

3.02 JOINT PREPARATION

A. Remove dirt, insecure coatings, moisture, and other substances which could interfere with bond of sealant.

B. Prepare joint surfaces, prime as required and install backup, and bond-breaker immediately before installation of sealant.
   1. Etch concrete and masonry joint surfaces as recommended by sealant manufacturer.
   2. Roughen vitreous and glazed joint surfaces as recommended by sealant manufacturer.

C. Prime joint surfaces where recommended by sealant manufacturer.
   1. Do not allow primer to spill or migrate onto adjoining surfaces.

3.03 INSTALLATION OF SEALANT

A. Comply with manufacturer's printed instructions except where more stringent requirements are shown or specified, and except where manufacturer's technical representative directs otherwise.

B. Set joint filler units at proper depth or position in joint to coordinate with other work, including installation of bond breakers, backer rods and sealant.
   1. Do not leave voids or gaps between ends of joint filler units.

C. Install sealant backer rod for sealants, except where recommended to be omitted by sealant manufacturer for application indicated.

D. Install bond breaker tape where required by manufacturer's recommendations to ensure that elastomeric sealants will perform properly.

E. Employ only proven installation techniques, which will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete wetting of joint bond surfaces equally on opposite sides.
   1. Except as otherwise indicated, fill sealant rabbet to slightly concave surface, slightly below adjoining surfaces.
   2. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form slight cove, so that joint will not trap moisture and dirt.
   3. Tool joints to form smooth, uniform beads with slightly concave surfaces, with finished joints straight, uniform, smooth and neatly finished.

4. Remove excess sealant from adjacent surfaces of joint, leaving work in neat, clean condition.
5. Do not use tooling agents unless recommended by sealant manufacturer.

F. Coordinate installation of backup and sealant with other work as it progresses.
1. Seal joints before adjacent surfaces are waterproofed or painted.

G. Perform Work under conditions required by sealant manufacturer's application instructions, including training of installers
1. Make test applications of sealants under direction of sealant manufacturer's technical representative
2. Run neat, full beads without voids
3. Use sufficient pressure to force sealant against internal surfaces of joints
4. Tool sealant faces to smooth surface sealed to adjacent materials
5. Do not stain or overrun adjacent materials
a. Use masking or other protection as necessary

H. Install sealant to depths recommended by sealant manufacturer but within following general limitations, measured at center (thin) section of bead:
1. For sidewalks, pavements and similar joints sealed with elastomeric sealant and subject to traffic and other abrasion and indentation exposures, fill joints to depth equal to 75 percent of joint width, but neither more than 1/2 inch deep nor less than 3/8 inch deep.
2. For normal moving joints sealed with elastomeric sealant but not subject to traffic, fill joints to depth equal to 50 percent of joint width, but neither more than 1/2 inch deep nor less than 1/4 inch deep.
3. For joints sealed with non-elastomeric sealants, fill joints to depth in range of 75 percent to 125 percent of joint width.

I. Where irregular surface or sensitive joint border exists apply masking tape at edge of joint to insure joint neatness and protection.
1. Remove masking tape after sealant is applied.

J. Spillage:
1. Do not allow sealants or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces.
2. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.

K. Recess exposed edges of exposed joint fillers slightly behind adjoining surfaces, unless otherwise shown, so that compressed units will not protrude from joints.

L. Bond ends of joint filler together with adhesive or join by other means as recommended by manufacturer to ensure continuous watertight performance.

3.04 FIELD QUALITY CONTROL

A. Testing Services:
1. Owner will provide services of testing laboratory to make tests of field installed sealant
2. Cooperate with laboratory personnel and provide materials and facilities required for testing

3. Work found to be deficient is to be removed and replaced at Contractor's expense
4. Costs for additional inspection and testing resulting from investigating and retesting deficient work will be paid by Contractor.

B. Field Inspections by Sealant Manufacturer:
1. Periodic field inspections performed by sealant manufacturer's technical representative.
2. Include representative's certification that sealant was properly installed in accordance with application instructions
3. Identify improper Work which was discovered and describe changes in application instructions for later work
4. Furnish final inspection report on completed Work, and certification to Owner that sealant was properly installed

C. Field Testing by Contractor:
1. Perform field tests on each lot of sealant received for tack-free time and proper curing.
2. Conform to the sealant manufacturer's instructions
3. Document results by lot number in quality control log

3.05 PROTECTION AND CLEANING

A. Protect joint sealants during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of substantial completion.
1. When, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealant immediately and reseal joints with new materials to produce joint sealant installations with repaired areas indistinguishable from original work.

B. Clean off excess sealant or sealant smears adjacent to joints as Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

END OF SECTION 07 9200

SECTION 08 1113

HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Hollow metal doors and frames as indicated and scheduled.
   2. Vision lights and louvers in doors.

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 07 9200: Joint Sealants
   3. Section 08 1400: Wood Doors
   4. Section 08 7100: Door Hardware
   5. Section 08 8000: Glazing; glass for vision lights
   6. Section 09 2216: Non-Structural Metal Framing
   7. Section 09 9100: Painting; field painting of hollow metal doors and frames

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition
   1. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.

B. American National Standards Institute (ANSI)/ Steel Door Institute (SDI):
   1. ANSI/SDI A250.4 – Test Procedure and Acceptance Criteria for – Physical Endurance for Steel Doors, Frames, and Frame Anchors
   2. ANSI/SDI A250.6 – Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames
   3. ANSI/SDI A250.8 – Specifications for Standard Steel Doors and Frames (SDI-100)
   4. ANSI A250.10 – Test Procedure and Acceptance Criteria for Prime Painted Steel Doors and Frames.
   5. ANSI/SDI A250.11 – Recommended Erection Instructions for Steel Frames.
   6. SDI 117 – Manufacturing Tolerances for Standard Steel Doors and Frames.

C. ASTM International (ASTM):
   1. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   2. ASTM A653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   3. ASTM A1008 – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
   4. ASTM A1011 – Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.

1.03 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Door and frame assemblies, including reinforcing and provisions for hardware as shown and specified.
   2. Drawings indicate profile and general details of steel frame fabrication and installation.

1.04 SUBMITTALS

A. Product Data:
   1. Manufacturer's data for each type of door and frame indicated.
      a. Including, but not necessarily limited to following:
         1) Door designation
         2) Type, level, and model
         3) Material description
         4) Core description
         5) Construction details
         6) Finishes.

B. Shop Drawings:
   1. Showing fabrication and installation of steel doors and frames.
      a. Including, but not limited to following:
         1) Details of each frame type
         2) Elevations of door design types
         3) Conditions at openings
         4) Details of construction
         5) Location and installation requirements of finish hardware and reinforcements.
         6) Details of joints and connections.
   2. Show anchorage and accessory items.

C. Samples:
   1. Hollow Metal Frame:
      a. Corner section of typical exterior and interior frame, of sufficient composite size to illustrate following:
         1) Corner joint construction.
         2) Hinge reinforcement.
         3) Closer reinforcement.
         4) Floor anchor, dust cover, and jamb anchors showing galvanizing and prime coat finishes.
   2. Hollow Metal Door:
      a. Section of typical interior door of sufficient composite size to illustrate:
         1) Edge, top, and bottom.
         2) Core construction
         3) Hinge reinforcement and face stiffening
         4) Closer and kick plate reinforcement
         5) Corner of vision opening construction with glazing beads.

D. Certification:
   1. Certification of compliance with referenced standards and specified criteria, including but not necessarily limited to:
      a. Physical Endurance in accordance with ANSI A250.4

b. Prime Paint performance in accordance with ANSI A250.10, and as specified.

E. Door Schedule:
1. Use same reference designations indicated on Drawings in preparing schedule for doors and frames.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Minimum documented experience of more than five years providing hollow metal doors and frames for similar size projects.

B. Coordinate with hardware supplier for fabrication of doors and frames to receive hardware items.

C. Quality Standards:
1. Provide steel doors and frames complying with referenced standards as follows:
a. ANSI/SDI A250.4
b. ANSI/SDI A250.8
c. ANSI A250.10

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver doors and frames cartoned or crated to provide protection during transit and Project storage.

B. Inspect doors and frames upon delivery for damage and notify shipper and supplier should damage be found.
1. Minor damages may be repaired provided refinished items are equal with respect to new work and acceptable to Architect.
2. Remove and replace damaged items that cannot be repaired as directed.

C. Store doors and frames at Project Site under cover.
1. Place units on minimum 4 inch high wood blocking.
2. Avoid using non-vented plastic or canvas shelters that could create humidity chamber.
3. Should door packaging become wet, remove cartons immediately.
4. Provide minimum 1/4 inch spaces between stacked doors to permit air circulation.

1.07 WARRANTY

A. Furnish manufacturer’s 1 year material and workmanship warranty.

B. Furnish installer’s 2 year labor warranty.

1.08 REGULATORY REQUIREMENTS

A. Accessibility:
1. Conform to requirements of CBC Chapter 11B, Section 11B-404

1.09 WARRANTY

A. Furnish manufacturer's 1 year material and workmanship warranty.

B. Furnish installer's 2 year labor warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, provide products by one of following, or approved equal:
   1. ASSA ABLOY Door Security Solutions.
   2. Door Components, Inc.
   3. Steelcraft; division of Allegion

B. Materials, Fabrication, and Installation:
   1. Comply with requirements of standards referenced in "Quality Assurance" Article.

2.02 MATERIALS

A. General:
   1. Steel thicknesses meeting minimum requirements of ASTM standards and as described in ANSI/SDI A250.8.

B. Hot Rolled Steel Sheets:
   1. ASTM A 1011, Commercial Steel (CS), Type B.
      a. Free of scale, pitting, or surface defects; pickled and oiled.

C. Metallic Coated Steel Sheets:
   1. ASTM A 653, Commercial Steel (CS), Type B.
      a. A40 zinc-iron-alloy (galvannealed) coating
      b. Stretcher-leveled standard of flatness.

D. Cold Rolled Steel Sheets:
   1. ASTM A 1008, Commercial Steel (CS)
      a. Suitable for exposed applications, Type B.
      b. Stretcher-leveled standard of flatness.

E. Supports and Anchors:
   1. Fabricate from minimum 16 gage sheet steel unless noted otherwise.
   2. After fabricating, galvanize units to be built into exterior walls according to ASTM A 153, Class B.

F. Inserts, Bolts, and Fasteners:
   1. Provide as shown on Drawings and to suit conditions of secure installations.
   2. Provide items to be built into exterior walls, hot-dip galvanized according to ASTM A 153.
   3. Furnish Type 304 stainless steel fasteners at exterior doors.

G. Sound Deadener:
   1. Spray-on type, non-combustible and non-bleeding

a. INC DC-10 Noise Dampening Compound by Industrial Noise Control, Inc., or approved equal

2.03 DOORS

A. General:
1. Provide type and size of doors shown with louvers and openings for glazing where indicated.
2. Minimum Door Thickness: 1-3/4 inches.

B. Interior Doors:
1. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI A250A for physical endurance level:
a. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).
1) 0.053 inch (16 gage) thick faces.

C. Exterior Doors:
1. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI A250A for physicalendurance level:
a. Level 3 and Physical Performance Level A (Extra Heavy Duty), Model 2 (Seamless).
1) 0.053 inch (16 gage) thick faces.

D. Door Louvers:
1. Interior Doors:
a. Provide louvers for interior doors, where indicated on Door Schedule.
b. Sightproof Louvers:
1) Stationary louvers constructed with inverted Y-shaped blades.
a) Form blades of 16 gage, cold-rolled steel sheet.
b) Frameless louver with blades flush with face of door.
2. Exterior Doors:
a. Provide louvers for exterior doors, where indicated on Door Schedule
b. Comply with following:
1) Steel sheet conforming to specified cold-rolled metallic coated steel sheets (ASTM A 653).
c. Blades:
1) Non-vision inverted split “Y” formed of 20 gage cold-rolled, metallic coated steel sheets.
d. Security Grille and Frame:
1) Fabricated of 12 gage cold-rolled, metallic coated steel sheets.
2) Provide with 13/16 inch square holes on 1 inch centers.
3) Install in door cut-out using 1/4 inch x 20 through bolts meeting ASTM F 1450 with one way vandal proof heads.
e. Product and Manufacturer:
1) Model PLSL Louver with Security Grille by Anemostat Door Products, San Antonio, TX, or approved equal.
3. Louver Insect Screens for Exterior Door Louvers:
a. Provide insect screen in removable frames for exterior door louvers.
1) Fabricate screen frames of same metal and finish as louver units to which secured, unless otherwise indicated.

2) Screen: 18 inch X 14 inch mesh of 0.015 inch grey fiberglass
b. Locate screens on inside face of louvers.
c. Secure screens to louver frames with machine screws at each corner.

E. Vision Lights:
1. Provide flush mounted steel vision light kit for 1/4 inch glass. .
a. Consisting of glass light moldings flush with face of door, to accommodate specified glass thickness.
1) Vision light kits with face frames are not acceptable. .
b. Comply with glazing requirements specified in Section 08 8000 for both fire-rated and non-rated glass.

2.04 FRAMES

A. General:
1. Provide fully welded steel frames for doors that comply with ANSI/SDI A250.8 and with details indicated for type and profile.
2. Conceal fastenings, unless otherwise indicated.

B. Frames of 0.067 inch (14 gage) thick steel sheet for:
1. Level 3 steel doors.
2. Wood doors

C. Door Silencers:
1. Except on frames scheduled to receive door seals, fabricate stops to receive silencers as follows:
a. Interior Hollow Metal Frames:
1) Provide for three silencers on strike jambs on single door frames.
2) Provide two silencers in head frame, for pairs of doors.
3) Do not leave pre-punched silencer holes unfilled or uncovered.
2. Silencers are specified in Section 08 7100.

D. Plaster Guards:
3. Provide 0.016 inch thick, steel sheet plaster guards or mortar boxes to close off interior of openings
4. Place at back of hardware cutouts where mortar or other materials might obstruct hardware operation.

B. Supports and Anchors:
1. Fabricated from not less than 0.042 inch thick, electrolytic zinc-coated or metallic-coated steel sheet.

2.02 SOURCE QUALITY CONTROL

A. Provide hollow metal doors and frames as products of single manufacturer.

2.03 FABRICATION

A. General:
1. Fabricate steel door and frame units to comply with ANSI/SDI A250.8 to be rigid, neat in appearance, and free from defects including warp and buckle.
2. Where practical, fit and assemble units in manufacturer's plant.

3. Clearly identify work that cannot be permanently factory assembled before shipment, to ensure proper assembly at Project Site.

B. Exterior Door Construction:
   1. Fabricate doors and frames from metallic coated steel sheet for exterior locations and elsewhere as indicated,.
   2. Close top and bottom edges of doors flush as integral part of door construction by addition of 0.053 inch thick, metallic coated steel channels with channel webs placed even with top and bottom edges.

C. Interior Door Faces:
   1. Fabricate exposed faces of doors, including stiles and rails of nonflush units, from following material:
      a. Cold -rolled steel sheet.

D. Core Construction:
   1. Vertical Steel Stiffeners:
      a. Stiffen door face sheets with continuous vertical-formed steel (rib) sections.
         1) Minimum 20 gage.
         2) Full thickness of interior space between door faces.
         3) Space 6 inches on center maximum.
         4) Spot weld to both faces at 4 inches on center maximum.
   2. Core Insulation:
      a. Provide sound deadening and insulating material through entire core of door.
         1) Full height, width, and thickness of door.
      b. Provide STC ratings where indicated on Drawings, scheduled, or for partition ratings indicated on Drawings.
      c. Provide doors having minimum sound transmission classification of 28 as tested under ASTM E 90 and ASTM E 413, unless noted otherwise.
      d. Provide exterior doors meeting or exceeding required thermal rating indicated, scheduled, or for wall rating.

E. Clearances for Non-Fire Rated Doors:
   1. Not more than 1/8 inch at jambs and heads, and not more than 1/8 inch between pairs of doors.
   2. Not more than 3/4 inch from bottom of door to top of concrete slab.

F. Single-Acting, Door Edge Profile:
   1. Beveled edge.

G. Tolerances:
   1. Comply with SDI 117 – Manufacturing Tolerances for Standard Steel Doors and Frames.

H. Fabricate concealed stiffeners, reinforcement, edge channels, louvers, and moldings from either cold or hot rolled steel sheet.

I. Hardware Preparation:
   1. Prepare doors and frames to receive mortised and concealed hardware according to final door hardware schedule and templates provided by hardware supplier.

2. Comply with applicable requirements in ANSI A250.6 and ANSI A 115 specifications for door and frame preparation for hardware.

J. Frame Construction:
   1. Fabricate frames to profiles shown with mitered or coped, continuously welded corners and seamless face joints
   2. For Exterior Applications:
      a. Fabricate frames from metallic coated steel sheet, with mitered or coped, continuously welded corners and seamless face joints.
      b. Provide continuously welded 12 gage closure plate of bottom of exterior frames.
   3. Provide welded frames with temporary spreader bars.
      a. Do not remove until frames are installed, unless otherwise directed.
   4. Sound Deadener:
      a. Apply sound deadener to concealed surfaces of frames in accordance with manufacturer's instructions.
      b. Produce effective sound deadening for each application.

K. Supports and Anchors:
   1. Fabricate from minimum 16 gage, galvanized steel sheet.
   2. Refer to details indicated on Drawings.
      a. Floor Anchors:Minimum thickness:
         1) 12 gage galvanized steel sheet or bent steel plate, securely fastened inside each jamb, with two holes in anchor at each jamb for 3/8 inch floor anchorage fasteners.
      b. For preframed wood stud walls provide and additional wood stud anchor located as close to bottom of jamb as practical.
      c. Where required at sloping and uneven floor conditions, or to coordinate adjustments for trim alignments, provide adjustable floor anchors, providing at least 2 inch height adjustment.
   3. Jamb Anchors – General:
      a. Locate anchors near top and bottom and at intermediate points not to exceed 24 inches on center.
      b. Provide 2 anchors per head for openings up to 48 inches wide.
      c. Openings over 48 inches wide provide anchors at 24 inches on center maximum.
   4. Anchors in Metal Stud Partitions:
      a. Provide steel anchors, 16-gage minimum sheet steel, of design to suit partition construction, securely welded inside each jamb.
   5. Through-Frame Anchors:
      a. At frames indicated to be anchored with bolts through frame, provide countersunk holes for bolts with 16 gage minimum sheet steel stiffeners full thickness of frame, and securely welded inside each frame at each hole.

L. Inserts, Bolts, and Fasteners:
   1. Manufacturer's standard units,
      a. Where zinc-coated items are to be built into exterior walls, comply with ASTM A 153, Class C or D as applicable.

M. Head Reinforcing:
   1. Reinforce internally with full length, 10 gage angles on each side of frame and bar at bottom of stop for closer reinforcement in frames.

2. Do not allow reinforcing to act as lintel or load-carrying member.
3. Provide at frames regardless of whether or not closer is specified.

N. Hardware Reinforcement and Accessories:
   1. Reinforce doors and frames to receive surface applied hardware.
      a. Drilling and tapping for surface applied hardware may be done at Project Site.
      b. Butt Hinge:
         1) Minimum 7 gage, 4 inches longer than height of hinge.
      c. Continuous Hinge:
         1) Minimum 14 gage continuous strip reinforcing.
      d. Door Closers:
         1) Minimum 14 gage channel, 6 inches high on each side of door.
         2) Extend reinforcement full width of door.
      e. Accomplish Reinforcing for other items of finish hardware according to ANSI A250.6
   2. Locate hardware as indicated on Shop Drawings
      a. Where not indicated, locate according to ANSI/SDI A250.8, except where modified by requirements of CBC, Section 1008.1.9.2.

O. Glazing Stops:
   1. Manufacturer's standard applied stops with mitered corners, formed from 0.032 inch thick steel sheet.
   2. Provide non removable stops in one-piece lengths on outside of exterior doors and on secure side of interior doors for glass and louvers in doors.
   3. Provide screw-applied, removable, glazing stops on inside of glass panels in doors.
      a. Secure within 3 inches of each end and at 12 inches on center with oval head countersunk tamper resistant screws

2.04 FINISHES

A. Shop Prime Finish:
   1. Manufacturer's standard, factory-applied coat of rust-inhibiting primer complying with ANSI A250.10 for acceptance criteria.
   2. Coordinate with Paint Systems in Section 09 9100 to ensure compatibility with field applied finish coats.

PART 3 EXECUTION

3.01 INSTALLATION – GENERAL

A. Install standard steel doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as specified.

3.02 FRAME INSTALLATION

A. Comply with provisions of SDI-105 – Recommended Erection Instructions for hollow metal frames, unless otherwise indicated.
   1. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set.
   2. Anchor frames in wood frame partitions with manufacturer recommended anchors.

3. Upon completion of wall construction, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
    a. Except for frames located at in-place concrete installations, place frames prior to construction of enclosing walls and ceilings.
4. In existing concrete construction, anchor frames with galvanized anchor bolts 3/8 inch diameter, counter-sunk at 24 inches on center.
    a. Provide at least three completed opening anchors per jamb.
    b. Install adjacent to hinge location on hinge jamb and at corresponding heights on strike jamb.
    c. Set frames and secure to adjacent construction with bolts
5. Install fire-rated frames in accordance with UL Listings andaccording to NFPA 80.

3.03 DOOR INSTALLATION

A. Install hollow metal doors complying with ANSI/SDI A2S0.B and in accordance with manufacturer's installation instructions.
    1. Coordinate with Work of other trades.

B. Fit hollow metal doors accurately in frames, within clearances specified in ANSI/SDI A2S0.8.
    1. Shim as necessary to comply with SDI-122 and ANSI/DHI A 115.1G.

C. Adjust operable parts for correct function.

D. Remove hardware, except prime coated items, tag, box, and install after finish painting has been completed.

3.04 PRIME COAT TOUCH-UP

A. Prime Coat Touch-Up:
    1. Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touch-up of compatible air drying primer.

3.05 REPAIR, ADJUST, AND CLEAN

A. Repairs:
    1. Fill surface depressions, including countersunk fasteners, with metallic paste filler
    2. Allow to thoroughly cure, sand flush, and smooth for invisible appearance with adjacent metal surfaces.

B. Protection Removal:
    1. Immediately before final inspection, remove protective wrappings from doors and frames.

C. Final Adjustment:
    1. Check and readjust operating finish hardware items, leaving hollow metal doors and frames undamaged and in complete and proper operating condition.

D. Remove and legally dispose of rubbish, debris and waste materials off Project Site.

3.06 PROTECTION

A. Protect Work until Substantial Completion.

END OF SECTION 08 1113

SECTION 08 1400

WOOD DOORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Solid Core Flush Wood Doors.
      a. Including following:
         1) Vision lights with tempered glass and flush wood stops.
         2) Door Louvers:
            a) Wood sightproof inverted chevron (V-Slat) with flush wood moulding.
   2. Where indicated and as scheduled.

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 06 1053: Miscellaneous Carpentry.
   3. Section 08 1113: Hollow Metal Doors and Frames; hollow metal frames for wood doors.
   4. Section 08 7100: Door Hardware
   5. Section 09 9100: Painting; field finishing of wood doors.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
   1. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.

B. American National Standards Institute (ANSI)/Window and Door Manufacturers Association (WDMA):
   1. ANSI/WDMA I.S. 1A – Architectural Wood Flush Doors

C. ASTM International (ASTM):
   1. ASTM D 5456 – Standard Specification for Evaluation of Structural Composite Lumber Products

D. Woodwork Institute (WI):
   1. North American Architectural Woodwork Standards (NAAWS) 4.0
      a. Section 9 – Doors

E. South Coast Air Quality Management District (SCAQMD):
   1. Rule 1168 – Adhesive and Sealant Applications

F. Door and Hardware Institute (DHI):
   1. DHI-WDHS Recommended Standards for Flush Wood Doors.

1.03 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Drawings indicate sizes, locations and general details of wood door construction and installation.

1.04 SUBMITTALS

A. Product Data:
   1. Manufacturer's product data, specifications and installation instructions for each type of wood door required, including details of core and edge construction, trim for louvers and similar components.

B. Shop Drawings:
   1. Schedules and plans, indicating location and size of each door.
   2. Elevations and details of each kind of door, indicating door construction details,
      a. Include opening identification symbols, sizes, door type and grade fire ratings, swing, louver cutout size and locations, undercuts, and other pertinent data.
   3. Show location and extent of hardware blocking.
      a. Provide blocking as required to eliminate need for through-bolting of surface applied hardware.
   4. Use same door numbering system as Drawing door schedules.
   5. Indicate name of door manufacturer on shop drawing.

C. Samples:
   1. Construction Samples:
      a. Minimum of 4 samples of not less than 6 inches by 6 inches for each type of door to be furnished, showing face, edge and core construction.
   2. Wood Louvers:
      a. Minimum of four 12 inch x 12 inch louvers in wood frame, unfinished.

D. Certificates:
   1. Certificate that solid core wood doors comply with requirements of WDMA I.S. 1A and NAAWS Section 9.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect wood doors during transit, storage, and handling to prevent damage, soiling and deterioration.
   1. Package doors at factory prior to shipping using manufacturer's standard method.

B. Deliver materials in manufacturers original, unopened, undamaged containers with identification labels intact.
   1. Include name of manufacturer stamped or marked on packaging.

C. Deliver doors to Project Site only after building has been provided with design temperature and humidity.

D. Store and handle in accordance with ANSI/WDMA I.S.1A.
   1. Store doors protected from exposure to harmful conditions and at temperature and humidity conditions recommended by manufacturer.

1.06 PROJECT CONDITIONS

A. Do not install doors until building is enclosed and ambient conditions are within temperature and humidity range recommended by door manufacturer.

1.07 WARRANTY

A. Door Manufacturer's Warranty:
   1. Written agreement on door manufacturer's standard form signed by manufacturer, installer and Contractor, agreeing to repair or replace defective doors which have warped (bow, cup or twist) or which show telegraphing of core construction in face veneers, or do not conform to tolerance limitations of NAAWS.
   2. Furnish Warranty in effect for following period of time after date of Substantial Completion:
      a. Solid Core Flush Interior Doors:
         1) Life of original installation

B. Installer Warranty:
   1. Furnish labor warranty for wood doors.
      a. Warranty Period: 2 years from date of Substantial Completion.

C. Responsibility for replacement or refinishing of doors where Contractor's work contributed to rejection or to voiding of manufacturer's warranty rests with Contractor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, provide products of one of following, or approved equal:
   1. Eggers Industries – Two Rivers, WI
   2. Haley Bros., Inc. – Buena Park, CA
   3. Lynden Door – Lynden, WA
   4. Masonite Architectural, Tampa, FL
   5. Oregon Door – Winston, OR
   6. V.T. Industries, Inc. – Holstein, IA

2.02 FLUSH SOLID CORE DOORS

A. Interior Flush Doors:
   1. Furnish interior doors as follows:
      a. Opaque Finished (Painted): Custom grade.
      b. Solid wood core flush veneered, 5 ply minimum, faced both sides with smooth resin fiber Medium Density Overlay (MDO), fully bonded to core.
   2. Core Material:
      a. Structural Composite Lumber (SCLC-5), complying with ASTM D 5456, and following:
         1) Uniform Density: 38 lbs per cubic foot.
         2) Modulus of Rupture: 6,000 psi, minimum.
         3) Modulus of Elasticity: 1.3 x 106 psi.
         4) Made with binder containing no urea-formaldehyde resin

3. Edge Strips:
   a. Closed grain hardwood. kiln-dried birch or other material as indicated.
4. Full Stile Edge Strip:
   a. Not less that 1-1/2 inches wide, 2 ply stile.
   a. Provide stiles fully bonded to core.
   b. Outer Face Stile:
      1) Full length 3/4 inch Birch or Maple.
   c. Inner Back Stile:
      1) 3/4 inch of similar species which may have two finger joints fully bonded to core.
5. Provide full length top and bottom edge rails which may be of glued up stock of similar species as edge strip, white fir or Douglas fir, minimum density 24.33 pounds per cubic foot, or higher
   a. Top Rail:
      1) Minimum of 2 inches.
   b. Bottom Rail:
      1) Minimum of 5 inches, fully bonded to core.
6. Crossbanding:
   a. Furnish doors with full width crossbanding of properly dried hardwood or engineered fiber composite material, 1/16 inch thick, with density of 52 pounds per cubic foot, or higher
7. Adhesive and Bonding:
   a. Fabricate bonding between veneer plies of wood face panel~~,~~ and between door faces, frame, and core unit with Type I or II waterproof adhesives.
   b. Use adhesives complying with SCAQMD Rule 1168.
   c. Do not use adhesives containing urea formaldehyde

2.03 SOURCE QUALITY CONTROL

A. Obtain doors from single manufacturer to ensure uniformity in quality of appearance and construction, fabricated to dimensions specified.

2.04 FABRICATION – GENERAL

A. Factory machine doors for hardware that is not surface applied.
   1. Locate hardware to comply with DHI-WDHS-3.
      a. Comply with requirements of CBC Chapter 11B for locations of hardware required to be accessible.
   2. Comply with following:
      a. Final hardware schedules.
      b. Door frame shop drawings,
      c. DHI Standards.
      d. Hardware templates.
   3. Coordinate locations of hardware preparation in hollow metal frames to verify dimensions and alignment prior factory machining of wood doors.

B. Openings:
   1. Cut and trim openings through doors to comply with applicable requirements of referenced standards for kinds of doors required.
   2. Vision Light Openings:
      a. Trim openings with moldings of material and profile indicated.
   3. Louvers:
      a. Factory install flush wood louvers in prepared openings.

2.05 FINISHING

A. Shop Priming:
   1. Doors for Opaque Paint Finish:
      a. Shop prime faces and edges of doors, including cutouts, with one coat of wood primer specified in Section 09 9100.
      b. Ensure compatibility of primer with specified finish coats.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install Work as specified in Woodwork Institute NAAWS.
   1. Provide Woodwork Institute Certified Compliance Certificate for Installation at Substantial Completion.

B. Provide each door accurately cut, trimmed, and fitted to its frame and hardware.
   1. Clearance at Stiles and Top: 1/8 inch.
   2. Undercut:
      a. Top of Slab to Bottom of Door: 3/4 inch, except where otherwise indicated.
   3. Arises:
      a. Rounded to 1/16 inch radius
   4. Lock Rail Edges:
      a. Slightly beveled.
   5. Screws for Hardware:
      a. Screws are to be screwed, not driven, into pre-drilled holes.

C. Ensure that doors operate freely, but not loosely, without sticking or binding, without hinge-bind conditions and with hardware properly adjusted and functioning.

3.02 CLEANING

A. Remove and legally dispose of rubbish, waste and debris off Project Site.
   1. Comply with requirements of Section 01 7419.

3.03 PROTECTION

A. Protect Work until Substantial Completion.

END OF SECTION 08 1400

SECTION 08 3100

ACCESS DOORS AND PANELS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Access doors and panels occurring in walls and ceilings in finished areas.
2. Fire-rated wall and ceiling access doors.

B. Related Sections:
1. Section 06 1053: Miscellaneous Carpentry
2. Section 09 2216: Non-Structural Metal Framing; partition framing
3. Section 09 2900: Gypsum Board.
4. Section 09 5100: Acoustical Ceilings
5. Section 09 9100: Painting; field painting of primed doors and panels.

C. Related Requirements:
1. Refer to respective Sections of Division 21, 22, 23, and 26 for access doors and panels for mechanical, electrical, and other equipment requiring maintenance, inspection, adjustment, and monitoring, which are installed in inaccessible areas such as behind walls, above ceilings, and in soffits.

1.02 SUBMITTALS

A. Product Data:
1. Manufacturer's technical data and installation instructions for each type of access door assembly, including setting drawings, templates, instructions and directions for installation of anchorage devices.
2. Provide typed list, based on Owner's directions and verification, of doors to receive locks.

B. Shop Drawings:
1. For fabrication and installation of access doors, panels, and frames.
2. Include details of each frame type, elevations of door design types, and accessory items.
3. Indicate sizes, materials, thickness, fabrication methods, access door or panel and frame reinforcement, anchorage, and installation details.
4. Provide layout drawings, indicating dimensioned locations of proposed access doors and panels.
    a. Determine and indicate required access doors panels in finished surfaces, whether furnished under this Section or as part of Work of Divisions 21, 22 23, and 26.

C. Samples:
1. Furnish minimum of two samples of each type of access door and panel required for Project for review by Architect and Mechanical Engineer.

D. Access Door, Panel, and Frame Schedule:
   1. Provide complete access door, panel, and frame schedule, including types, locations, sizes, latching or locking provisions, and other data pertinent to installation.
   2. Coordinate with access doors to be provided under Division 21, 22, 23, and 26 Sections.

1.03 QUALITY ASSURANCE

A. Size Variations:
   1. Obtain Architect's acceptance of manufacturer's standard size units which may vary slightly from sizes indicated.

B. Coordination:
   1. Furnish inserts and anchoring devices which must be built into other Work for installation of access doors and panels.
   2. Coordinate access doors and panels specified in this Section with related mechanical and electrical work in order that appropriate access doors and panels are provided in finished construction.
   3. Coordinate delivery with other Work to avoid delay.

C. Verification:
   1. Determine specific locations and sizes for access doors or panels needed to gain access to concealed plumbing, mechanical, or other concealed work, and indicate in schedule specified in "Submittals" Article.
   2. Access doors and panels furnished under Division 21 through 23, and Division 26 Sections that are indicated as occurring in architecturally finished areas are subject to requirements of this Section.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Access Doors, Panels, and Frames:
   1. Provide protection as required by manufacturer to protect from damage during storage.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design:
   1. Design for access doors and panels is based on characteristics of products as manufactured by Elmdor/Stoneman, City of Industry, CA.

B. Subject to compliance with specified requirements, provide named product or comparable product by one of following manufacturers:
   1. Jay R. Smith Mfg. Co., Montgomery, AL
   2. Milcor by Hart & Cooley, Inc. Grand Rapids, MI
   3. Karp Associates, Inc., Melville, NY

2.01 MATERIALS AND FABRICATION – GENERAL

A. Furnish each access door assembly manufactured as factory-fabricated integral unit, complete with parts, attachment devices, and ready for installation.

B. Steel Access Doors, Panels, and Frames: Fabricate units of continuous welded steel construction, unless otherwise indicated.
   1. Grind welds smooth and flush with adjacent surfaces.
   2. Furnish attachment devices and fasteners of type required to secure access doors and panels to types of support shown.
   3. Frames: Fabricate from 16 gage steel.

C. Flush Panel Doors: Fabricate from not less than 14 gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees.
   1. Finish with manufacturer's factory applied prime paint.

D. Locking and Latching Devices: Furnish flush, screwdriver-operated cam locks of number required to hold door in flush, smooth plane when closed.
   1. Where shown or scheduled, provide one cylinder lock per access door.
      a. Furnish 2 keys per lock and key locks alike, unless otherwise scheduled.
      b. Verify and coordinate locking requirements with Owner and Architect prior to submittal.
   2. For recessed panel doors, provide access sleeves for each locking device.
      a. Furnish plastic grommets and install in holes cut through finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which access door and panel products are to be installed.
   1. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.02 INSTALLATION

A. Comply with manufacturer's instructions for installation of access doors and panels.

B. Coordinate installation with Work of other trades.

C. Set frames accurately in position and securely attach to supports, plumb and level, with plane of face panels aligned with adjacent finish surfaces.
   1. Brace to prevent displacement by adjacent Work.

D. Examine panels after installation:
   1. Adjust hardware, doors and panels after installation for proper operation.
   2. Repair finishes damaged during installation.
      b. Restore finishes so no evidence remains of corrective work.
      c. Replace doors or panels when finishes cannot be repaired to satisfaction of Architect.
   3. Replace doors, panels, or frames which are warped, bowed or otherwise damaged during installation.

3.01 CLEAN UP

A. Remove rubbish, debris and waste materials and legally dispose of off Project Site.
   1. Comply with requirements of Sections 01 7419 and 01 7423.
   2. Use methods acceptable to manufacturer which will not damage finish.

3.01 PROTECTION

A. Protect Work until Substantial Completion.

END OF SECTION 08 3100

SECTION 08 5115

ALUMINUM WINDOWS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fixed storefront type framing for fixed aluminum window units:
      a. Thermally broken for 1 inch insulating glazing.

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 05 0513: Shop-Applied Coatings for Metal
   3. Section 07 9200: Joint Sealants
   4. Section 08 8000: Glazing; insulating glass units.
   5. Section 09 2513: Portland Cement Plaster; exterior wall finish.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.

B. ASTM International (ASTM):
   1. ASTM B 209 – Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   2. ASTM B 221 – Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
   3. ASTM C 509 – Standard Specification for Elastomeric Cellular Preformed Gasket and Sealing Material
   4. ASTM E 283 – Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen
   5. ASTM E 330 – Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
   6. ASTM E 331 – Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference

C. Fenestration and Glazing Industry Alliance (FGIA):
   [formerly American Architectural Manufacturers Association (AAMA)]
   1. AAMA Volume 1 – Windows and Sliding Glass Doors
   2. AAMA 501.2 – Quality Assurance and Diagnostic Water Leakage Field Check of Installed Storefronts, Curtain Walls, and Sloped Glazing Systems
   3. AAMA 1503.1 – Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections
   4. AAMA 2605 – Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix).

D. American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI):
   1. ASCE/SEI 7 – Minimum Design Loads and Associated Criteria for Buildings and Other Structures.

E. South Coast Air Quality Management District (SCAQMD):
   1. Rule 1168 – Adhesive and Sealant Applications

F. Sheet Metal & Air Conditioning Contractors' National Association (SMACNA):
   1. Architectural Sheet Metal Manual

1.03 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Basis-of-Design System:
      a. Based on Arcadia TC670 Series framing system:
         1) Compensating Stick, Offset Glazed, System
            a) Thermally broken for 1 inch insulating glass..
         2) Size: 2-1/4 inches by 6 inches.
   2. Complying with applicable provisions of AAMA Volume 1 – Windows and Sliding Glass Doors for design, materials, fabrication and installation of component parts.

1.02 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications, recommendations, and standard details for aluminum window units, including:
      a. Details for each product specified of construction relative to materials, dimensions of individual components, profiles, and finishes.
      b. Certified test laboratory reports as necessary to show compliance with requirements.

B. Shop Drawings:
   1. Show details of fabrication and installation.
      a. Include following:
         1) Plans, elevations, sections, and details of components.
         2) Wall elevations at 1/4 inch scale
         3) Typical unit elevations at 3/4 inch scale.
         4) Full size detail sections of every typical composite member.
         5) Provisions for expansion and contraction, and attachments to other work.
   2. Show anchors and other components not included in manufacturer's standard data.
      a. Include glazing details.

C. Samples:
   1. Minimum of four, 8 inches square, of exposed finish required.
   2. Prepare samples on metal of same alloy and gage to be used for Work.
   3. Where finishes involve normal color and texture variations, include Sample sets showing full range of variations expected.

D. Certification:
   1. Where manufacturer's standard window units comply with requirements and have been tested in accordance with specified tests, provide certification by manufacturer showing compliance with such tests; otherwise, perform required tests through recognized testing laboratory or agency and provide certified test results.

1.03 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer's Qualifications:
      a. Capable of providing field service representation during construction, approving acceptable installer, and approving application methods.
   2. Installer Qualifications:
      a. Not less than five years of successful experience in erection of aluminum storefront type windows, who has specialized in installation of work similar to that required for Project and who is acceptable to product manufacturer.

B. Pre-Installation Meeting:
   3. Conduct pre-installation meeting in accordance with requirements of Section 01 3119 to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.

C. Design Criteria:
   1. Comply with applicable performance standards as referenced in specification: AAMA – Aluminum Storefront and Entrance Manual for design, materials, fabrication and installation of component parts.
   2. Transmission Characteristics of Fixed Framing:
      a. Comply with requirements indicated below for transmission characteristics and test methods:
         1) Air and Water Leakages:
            a) Air infiltration of not more than 0.06 CFM per sq. ft. of fixed area per ASTM E 283 and no uncontrolled water penetration per ASTM E 331 at pressure differential of 6.24 psf

1.04 SEQUENCING

A. Field Measurements:
   1. Confirm actual window openings by accurate field measurement before fabrication.
      a. Show recorded measurements on final shop drawings.
   2. Coordinate fabrication schedule with construction progress to avoid delay of Work.
   3. Where necessary, proceed with fabrication without field measurements, and coordinate fabrication tolerances to ensure proper fit of window units.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's packaging to protect windows during transportation and storage.

B. Store windows indoors in clean ventilated area and stack vertically on edge with wood or plastic shims between components to provide water drainage and air circulation.

1.06 WARRANTY

A. Special Assembly Warranty:
   1. Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum framed systems that do not comply with requirements or that deteriorate as defined in this Section within specified warranty period.
      a. Warranty Period:
         1) Five years from date of Substantial Completion.
   2. Failures include, but are not necessarily limited to, following:
      a. Structural failures including, but not limited to, excessive deflection.
      b. Noise or vibration caused by thermal movements.
      c. Water leakage through fixed glazing and framing areas.

B. Special Finish Warranty:
   1. Comply with requirements set forth in Section 05 0513

C. Glass:
   1. Conform to requirements in Section 08 8000 for glass warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design:
   1. Design for fixed aluminum windows, is based on following products by Arcadia, Inc.:
      a. Exterior Window System:
         1) Framing System:
            a) TC670 Series, nominal 2-1/4 inches by 6 inches, Compensating Stick, Offset Glazed, System, thermally broken, for 1 inch insulating glass.

B. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:
   2. Submit items listed in “Submittals” Article and as specified in Section 01 3300, for evaluation of proposed system.
   3. Complete project shop drawings for similar project may be submitted for evaluation purposes, however shop drawings specific to this Project will be required from successful bidder.
   4. Furnish documentation that tests have been made for identical systems within ranges of specified performance criteria.
   5. Copy of manufacturer's 10 year finish and material warranty.

2.02 MATERIALS AND ACCESSORIES

A. Aluminum Members:
   1. Alloy and temper recommended by manufacturer for strength, corrosion resistance, and application of required finish:

a. Aluminum alloy and temper 6063-T6 conforming to:
1) ASTM B 221 for extrusions.
b. Aluminum alloy and temper 6061-T6 conforming to:
1) ASTM B 209 for sheet/plate.
2. Minimum Wall Thickness for Framing Members: 0.125 (nominal 1/8) inch.

B. Aluminum Sheet:
1. Alloy and Temper:
a. 5005H34, complying with ASTM B 209.

C. Screws, Fastening Devices, and Internal Components:
1. Aluminum, non-magnetic stainless steel, or other materials complying with ASTM B 633 and warranted by manufacturer to be corrosion resistant and compatible with aluminum components.
2. Perimeter Anchors:
a. Aluminum or steel, providing steel is properly isolated from aluminum.
3. Do not use exposed fasteners

D. Concealed Flashing:
1. Dead-soft stainless steel, minimum 26 gage
2. Extruded aluminum, minimum 0.062 inch
a. Alloy and type selected by manufacturer for compatibility with other components.

E. Glazing Gasket:
1. Silicone compatible.
2. Compression-type design, replaceable, molded or extruded santoprene, polyvinyl chloride (PVC), or ethylene propylene diene monomer (EPDM).
3. Provide type that locks securely into glazing reglet to prevent glazing gaskets from disengaging.
4. Color: Black

F. Brackets and Reinforcements:
1. Manufacturer's high-strength aluminum units where feasible; otherwise, nonmagnetic stainless steel or hot-dip galvanized steel complying with ASTM A 386.

G. Anchors and Inserts:
1. Non-ferrous metal, cast iron, malleable iron, or hot-dip galvanized steel anchors and inserts:
a. Complying with ASTM A 386 for exterior installations and elsewhere as required for corrosion resistance.
2. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors.
3. Furnish inserts, as required, to be set into concrete or masonry work.

H. Isolation Between Dissimilar Materials:
1. Provide single-component, inert-type non-corrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities:
a. VOC compliant.
2. Elasto-Deck BT as manufactured by Pacific Polymers International, Inc. or equivalent product acceptable to Architect.

I. Glazing:
   1. Provide glazing materials which comply with requirements of Section 08 8000.

2.02 SOURCE QUALITY CONTROL

A. Single-Source Responsibility:
   1. Provide aluminum window units from one source and produced by single manufacturer.

2.03 FABRICATION AND ACCESSORIES

A. Sizes and Profiles:
   1. Required sizes for door and frame units, including profile requirements, are shown on Drawings
   2. Variable dimensions are indicated, together with maximum and minimum dimensions required to achieve design requirements and coordination with other work.
   3. Details shown are based upon standard details of "Basis-of-Design" system as specified.
   4. Similar details by other manufacturers may be acceptable, provided they comply with other requirements, including profile limitations.

B. Prefabrication:
   1. Complete fabrication, assembly, finishing, hardware application, and other work to greatest extent possible, before shipment to Project Site.
   2. Disassemble components only as necessary for shipment and installation.
   3. Do riot drill and tap for surface-mounted hardware items until time of installation at Project Site.

C. Sequence:
   1. Complete cutting, fitting, forming, drilling, and grinding of metal work prior to cleaning, finishing, surface treatment, and application of finishes.
   2. Remove arises from cut edges and ease edges and corners.

D. Welding:
   1. Comply with AWS recommendations to avoid discoloration.
   2. Grind exposed welds smooth and restore mechanical finish.

E. Reinforcing:
   1. Install reinforcing as necessary for performance requirements.
      a. Separate dissimilar metals with specified isolation material or other separator which will prevent corrosion.
   2. Provide continuous steel reinforcing stiffening members within jambs and heads of door frames.
      a. Omit at jambs that are secured to adjacent fixed walls.
   3. Cut vertical reinforcing 2 inches less than mullion height and cut horizontal reinforcing 3 inches less than door head framing member.
   4. Securely fasten in manner so that fasteners will not be visible in finished Work.
      a. Fasten aluminum sections to steel reinforcing 6 inches from each end and intermediately at 24 inches on center, maximum spacing.
   5. Construct door frames to be free of vibration and distortion when doors are used.

F. Maintain accurate relation of planes and angles, with hairline fit of contacting members.

G. Fasteners:
1. Conceal fasteners wherever possible.

H. Formed Metal Fabrications:
1. Fabricate items to comply with requirements indicated, including those for quality, thickness and finish of material as well as those indicating dimensions and details.
a. Use heavier metal gages, stiffeners or metal backing as required to produce surface flatness, free of "oil-canning", and to impart sufficient strength for use indicated.
b. Unless otherwise indicated, provide following minimum thickness of metal and comply with SMACNA recommendations for fabrication and installation details.
1) Aluminum:
a) Minimum 0.093 (nominal 3/32) inch.
2. Form sheet metal items in maximum lengths and keep joints to minimum.
a. Do not exposed cut edges of sheet metal except as indicated.
b. Fold back exposed ends of unsupported sheet metal to form a 1/2 inch wide hem on concealed side, or ease exposed edges with backing to radius of approximately 1/32 inch.
c. Form items with flat, flush surfaces, true to line and level, and without cracking and grain separation at bends.
3. Continuously weld joints and seams except where other methods of joining are indicated; grind welds smooth and flush on exposed surfaces.
a. Comply with AWS and other metal authorities.
4. Use filler metals and welding procedures which will blend with and match color of sheet metal being joined and will avoid discoloration at welds.
5. Provide straps, plates and brackets as required for support and anchorage of fabricated items to adjoining work:
6. Reinforce sheet metal items as required for attachment.
7. Finish formed metal components to match storefront finish.

I. Glazing Stops:
1. Screw-applied or snap-on square glazing stops, coordinated with glass selection and glazing system indicated.
a. Finish glazing stops to match window units.
b. Affix glazing stops on inside of window units.

2.04 FINISHES

A. High performance pigmented organic coating, meeting or exceeding performance and test provisions of AAMA 2605 for ten years minimum, complying with requirements specified in Section 05 013 .
1. Color: As scheduled.

2.05 PERFORMANCE REQUIREMENTS

A. Comply with structural performance, air infiltration, and water penetration requirements indicated in AAMA/WDMA/CSA 101/I.S.2, for type, grade, and performance class of window units required.

1. Design wind velocity at Project Site is 85 mph, Exposure C.
2. Conform to CBC, current Edition and ASCE/SEI 7.
3. Provide certified independent laboratory test reports.
4. Windows and component structural tests shall equal or exceed specified AAMA Standards, unless more stringent requirements are specified.

B. Test Units:
1. Perform tests on Project's largest size window to equal or exceed AAMA requirements, unless noted otherwise.

C. Test Procedures:
1. Air Infiltration Test (Perform before Water Test):
   a. Air Infiltration:
      1) Maximum 0.3 cfm per square foot of window at 6.24 psf pressure differential.
         a) When tested in accordance with ASTM E 283.
2. Water Resistance Test:
   a. No uncontrolled water leakage occurring at 10.0 psf pressure differential with water rate 5 gallons/hr./sf.
      1) When tested in accordance with ASTM E 331.
3. Uniform Load Deflection Test:
   a. No glass breakage, permanent damage to fasteners, hardware parts, or damage to make window inoperable.
   b. No deflection of unsupported span, including, but not limited to:
      1) Meeting rails, muntins, frames, or mullions, in excess of L/175 at both positive and negative load of 65.0 psf, design pressure.
         a) When tested in accordance with ASTM E 330.
4. Uniform Load Structural Test:
   a. Test Unit at specified wind pressure, both positive and negative, acting normal to plane of wall in accordance with ASTM E 330.
   b. No Glass breakage, permanent damage to fasteners, or permanent deformation of main frame section in excess of 0.4 percent of its span.
5. Vertical Concentrated Load Test on Intermediate Frame Rails:
   a. Deflection at point of load application maximum 0.070 inch.
      1) When tested per AAMA/WDMA 101/I.S.2.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect openings before beginning installation.
1. Verify that masonry rough openings are correct and sill plate is level.
2. Ensure that metal surfaces are:
   a. Dry, clean, free of grease, oil, dirt, rust and corrosion, and welding slag.
      1) Without sharp edges or offsets at joints.

3.02 INSTALLATION

A. Comply with manufacturer's specifications and recommendations for installation of window units and other components of Work.

B. Set units plumb, level and true to line, without warp or rack of frames or sash.
1. Provide proper support and anchor securely in place.

2. Ensure surfaces are free from dents, buckles, dimples, or other defects.

C. Anchor frames and other items securely to continuous construction to result in rigid installation and in accordance with required safety factors.
1. Where anchorage involves other work, provide setting drawings for proper installation.

D. Set members in full bed of silicone sealant as shown, to provide weathertight and watertight construction.
1. Refer to Section 07 9200 for sealants to be installed with window units.
2. Coordinate installation with wall flashing and other components of Work.

E. Protection of Contact Surfaces:
1. Protect aluminum and other corrodible surfaces in contact with dissimilar metals from sources of corrosion or electrolytic action at points of contact with other incompatible materials such as masonry or other cementitious materials.
2. Comply with requirements specified under paragraph "Dissimilar Materials" in Appendix to AAMA/WDMA 101/I.S.2 by applying specified isolation material to contact surfaces before installation or isolate with non-absorptive tape or gaskets.

F. Expansion and Contraction:
1. Install aluminum work so as to avoid objectionable distortion or overstress of parts and fastenings resulting from thermal expansion and contraction.

G. Glazing:
1. Comply with requirements for Glass Type **GX** in Section 08 8000 and following:
   a. Determine glass sizes and edge clearances by measuring actual openings.
   b. Set glass on glazing blocks to equally support full glass height and prevent give or fracture.
   c. Set glass with specified materials in accordance with reviewed shop drawings and manufacturer’s instructions.

3.03 CLEANING

A. After installation, clean metal and glass surfaces, on both interior and exterior, of mortar, paint, and other contaminants, exercising care to avoid damage to protective coatings and finishes.
1. Do not use abrasives.
2. Use mild soap and water.
3. Remove excess glazing and sealant compounds, dirt, and other substances.

3.04 PROTECTION

A. Initiate and maintain protection and other precautions required to ensure that window units will be without damage or deterioration at time of Substantial Completion.

END OF SECTION 08 5115

SECTION 08 7100

DOOR HARDWARE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Door hardware

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 06 4000: Architectural Woodwork; cabinet hardware.
   3. Section 07 9200: Joint Sealants; sealant for thresholds.
   4. Section 08 1113: Hollow Metal Doors and Frames
   5. Section 08 1400: Wood Doors
   6. Section 10 1400: Signage; including signage on doors.
   7. Section 28 1300: Electronic Access Control; access control hardware.
   8. Section 28 1600: Intrusion Detection System
   9. Section 32 3113: Chain Link Fences and Gates; gate hardware.

C. Related Requirements:
   1. Refer to Division 28 Sections for electronic access control, intrusion alarm, and fire alarm requirements related to door hardware, as required.

D. Specific Omissions:
   1. Hardware for following is specified or indicated elsewhere:
      a. Cabinets, including open wall shelving and cabinet hardware.
      b. Signage, including signage on doors.
      c. Toilet accessories, including grab bars.
      d. Rough hardware.
      e. Access doors and panels.
      f. Chain link gate hardware.
      g. Padlocks will be provided by Owner.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
   1. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.

B. American National Standards Institute/Builders Hardware Manufacturers Association (ANSI/BHMA):
   1. ANSI/BHMA A156 Series Standards, including following:
      a. ANSI/BHMA A156.4 – Door Controls – Closers.
      b. ANSI/BHMA A156.18 – Materials and Finishes.

C. Door and Hardware Institute (DHI):
   1. DHI Handbooks

D. UL, LLC (UL):
   1. UL 1784 – Standard for Air Leakage Tests of Door Assemblies and Other Opening Protectives

E. Steel Door Institute (SDI):
   1. Technical Documents and Standards (Fact File).

F. Woodwork Institute (WI):
   1. North American Architectural Woodwork Standards (NAAWS), 4.0
      a. Section 09 – Passage Doors

G. National Association of Architectural Metal Manufacturers (NAAMM):
   1. Hollow Metal Manufacturers Association (HMMA):
      a. HMMA 830 – Hardware Selection for Hollow Metal Doors and Frames
      b. HMMA 831 – Recommended Hardware Locations for Hollow Metal Doors and Frames

1.03 SUBMITTALS

A. Door Schedule:
   1. Copies of schedule complying with requirements of Section 01 3300 for electronic submittals and following:
      a. Only submittals printed one sided will be accepted and reviewed.
      b. Organize vertically formatted schedule into “Hardware Sets” with index of doors and headings, indicating complete designations of every item required for each door or opening.
         1) Minimum 10 point font size.
   2. Include following information:
      a. Type, style, function, size, quantity, and finish of hardware items.
      b. Use BHMA Finish codes per ANSI A156.18.
      c. Name, part number and manufacturer of each item.
      d. Fastenings and other pertinent information.
      e. Location of hardware set coordinated with floor plans and door schedule.
      f. Explanation of abbreviations, symbols, and codes contained in schedule.
      g. Mounting locations for hardware.
      h. Door and frame sizes, materials and degrees of swing.
      i. List of manufacturers used and their nearest representative with address and phone number.
      j. Catalog cuts with submitted items specifically identified.
      k. Date of Project Site visit.

B. Bid and submit manufacturer’s updated/improved item when scheduled item is discontinued.
   1. Identify substituted items in “Schedule of Door Hardware”.
   2. Substituted items are subject to Architect’s review and acceptance.

C. Deviations:
   1. Highlight, encircle or otherwise identify deviations from “Schedule of Door Hardware” on submittal with notations clearly designating those portions as deviating from this Section.

D. Where discrepancy exists between Drawings and specified material in this Section:
   1. Bid more expensive of two choices.
   2. Note discrepancy in submittal.
   3. Request direction from Architect for resolution.

E. Substitutions:
   1. Requests for substitutions in accordance with requirements of Section 01 6000.
   2. Include product data and indicate benefit to Project.
   3. Furnish operating samples on request.

F. Items listed with no substitute manufacturers have been requested by Owner to meet existing District Standards

G. Furnish as-built/as-installed schedule with closeout documents, including keying schedule, riser and point-to-point wiring diagrams, manufacturer's installation, adjustment and maintenance information, and supplier's final inspection report.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Hardware Supplier:
      a. Direct factory contract supplier who employs certified Architectural Hardware Consultant (AHC), available at reasonable times during course of Work for project hardware consultation to Owner, Architect, and Contractor.
      b. Responsible for detailing, scheduling and ordering of finish hardware.
         1) Detailing implies that the submitted schedule of hardware is correct and complete for intended function and performance of openings.

B. Hardware – General:
   1. Free of defects, blemishes and excessive play.
   2. Obtain each kind of hardware (hinges and closers) from one manufacturer.

C. Furnish hardware items required to complete Work in accordance with specified performance level and design intent, complying with manufacturers' instructions and code requirements.

D. Pre-Installation Meeting:
   1. Initiate and conduct with supplier, installer, and related Trades.
   2. Coordinate materials and techniques, and sequence complex hardware items and systems installation.
   3. Include manufacturers' representatives of locks, fire exit/panic hardware, and door closers in meeting.
   4. Convene meeting prior to commencement of related Work.

1.05 ABBREVIATIONS

A. Manufacturers:
   1. Refer to table in Article 2.01

B. Finishes:
   1. Refer to Article 2.07

1.06 DELIVERY, STORAGE AND HANDLING

A. Delivery:
   1. Coordinate delivery to appropriate locations (shop or field).
   2. Permanent Keys and Cores:
      a. Secured delivery direct to Owner's representative.

B. Acceptance at Site:
   1. Items individually packaged in manufacturer's original containers, complete with proper fasteners and related pieces.
   2. Clearly mark packages to indicate contents, locations in hardware schedule and door numbers.

C. Storage:
   1. Provide securely locked storage area for hardware.
   2. Protect from moisture, sunlight, paint, chemicals, dust, excessive heat and cold

1.07 PROJECT CONDITIONS AND COORDINATION

A. Environmental Considerations:
   1. Dispose of unused recyclable paper and paper product packaging, uninstalled metals, and plastics, in accordance with requirements of Section 01 7419.

B. Prior to submittal, carefully inspect existing conditions to verify finish hardware required to complete Work, including sizes, quantities, existing hardware scheduled for re-use, and sill condition material.
   1. When conflict may exist between specified/scheduled hardware and existing conditions, submit request for direction from Architect.
   2. Submittals prepared without thorough Project Site visit by qualified hardware expert will be rejected as non-compliant.

C. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical same operation and quality as type specified, subject to Architect's approval.

D. Coordination:
   1. Coordinate hardware with other Work.
   2. Furnish hardware items of proper design for use on doors and frames of thickness, profile, swing, security, and similar requirements indicated, as necessary for proper installation and function, regardless of omissions or conflicts in information on Contract Documents.
   3. Furnish related trades with following information:
      a. Location of:
         1) Embedded and attached items to concrete.
         2) Wall-mounted hardware, including wall stops.
         3) Finish floor materials and floor-mounted hardware.
         4) Conduit and raceways as needed for electrical and electronic hardware items.
      b. Coordination and interfacing with following:
         1) Electronic access control and related hardware.
         2) Intrusion detection system.
         3) Fire/life-safety system.

c. Flush top rails of out swinging exteriors doors
d. Manufacturers' templates to door and frame fabricators.

E. Review shop drawings for doors and entrances to confirm that adequate provisions will be made for proper hardware installation.
4. Do not order hardware until submittal has been reviewed by frame and door suppliers for compatibility with their products.

1.08 REGULATORY REQUIREMENTS

A. Locate latching hardware between 34 inches to 44 inches above finished floor, per CBC Section 11B-404.2.7.

B. Handles, Pull, Latches, Locks, Other Operable Parts:
1. Readily openable from egress side with one hand and without tight grasping, tight pinching, or twisting of wrist to operate, per CBC Section 11B-309.4.
2. Force Required to Activate Operable Parts:
a. 5.0 pounds maximum, per CBC Section 11B-309.4

C. Adjust doors to open with not more than 5.0-pounds pressure to open at exterior doors and 5.0-pounds at interior doors.
1. As allowed per CBC Section 11B-404.2.9, local authority may increase allowable pressure for fire doors to achieve positive latching, not to exceed 15 pounds.

D. Adjust door closer sweep periods so that from open position of 90 degrees, door will take at least 5 seconds to move to point 12 degrees from latch, measured to landing side of door, per CBC Section 11B-404.2.7.

E. Smooth surfaces at bottom 10 inches of push sides of doors, facilitating push-open with wheelchair footrests, per CBC Section 11B-404.2.10.

F. Door opening clear width no less than 32 inches, measured from face of frame stop, or edge of inactive leaf of pair of doors, to door face with door opened to 90 degrees.
1. Hardware projection not factor in clear width when located above 30 inches and below 80 inches, and hardware projects no more than 4 inches per CBC Section 11B-404.2.3.
2. Exception:
a. Doors not requiring full passage through opening, (i.e spaces less than 24 inches in depth), may have clear opening width reduced to 20 inches.

G. Door Closers and Overhead Stops:
1. Not less than 78 inches above finished floor or ground, per CBC Section 11B-307.4.

H. Thresholds:
1. Floor or landing no more than 0.50 inches below top of threshold of doorway, per CBC Section 11B-404.2.5.
2. Vertical rise no more than 0.25 inches
b. Change in level between 0.25 inches and 0.50 inches.
c. Beveled to slope not greater than 1:2 (50 percent slope). per CBC Sections 11B-303.2 and 11B-303.3.

I. Floor Stops:
   1. Do not locate in path of travel.
   2. Locate no more than 4 inches from walls, per DSA Policy No. 98-08 (Access).

J. Pairs of Doors with Independently Activated Hardware Both Leaves:
   1. Limit swing of right-hand or right-hand-reverse leaf to 90 degrees to protect persons reading wall-mounted tactile signage, per CBC Section 11B-703.4.2.

K. Door and Door Hardware Encroachment:
   1. When door is swung fully-open into means-of-egress path, door may not encroach/project more than 7 inches into required exit width, with exception of door release hardware such as lockset levers or fire exit/panic hardware.
   2. These hardware items must be located not less than 34 inches and not more than 44 inches above floor/ground, per CBC Section 11B-404.2.7.
   3. Do not provide hardware (including fire exit/panic hardware) with "night latch" (NL) function for accessible doors.

1.09 WARRANTY

A. Part of respective manufacturers' regular terms of sale.
   1. Provide manufacturers' written warranties.

B. Include factory order numbers with close-out documents to validate warranty information, required for Owner in making future warranty claims:

C. Minimum Warranties:
   1. Closers: Thirty years mechanical
   2. Hinges: One year
   3. Other Hardware: Two years

1.10 COMMISSIONING

A. Conduct these tests with installer present prior to request for certificate of substantial completion:
   1. Test door hardware operation with climate control system both at rest and while in full operation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Listed Acceptable Manufacturers:

Item:	**Manufacturer:**
Continuous Hinges	(IVE) Ives
Surface Closers	(LCN) LCN
Auto Flush Bolts	(IVE) Ives
Coordinators	(IVE) Ives
Door Stops	(IVE) Ives
Overhead Stops	(GLY) Glynn-Johnson
Thresholds	(ZER) Zero
Seals and Door Bottoms	(ZER) Zero

2.02 HINGING METHODS

A. Drawings typically depict doors at 90 degrees, doors will actually swing to maximum allowable.
   1. Use wide-throw continuous hinges as needed up to 8 inches in width to allow door to stand parallel to wall for true 180-degree opening.
      a. Advise Architect where 8 inch width is insufficient.

B. Conform to manufacturer's published hinge selection standard for door dimensions, weight ,and frequency, and to hinge selection as scheduled.
   1. Where manufacturer's standard exceeds the scheduled product, furnish the heavier of the two choices.
   2. Notify Architect of deviation from scheduled hardware.

C. Continuous Hinges:
   1. Geared-type aluminum.
      a. Use wide-throw units where needed for maximum degree of swing.
         1) Advise Architect where commonly available hinges are insufficient.

2.03 LOCKSETS

A. Electronic locking devices and associated hardware are specified in Section 28 1300.

2.04 CLOSERS

A. Provide Door Closers Conforming to Following Requirements:
   1. Conform to ANSI/BHMA A156.4 Grade 1 requirements by BHMA certified independent testing laboratory.
      a. ISO 9000 certified closers.
      b. Stamp units with date of manufacture code.
      c. Exterior door closers: tested to 100 hours of ASTM B 117 salt spray test,
         1) Furnish data on request.
   2. Cylinder:
      a. Consisting of 1-1/2 inch diameter with 3/4 inch diameter double heat-treated pinion shaft, single piece forged piston, and chrome-silicon steel spring.
      b. Full rack-and-pinion type cylinder with removable non-ferrous cover and cast iron body.
      c. Non-sized, non-handed, and adjustable with spring power continuously adjustable over full range of closer sizes, providing reduced opening force as required by accessibility codes and standards.
   3. Hydraulic Fluid:
      a. Fireproof, passing requirements of UL10C.
      b. Non-flaming fluid will not fuel door or floor covering fires.
      c. Exterior Doors:
         1) Seasonal closer adjustment not required for temperatures ranging from 120 degrees F to minus 30 degrees F.
   4. Hydraulic Regulation:
      a. By tamper-proof, non-critical valves, with separate adjustment for latch speed, general speed, and backcheck.

b. Separate adjusting valves for closing speed, latching speed and backcheck.
   1) Fourth valve for delayed action where scheduled.
c. Adjust doors to open with not more than 5.0 pounds pressure to open at exterior doors and 5.0 pounds at interior doors.
   1) As allowed per CBC Section 11B-404.2.9, local authority may increase allowable pressure for fire doors to achieve positive latching, not to exceed 15 pounds.
d. Pressure Relief Valve (PRV) Technology: Not permitted.

5. Closer Arms:
   a. Solid forged steel main arms and factory assembled heavy-duty forged forearms for parallel arm closers.
6. Provide special templates, drop plates, mounting brackets, or adapters for arms as required for details, overhead stops, and other door hardware items interfering with closer mounting.
7. Finish for Closer Cylinders, Arms, Adapter Plates, and Metal Covers:
   a. Powder coated finish which has been certified to exceed 100 hours salt spray testing as described in ANSI Standard A156.4 and ASTM B 117, or has special rust inhibitors.

2.05 OTHER HARDWARE

A. Automatic Flush Bolts:
   1. Low operating force design.

B. Overhead Stops:
   1. Non-plastic mechanisms and finished metal end caps.

C. Door Stops:
   1. Provide stops to protect walls, casework, or other hardware.
   2. Unless otherwise noted in Hardware Sets, provide floor type with appropriate fasteners.
      a. Where floor type cannot be used, provide wall type.
      b. When neither can be used, provide overhead type.
   3. Locate overhead stops for maximum possible opening.
      a. Consult with Owner for furniture locations.
      b. Minimum: 90 degree stop / 95 degree deadstop.
      c. Note degree of opening in submittal.

D. Smoke Seals:
   1. Provide where scheduled, tested in accordance with UL1784.

E. Thresholds
   1. General:
      a. As scheduled and per details.
      b. Comply with CBC Section11B-404.2.5.
   2. Substitute Products:
      a. Certify that products equal or exceed specified material's thickness.
      b. Submit proposed substitutions for Architect's review and acceptance.
   3. Saddle Thresholds:
      a. Minimum Thickness: 0.125 inch.
   4. Thresholds for Exterior and Acoustic Openings:
      a. Seal perimeter to exclude water and vermin.

b. Set thresholds in full bed of silicone sealant complying with requirements in Section 07 9200

5. Threshold Fasteners:
   a. Flat Head Sleeve Anchors:
      1) Minimum 1/4-20 stainless steel sleeve anchors:
         a) Zero No. 226
      2) Optional Products:
         a) National Guard Products' "COMBO"
         b) Pemko Manufacturing "FHSL".
         c) Red-Head No. SFS-1420
   b. Exposed Screw Heads:
      1) Phillips or Robertson drive.
      2) Pinned TORX drive at high security areas.
   c. Machine Screws with Lead Anchors:
      1) 10-24 machine screws with lead anchors are not acceptable.

F. Hardware Fasteners:
1. Manufacturers' fasteners furnished with hardware items, unless indicated otherwise.
   a. Where manufacturer-furnished fasteners are not adequate, submit Request for Substitution with Architect.
2. Sleeve Nuts:
   a. Full length, equal to door thickness, to prevent door compression.
3. Sheet Metal and Wood Screws:
   a. Where acceptable for use.
   b. Furnish full-threaded.
4. Plastic plugs for use with wood or sheet metal screws are not acceptable substitute for specified fastening methods.
5. Through-bolts:
   a. Use of through-bolts is not permitted.
   b. Coordinate with metal doors and frames to ensure provision of proper reinforcement to support machine screws for mounting exit/panic hardware and door closers.
   c. Coordinate with fire-rated mineral core wood doors to ensure provisions for solid blocking at locations including, but not necessarily limited to, locksets, exit devices, overhead door stops, and closers.

G. Silencers:
1. Interior Hollow Metal Frames:
   a. Provide 3 for single doors.
   b. Provide 4, in head frame, for pairs of doors.
   c. Do not leave pre-punched silencer holes unfilled or uncovered.
2. Provide silencers by one of following, or approved equal:
   a. Ives No. SR64 by Ives Architectural Hardware, division of Allegion
   b. Rockwood No. 608 by Rockwood Manufacturing Company, division of Assa Abloy
   c. Trimco No. 1229A

2.06 FINISH

A. BHMA 626 – Satin Chromium, except where indicated otherwise.
1. Areas Using BHMA 626:

a. Furnish push-plates, pulls, and protection plates of BHMA 630 – Satin Stainless Steel, unless otherwise scheduled.

B. Door Closers:
1. Factory powder coated to match other hardware, unless noted otherwise. .

PART 3 EXECUTION

3.01 ACCEPTABLE INSTALLERS

A. Experienced craftsperson with resume of successful projects similar in scope to this Project.
1. Capable of performing following:
a. Read and understand manufacturers' templates, supplier's hardware schedule, and printed installation instructions.
b. Readily differentiate between manufacturer's furnished fasteners, number 10-24 machine screws and drywall screws and explain their correct usage.
c. Readily differentiate between number 2 and number 3 Phillips-drive screws and screwdrivers.
d. Available to meet with manufacturer's representatives and related trades to discuss installation of hardware.

3.02 PREPARATION

A. Ensure that walls and frames are square and plumb before hardware installation.
1. Make corrections before commencing hardware installation.
2. Installation denotes acceptance of wall/frame condition.

B. Locate hardware per SDI-100 and applicable building, fire, life-safety, accessibility, and security codes.
1. Notify Architect of code conflicts before ordering material.
2. Locate latching hardware between 34 inches to 44 inches above finished floor, per CBC Section 11B.404.2.7.
3. Locate panic hardware between 36 inches to 44 inches above finished floor.

C. Overhead Stops:
1. When possible, determine proposed locations of furniture items, fixtures, and other items to be protected by overhead stops prior to installation.

3.03 INSTALLATION

A. Install hardware per manufacturer's instructions and recommendations.
1. Use manufacturers' fasteners furnished with hardware items as specified in Article 2.06 F 3.
a. Submit Request for Substitution with Architect for alternate fasteners..
2. Do not install surface-mounted items until finishes have been completed on substrate.
3. Set units level, plumb and true to line and location.
4. Adjust and reinforce attachment substrate for proper installation and operation.
5. Remove and reinstall or replace work deemed defective by Architect.
6. Door Seals and Gaskets:

a. Install jamb-applied doors seals and gaskets before closers, overhead stops, rim strikes, and like items.
b. Fasten hardware over and through these seals.
c. Install sweeps across bottoms of doors before astragals.
1) Cope sweeps around bottom pivots, trim astragals to tops of sweeps.

7. When hardware is to be attached to existing metal surface where insufficient reinforcement exists:
a. Use RivNuts, NutSerts or similar anchoring device for screws.
8. Do not use power-driven tools to install fasteners.

B. Locate floor stops not more that 4 inches from walls and not within paths of travel.
1. Refer to Article 2.02 regarding hinge widths.
a. Door should be well clear of point of wall reveal.
b. Point of door contact no closer to the hinge edge than half door width.
c. Where situation is questionable or difficult, contact Architect for direction

C. Locate overhead stops for minimum 90 degrees at rest and for maximum allowable degree of swing.

3.04 ADJUSTING

A. Adjust and check for proper operation and function.
1. Replace units, which cannot be adjusted to operate freely and smoothly.
2. Repair or replace hardware damaged by improper installation or adjustment methods to Owner's satisfaction.
3. Adjust doors to fully latch with no more than 1 pound of pressure.
a. Door closer valves: turn valves clockwise until at bottom – Do Not Force.
b. Turn valves back out one and one-half turns and begin adjustment process from that point.
c. Do not force valves beyond three full turns counterclockwise.
4. Adjust door closers per Article 1.08.
a.

3.05 DEMONSTRATION

A. Demonstrate mechanical hardware and electrical and electronic hardware systems, including adjustment and maintenance procedures.

3.06 PROTECTION / CLEANING

A. Cover installed hardware, protect from paint, cleaning agents, weathering, carts/barrows, and like items.
1. Remove covering materials and clean hardware just prior to substantial completion

B. Clean adjacent wall, frame and door surfaces soiled from installation / reinstallation process.

3.07 MAINTENANCE

A. Maintenance Materials:
   1. Furnish following to Owner at Substantial Completion:
      a. As-built hardware schedule.
      b. Copies of warranty information for each hardware type.
         1) Include requirement for factory order numbers, needed by Owner should claim need to be made.
      c. Binder of catalog cuts or complete catalog sections, when necessary, of items used/installed.
         1) Include installation and maintenance/adjustment information.

3.08 SCHEDULE OF FINISH HARDWARE

A. Refer to Door Schedule in Drawings for hardware set assignments.

B. Do not order material until submittal has been reviewed, stamped, and signed by Architect's door hardware consultant.

HW SET: 01

1	EA	CONTINUOUS HINGE	224XY	628	IVE
1	EA	PUSH PLATE	8200 4" X 16"	630	IVE
1	EA	PULL PLATE	8300 4" X 16"	630	IVE
1	EA	CLOSER	4040XP	689	LCN
1	EA	KICK PLATE	8400 10" X 2" LDW	630	IVE
1	EA	DOME STOP	FS436/438	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 02

1	EA	CONTINUOUS HINGE	224XY	628	IVE
1	EA	ELECTRONIC LOCK	REFER TO SECTION 28 1300		
1	EA	CYLINDER	BY ELECTRONIC LOCK MFGR.		
1	EA	DOME STOP	FS436/438	626	IVE
3	EA	SILENCER	SR64	GRY	IVE

HW SET: 03*[Not Used]*

HW SET: 04

1	EA	CONTINUOUS HINGE	224XY	628	IVE
1	EA	ELECTRONIC LOCK	REFER TO SECTION 28 1300		
1	EA	CYLINDER	BY ELECTRONIC LOCK MFGR.		
1	EA	CLOSER	4040XP	689	LCN
1	EA	DOME STOP	FS436/438	626	IVE
1	SET	PERIMETER SEALS	328AA HEAD AND JAMBS	AL	ZER
1	EA	DOOR SWEEP/DRIP	8197AA	AL	ZER
1	EA	THRESHOLD	103 X 226	AL	ZER

NOTE: INSTALL DOOR SWEEP/DRIP ON EXTERIOR FACE OF DOOR

HW SET: 05

1	EA	CONTINUOUS HINGE	224XY	628	IVE
1	EA	ELECTRONIC LOCK	REFER TO SECTION 28 1300		
1	EA	CYLINDER	BY ELECTRONIC LOCK MFGR.		
1	EA	CLOSER	4040X-3077CNS	689	LCN
1	SET	PERIMETER SEALS	328AA HEAD AND JAMBS	AL	ZER
1	EA	DOOR SWEEP	39	AL	ZER
1	EA	RAIN DRIP	11	AL	ZER
1	EA	THRESHOLD	103 X 226	AL	ZER

NOTE: INSTALL DOOR SWEEP ON INTERIOR FACE OF DOOR AND RAIN DRIP ON EXTERIOR FACE OF DOOR

HW SET: 06

1	EA	CONTINUOUS HINGE	224XY	628	IVE
1	EA	ELECTRONIC LOCK	REFER TO SECTION 28 1300		
1	EA	CYLINDER	BY ELECTRONIC LOCK MFGR.		
1	EA	CLOSER	4040XP EDA	689	LCN
1	EA	WALL STOP	WS406/407CVX	626	IVE
1	SET	PERIMETER SEALS	328AA HEAD AND JAMBS	AL	ZER
1	EA	DOOR SWEEP/DRIP	8197AA	AL	ZER
1	EA	THRESHOLD	103 X 226	AL	ZER

NOTE: INSTALL DOOR SWEEP/DRIP ON EXTERIOR FACE OF DOOR

HW SET: 07

1	EA	CONTINUOUS HINGE	224XY	628	IVE
1	EA	ELECTRONIC LOCK	REFER TO SECTION 28 1300		
1	EA	CYLINDER	BY ELECTRONIC LOCK MFGR.		
1	EA	CLOSER	4040XP-3077CNS	689	LCN
1	SET	PERIMETER SEALS	328AA HEAD AND JAMBS	AL	ZER
1	EA	DOOR SWEEP	39	AL	ZER
1	EA	RAIN DRIP	11	AL	ZER
1	EA	THRESHOLD	103 X 226	AL	ZER

NOTE: INSTALL DOOR SWEEP ON INTERIOR FACE OF DOOR AND RAIN DRIP ON EXTERIOR FACE OF DOOR

HW SET: 08

1	EA	CONTINUOUS HINGE	224XY	628	IVE
1	EA	ELECTRONIC LOCK	REFER TO SECTION 28 1300		
1	EA	CYLINDER	BY ELECTRONIC LOCK MFGR.	626	SCH
1	EA	CLOSER	4040XP	689	LCN
1	EA	DOME STOP	FS436/438	626	IVE
1	SET	PERIMETER SEALS	328AA HEAD AND JAMBS	AL	ZER
1	EA	DOOR SWEEP/DRIP	8197AA	AL	ZER
1	EA	THRESHOLD	103 X 226	AL	ZER

NOTE: INSTALL DOOR SWEEP/DRIP ON EXTERIOR FACE OF DOOR

HW SET: 09

2	EA	CONTINUOUS HINGE	224XY	628	IVE
1	SET	AUTO FLUSH BOLT	FB31/41	626	IVE
1	EA	DUST PROOF STRIKE	DP1/2	626	IVE
1	EA	ELECTRONIC LOCK	REFER TO SECTION 28 1300		
1	EA	CYLINDER	BY ELECTRONIC LOCK MFGR.		
1	EA	COORDINATOR	COR2-COMPLETE – PAINTED TO MATCH DOOR FRAME	PAINTED	IVE
2	EA	CLOSER	4040XP EDA	626	LCN
1	SET	PERIMETER SEALS	328AA HEAD AND JAMBS	AL	ZER
1	EA	ASTRAGAL	47AA SEC X 188S	600	ZER
2	EA	DOOR SWEEP	39	AL	ZER
2	EA	RAIN DRIP	11	AL	ZER
1	EA	THRESHOLD	103 X 226	AL	ZER

NOTE: INSTALL DOOR SWEEP ON INTERIOR FACE OF DOOR AND RAIN DRIP ON EXTERIOR FACE OF DOOR

HW SET: 10

2	EA	CONTINUOUS HINGE	224XY	628	IVE
1	SET	AUTO FLUSH BOLT	FB31/41	626	IVE
1	EA	DUST PROOF STRIKE	DP1/2	626	IVE
1	EA	ELECTRONIC LOCK	REFER TO SECTION 28 1300		
1	EA	CYLINDER	BY ELECTRONIC LOCK MFGR	626	SCH
1	EA	COORDINATOR	COR2-COMPLETE – PAINTED TO MATCH DOOR FRAME	PAINTED	IVE
2	EA	CLOSER	4040XP-3077CNS	689	LCN
1	SET	PERIMETER SEALS	328AA HEAD AND JAMBS	AL	ZER
1	EA	ASTRAGAL	47AA SEC X 188S	600	ZER
2	EA	DOOR SWEEP	39	AL	ZER
2	EA	RAIN DRIP	11	AL	ZER
1	EA	THRESHOLD	103 X 226	AL	ZER

NOTE: INSTALL DOOR SWEEP ON INTERIOR FACE OF DOOR AND RAIN DRIP ON EXTERIOR FACE OF DOOR

END OF SECTION 08 7100

SECTION 08 8000

GLAZING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Glass and glazing as specified and scheduled on Drawings.
   2. Providing glass and glazing including accessories for, but not necessarily limited to, following:
      a. Vision lights in doors.
      b. Windows

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 07 9200: Joint Sealants; sealants other than glazing sealant.
   3. Section 08 1113: Hollow Metal Doors and Frames; vision and side lights
   4. Section 08 1400: Wood Doors; vision lights
   5. Section 08 5113: Aluminum Windows

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
   1. Chapter 24 – Glass and Glazing

B. Comply with applicable performance standards of following:
   1. Glazing Association of North America (GANA):
      a. Glazing Manual
      b. Sealants Manual
   2. Fenestration & Glazing Industry Alliance (FGIA):
      [formerly Insulating Glass Manufacturers Alliance (IGMA)]
      a. TM-3000 – North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use
   3. Insulating Glass Certification Council (IGCC):
      a. Certified Products Directory
   4. Consumer Product Safety Commission (CPSC):
      a. CPSC 16 CFR 1201 – Safety Standard for Architectural Glazing Materials
   5. American National Standards Institute (ANSI):
      a. ANSI Z97.1 – Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test

C. ASTM International (ASTM):
   1. ASTM C 864 – Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers
   2. ASTM C 1036 – Standard Specification For Flat Glass.
   3. ASTM C 1048 – Standard Specification For Heat-Treated Flat Glass.
   4. ASTM E 2190 – Standard Specification for Insulating Glass Unit Performance and Evaluation.

D. British Standards (BS):
   1. BS EN 14179-1 Glass in building - Heat-soaked thermally toughened soda lime silicate safety glass

1.03 DEFINITIONS

B. Deterioration of Coated Glass:
   1. Defects developed from normal use that are attributed to manufacturing process and not to causes other than glass breakage and practices for maintaining and cleaning coated glass contrary to manufacturer's written instructions.
      a. Defects include peeling, cracking, and other indications of deterioration in metallic coating.

C. Deterioration of Insulating Glass:
   1. Failure of hermetic seal under normal use due to causes other than glass breakage and improper practices for maintaining, and cleaning insulating glass.
      a. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
      b. Improper practices for maintaining and cleaning glass are those that do not comply with manufacturer's directions.

1.04 SUBMITTALS

A. Product Data:
   1. Manufacturer's product data for each glass product and glazing material required.

B. Product Certificates:
   1. Provide documentation for solar control low-emissivity (low-e) glass, demonstrating that manufacturer of coated glass is certified by coating manufacturer.

C. Samples:
   1. Glass:
      a. Minimum of four 12 inch square samples of each type of glass indicated except for clear monolithic glass.
   2. Sealants and Gaskets:
      a. Minimum of four 6 inch long samples of each color required (except black) for each type of sealant or gasket exposed to view.
   3. Install sealant or gasket sample between two strips of material representative in color of adjoining framing system.

D. Compatibility and Adhesion Test Reports:
   1. From sealant manufacturer indicating that glazing materials were tested for compatibility and adhesion with glazing sealants.
      a. Include sealant manufacturer's interpretation of test results relative to sealant performance and recommendations for primers and substrate preparation needed for adhesion.
   2. From manufacturer of insulating glass edge sealant indicating that glass edge sealants were tested for compatibility with other glazing materials.
      a. Including sealants, glazing tape, gaskets, setting blocks, and edge blocks.

E. Product Test Reports:
   1. For each type of glazing sealant and gasket indicated, evidencing compliance with specified requirements.

F. Maintenance Data:
   1. Manufacturer's maintenance data for glass and other glazing materials.

1.05 QUALITY ASSURANCE

A. Glazing Publications:
   1. Comply with published recommendations of glass product manufacturers and organizations listed under "References", except where more stringent requirements are indicated.
   2. Refer to these publications for glazing terms not otherwise defined in this Section or in referenced standards.

B. Grading and Labeling:
   1. Grade and label each light stating quality and grade of glass and manufacturer's name and brand designation.
   2. Leave labels intact until removal is directed by Architect.

C. Glazier Qualifications:
   1. Engage experienced glazier who has completed glazing similar in material, design, and extent to that indicated for Project with record of successful in-service performance.

D. Single-Source Responsibility for Glass:
   1. Obtain glass from one source for each product indicated below:
      a. Primary glass (ASTM C 1036) of each type and class indicated.
      b. Heat treated glass (ASTM C 1048) of each condition indicated.
      c. Solar control low-emissivity glass (ASTM C 1376 and C 1048) of each condition indicated.
      d. Insulating glass of each construction indicated.
      e. Fire rated glass of each type and condition indicated.

E. Field Constructed Mockups:
   1. Prior to glazing, erect mockups for each glass product indicated below to verify selections made under sample submittals and to demonstrate aesthetic effects and quality of materials and execution.
   2. Construct mockups to comply with following requirements, using materials indicated for final unit of Work:
      a. Glass Products:
         1) Erect mockups with following kinds of glass to match glazing systems required for Project, including typical light size, framing systems, and glazing methods:
            a) Fully tempered tinted and coated glass insulating vision unit.
   3. Place mockups on Project Site in location and of size indicated or as directed by Architect.
   4. Notify Architect one week in advance of dates and times when mockups will be erected.
   5. Obtain Architect's acceptance of mockups before start of final unit of Work.
   6. Demonstrate proposed range of aesthetic effects and workmanship.
   7. Retain and maintain mockups during construction in undisturbed condition as standard for judging completed unit of Work.

a. When directed, demolish and remove mockups from Project site.
b. Accepted mockups in undisturbed condition at time of Substantial Completion may become part of completed unit of Work.

F. Preconstruction Compatibility and Adhesion Testing:
1. Submit to sealant manufacturers, samples of each glass, gasket, glazing accessory, and glass framing member that will contact or affect glazing sealants for compatibility and adhesion testing as indicated below.
2. Use test methods standard with sealant manufacturer to determine when priming and other specified preparation techniques are required for rapid, optimum glazing sealants adhesion to glass and glazing channel substrates.
a. Perform tests under normal environmental conditions during installation.
3. Submit quantity of each type and finish of glass framing members and each type, class, kind, condition, and form of glass sufficient for adhesion testing, as well as one sample of each glazing accessory for compatibility testing.
4. Schedule sufficient time to test and analyze results to prevent delay in Work.
5. Investigate materials failing compatibility or adhesion tests and obtain sealant manufacturer's written recommendations for corrective measures, including use of specially formulated primers.

G. Pre-Installation Conference:
1. Conduct conference at Project Site to comply with requirements of Section 01 3119.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver glass and glazing materials with manufacturer’s labels intact.

B. Protect glazing materials to comply with manufacturer's directions and as needed to prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

1.07 PROJECT CONDITIONS

A. Environmental Conditions:
1. Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing materials manufacturer or when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1.08 REGULATORY REQUIREMENTS

A. California Building Code (CBC), Chapter 24 – Glass and Glazing.
1. Comply with wind design requirements of CBC, Chapter 16A – Structural Design, Section 1609A – Wind Loads.

B. Safety Glass:
1. Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1
2. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to authorities having jurisdiction.

1.09 WARRANTIES

A. General:
   1. Warranties specified in this Article do not deprive Owner of other rights Owner may have under other provisions of Contract Documents and are in addition to and run concurrent with other warranties made by Contractor under requirements of Contract Documents.

B. Manufacturer's Warranty for Coated Glass:
   1. Written warranty signed by glass manufacturer agreeing to furnish replacements for those coated glass units that deteriorate as defined in "Definitions" article, within specified warranty period indicated below.
   2. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, and cleaning practices contrary to glass manufacturer's published instructions.
   3. Warranty Period:
      a. Manufacturer's standard but not less than 10 years after date of Substantial Completion.

C. Manufacturer's Warranty on Insulating Glass:
   1. Written warranty signed by manufacturer of insulating glass agreeing to furnish replacements for insulating glass units that deteriorate as defined in "Definitions" article, within specified warranty period indicated below.
   2. Warranty covers only deterioration due to normal conditions of use and not to handling, installing, protecting, and maintaining practices contrary to glass manufacturer's published instructions.
   3. Warranty Period:
      a. Manufacturer's standard, but not less than 10 years after date of Substantial Completion.

D. Manufacturer’s Warranty on Heat-Soaked Glass:
   1. Written warranty signed by manufacturer of fully tempered glass that has been Heat Soaked.
   2. Warrants that heat soaked tempered glass will not break spontaneously as result of Nickel Sulfide (NiS) inclusions in more than three lights of glass, within insulating or monolithic unit, per project,
   3. Warranty Period:
      a. Manufacturer's standard, but not less than 10 years after date of Substantial Completion.

PART 2 PRODUCTS

2.01 PRIMARY FLOAT GLASS

A. Refer to Schedule of Glass Types in Article 3.06.

B. Clear Float Glass:
   1. Conforming to ASTM C 1036, Type 1 (transparent glass, flat), Class 1 (clear), quality q3 (glazing select) of following type and thickness:
      a. Clear, heat-treated and fully tempered and heat soaked, nominal 1/4 inch (6 mm).
   2. Float Glass Manufacturers:
      a. Guardian Glass, Auburn Hills, MI

b. Pilkington North America, Inc., Toledo, OH
c. Vitro Architectural Glass (formerly PPG), Cheswick, PA

C. Safety Glass:
1. Category II materials complying with testing requirements in 16 CFR 1201 and ANSI Z97.1.
a. Fully tempered glass, except laminated glass), complying with CBC, Section 2406.
2. Subject to compliance with requirements, permanently mark safety glass with certification label of Safety Glazing Certification Council or another certification agency acceptable to Division of the State Architect.
a. Etch identification mark or ceramic fire on glass, readable from inside of building after installation.

2.02 TINTED GLASS

A. Conforming to ASTM C 1036, Type 1 (transparent glass, flat), Class 2 (tinted, heat absorbing and light reducing) quality q3 (glazing select)
1. Nominal Thickness: 1/4 inch (6 mm).
2. Color:
a. As indicated in Schedule of Glass Types at end of this Section.
3. Tinted Glass Manufacturers:
a. Guardian Glass, Auburn Hills, MI
b. Pilkington North America, Inc., Toledo, OH
c. Vitro Architectural Glass (formerly PPG), Cheswick, PA

2.03 HEAT TREATED GLASS

A. Fabrication Process:
1. Horizontal (roller hearth) process with inherent rollerwave distortion parallel to bottom edge of glass as installed.
a. Glass with tong marks is unacceptable.
2. Maximum peak to valley rollerwave 0.003 inch in central area and 0.008 inch within 11.3 inches of leading and trailing edge.
3. For clear glass 1/4 inch thick without ceramic frit
a. Maximum plus or minus 100 millidiopter (mD) over 95 percent of glass surface.
4. Maximum bow and warp 1/32 inch per lineal foot.
5. Fully tempered glass:
a. Provide heat soak testing conforming to BS EN 14179-1, including 2 hour dwell at 290 degrees C, plus or minus 10 degrees C.

B. Uncoated and Coated, Clear, Heat Treated Float Glass:
1. Conforming to ASTM C 1048, Condition A (uncoated surfaces), Condition C (other coated glass), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select).
2. Nominal Thickness: 1/4 inch (6 mm), fully tempered.

C. Coated, Tinted, Heat Treated Float Glass:
1. Conforming to ASTM C1048, Condition C (other coated surfaces), Type 1 (transparent glass, flat), Class 2 (tinted heat-absorbing and light reducing), Quality q3 (glazing select).
2. Tint color and performance characteristics matching those indicated for annealed primary tinted float glass.
3. Nominal Thickness: 1/4 inch (6 mm), fully tempered.

D. Etch identification mark or ceramic fire on glass, readable from inside of building after installation.

2.04 SOLAR CONTROL LOW EMISSIVITY (LOW-E) COATED GLASS

A. Solar Control Low-Emissivity Heat Treated Glass:
   1. Sputter Coated Glass Conforming to:
      a. ASTM C 1376 float glass with metallic coating deposited by vacuum deposition process after manufacture and heat treatment and complying with other requirements specified.
         1) Edge delete coating of surfaces in contact with insulating glass edge seals.
      b. ASTM C 1048, Condition C (other coated glass), Type I (transparent glass, flat), Class 1 (clear), Quality q3 (glazing select).
   2. Nominal Thickness: 1/4 inch (6 mm), fully tempered.
   3. Basis of Design Product:
      a. Low-e coating as follows:
         1) Clear and tinted glass with low-e coating on number 2 surface.
         2) VNE 53 by Viracon, Owatonna, MN
   4. Subject to compliance with specified requirements, including conformance with specified performance and appearance characteristics, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Division 01 and following:
      a. Submit items listed in Article 1.04 and as specified in Division 01 for evaluation of proposed system.
      a. Copy of manufacturer's 10 year material warranty.

2.05 INSULATING GLASS

A. Sealed Insulating Glass Units:
   1. Preassembled units consisting of organically sealed lights of glass separated by dehydrated air spaces complying with ASTM E 2190 and other requirements indicated.

B. For properties of individual glass lights making up units, refer to requirements specified elsewhere in this Section applicable to types, classes, kinds, and conditions of glass products comprising lights of insulating glass units.

C. Provide heat treated glass, (heat strengthened) or fully tempered and heat soaked, unless indicated otherwise.

D. Air Space:
   1. Nominal 1/2 inch

E. Sealing System:
   1. Dual sealed, with primary seal of polyisobutylene and secondary seal of silicone.:
      a. Using manufacturer's standard sealants.

F. Spacer Specifications:
   1. Manufacturer's standard metal
   2. Desiccant:
      a. Either molecular sieve or silica gel or blend of both.

3. Corner Construction:
    a. Manufacturer's standard corner construction.
4. Spacer Color: Black.

G. Insulating Glass Manufacturers/Fabricators:
1. Basis-of-Design Manufacturer:
    a. Viracon, Owatonna, MN
2. Subject to compliance with specified requirements, including conformance with specified performance and appearance characteristics, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Division 01 and following:
    a. Submit items listed in Article 1.04 and as specified in Division 01 for evaluation of proposed system.
    b. Copy of manufacturer's 10 year material warranty.

2.06 GLAZING SEALANTS

A. General – Provide products complying with following requirements:
1. Compatibility:
    a. Select glazing sealants and tapes of proven compatibility with other materials they will contact.
        1) Including, but not necessarily limited to, glass products, seals of insulating glass units, and glazing channel substrates, under conditions of installation and service, as demonstrated by testing and field experience.
2. Suitability:
    a. Comply with sealant and glass manufacturer's recommendations for selecting glazing sealants and tapes that are suitable for applications indicated and conditions existing at time of installation.
3. Colors:
    a. Provide color of exposed joint sealants to comply with following:
        1) Provide selections made by Architect from manufacturer's full range of standard colors for products of type indicated.

B. Glazing Sealant:
1. One part silicone rubber glazing sealant complying with ASTM C 920, Type S, Grade NS, Class 25.
2. Provide acid curing type recommended by manufacturer where only nonporous bond surfaces are contacted.
    a. DOWSIL 999-A Silicone Building & Glazing Sealant by Dow Performance Silicones, or approved equal.
3. Provide non-acid curing type recommended by manufacturer where one or more porous bond surfaces are contacted.
    a. DOWSIL 795 Silicone Building Sealant by Dow Performance Silicones, or approve equal.
4. Low Emitting Materials:
    a. Provide glazing sealants and sealant primers for use inside building envelope that comply with specified limits for VOC content when calculated according to California Air Resources Board (CARB) regulations and SCAQMD Rule 1168:
        1) Comply with requirements specified in Section 07 9200.

C. Glazing Tape – General Use:
   1. Closed cell polyvinyl chloride (PVC) foam, coiled on release paper over adhesive on two sides.
   2. Maximum water absorption by volume of 2 percent.

2.07 MISCELLANEOUS GLAZING MATERIALS

A. Cleaners, Primers and Sealers:
   1. Type recommended by sealant or gasket manufacturer.

B. Setting Blocks:
   1. Elastomeric material of Neoprene, EPDM, or silicone.
      a. Provide 70 to 90 Durometer with Shore A hardness, with proven compatibility with sealants used.
      b. Conforming to ASTM C 864.

C. Spacers:
   1. Elastomeric blocks or continuous extrusions with Durometer and Shore hardness required by glass manufacturer to maintain glass lights in place for installation indicated.

D. Edge Blocks:
   1. Elastomeric material of hardness needed to limit glass lateral movement

2.08 FABRICATION OF GLASS AND OTHER GLAZING PRODUCTS

A. Fabricate glass and other glazing products in sizes required to glass 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.

B. Provide assemblies as specified under Article 3.06

2.09 PERFORMANCE

A. Comply with applicable performance standards of following:
   1. Glazing Association of North America (GANA)
   2. Fenestration & Glazing Industry Alliance (FGIA):
      [formerly Insulating Glass Manufacturers Alliance (IGMA)]
      a. IGMA TM-3000
   3. Insulating Glass Certification Council (IGCC)
   4. Consumer Product Safety Commission (CPSC):
      a. CPSC 16 CFR 1201

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine glass framing, with glazier present, for compliance with following:
   1. Manufacturing and installation tolerances, including those for size, squareness, offsets at corners.
   2. Presence and functioning of weep system at exterior locations.
   3. Minimum required face or edge clearances.
   4. Observable edge damage or face imperfections.
   5. Effective sealing between joints of glass framing members.

B. Do not proceed with glazing until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Clean glazing channel, or other framing members to receive glass, immediately before glazing.
   1. Remove coatings which are not firmly bonded to substrate.
   2. Remove lacquer from metal surfaces wherever elastomeric sealants are used.

3.03 GLAZING – GENERAL

A. Watertight and airtight installation of each piece of glass is required, except as otherwise shown
   1. Each installation must withstand normal temperature changes, wind loading, impact loading (for doors), without failure, including loss or breakage of glass, failure of sealants or gaskets to remain watertight and airtight, deterioration of glazing materials and other defects in Work.

B. Protect glass from edge damage during handling and installation as follows:
   1. Use rolling block in rotating glass units to prevent damage to glass corners.
   2. Do not impact glass with metal framing.
   3. Use suction cups to shift glass units within openings; do not raise or drift glass with pry bar.
   4. Rotate glass lights with flares or bevels on bottom horizontal edges so edges are located at top of opening, unless otherwise indicated by manufacturer's label.
   5. Remove damaged glass from Project site and legally dispose of off site.
      a. Damaged glass is glass with edge damage or other imperfections that, when installed, weaken glass and impair performance and appearance.

C. Glazing channel dimensions as shown are intended to provide for necessary bite on glass, minimum edge clearance, and adequate sealant thicknesses, with reasonable tolerances.
   1. Adjust as required by Project conditions at time of installation.

D. Comply with combined recommendations and technical reports by manufacturers of glass and glazing products as used in each glazing channel, and with recommendations of GANA – Glazing Manual, except where more stringent requirements are indicated.

E. Apply primer or sealer to joint surfaces wherever recommended by sealant manufacturer.

F. Install elastomeric setting blocks in sill rabbets, sized and located to comply with referenced glazing standard, unless otherwise required by glass manufacturer.
   1. Set blocks in thin course of compatible sealant suitable for heel bead.

G. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lights.

H. Provide spacers for glass sizes larger than 50 united inches (length plus height) as follows:
   1. Locate spacers inside, outside, and directly opposite each other.

2. Install correct size and spacing to preserve required face clearances, except where gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and comply with system performance requirements.
3. Provide 1/8 inch minimum bite of spacers on glass and use thickness equal to sealant width.
    a. With glazing tape, use thickness slightly less than final compressed thickness of tape.

I. Provide edge blocking to comply with requirements of referenced glazing publications, unless otherwise required by glass manufacturer.

J. Set glass lights in each series with uniform pattern, draw, bow, and similar characteristics.

K. Provide fully tempered safety glass, unless indicated otherwise.

L. Install insulating glass units to comply with recommendations by Insulating Glass Manufacturers Association (IGMA), except as otherwise specifically indicated or recommended by glass and sealant manufacturers.

3.04 GLAZING PROCEDURES

A. Cutting and Fitting Glass:
1. Accurately cut and fit glass to opening size.
2. Provide clearance for expansion.
3. Cut and set glass to keep wave lines horizontal.
4. Ensure sharp, clean cut glass edges.
5. Do not attempt to cut, seam, nip or abrade glass which is tempered, heat strengthened, or coated.

B. Force sealants into channel to eliminate voids and to ensure complete bond of sealants to glass and channel surfaces.

C. Tool exposed surfaces of glazing liquids and compounds to provide wash away from glass.
1. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.

D. Clean and trim excess glazing materials from glass and stops or frames promptly after installation, and eliminate stains and discolorations.

E. Mitered Joints:
1. Seam miter cut edges.
2. Clean edge of glass to ensure proper adherence of sealant.
3. Air pockets or voids in joint are not acceptable.

F. Gasket Glazing:
1. Miter cut and bond ends together at corners where gaskets are used for channel glazing, so that gaskets will not pull away from corners and result in voids or leaks in glazing system.

3.05 CURE, PROTECTION, AND CLEANING

A. Cure glazing sealants and compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength, and surface durability.

B. Protect exterior glass from breakage immediately upon installation, by attachment of crossed streamers to framing held away from glass.
   1. Do not apply markers of any type to surfaces of glass.
   2. Remove nonpermanent labels and clean surfaces.

C. Remove and replace glass which is broken, chipped, cracked, abraded or damaged in other ways during construction period, including natural causes, accidents and vandalism.

D. Protect glass from contact with contaminating substances resulting from construction operations including weld splatter.
   1. Should, despite such protection, contaminating substances come into contact with glass, remove them immediately as recommended by glass manufacturer.

E. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once per month, for build up of dirt, scum, alkali deposits, or stains, and remove as recommended by glass manufacturer.

3.06 SCHEDULE OF GLASS TYPES

A. Glass Type **G1**:
   1. Clear, heat treated glass, fully tempered and heat soaked, nominal 1/4 inch (6 mm) thickness.
      a. For use in interior door vision lights, and window assemblies.

B. Glass Type **G2**:
   1. Tinted Gray tempered vision glass unit of nominal 1 inch thickness with low-emissivity coating on number 2 surface.
      a. Outer Light: Coated, tinted, heat treated glass, fully tempered and heat soaked, 1/4 inch (6 mm) nominal thickness with low-emissivity coating on number 2 surface.
      b. Air Space: 1/2 inch (13.2 mm)
      c. Inner Light: Uncoated, clear, heat treated glass, fully tempered, 1/4 inch (6 mm) nominal thickness.
      d. Nominal Performance Characteristics:
         1) Visible Light Transmittance: 24 percent
         2) Outdoor Visible Reflectance: 8 percent
         3) Shading Coefficient: 0.19
         4) Solar Heat Gain Coefficient: 0.16
         5) Winter NFRC U-Value: 0.29 Btu/(hr x sq. ft. x degrees F)
         6) Summer Daytime U Value: 0.25 Btu/(hr x sq. ft. x degrees F)
      e. Product and Manufacturer: VNE3-53 by Viracon.

END OF SECTION 08 8000

SECTION 09 0562

MOISTURE VAPOR EMISSION CONTROL SYSTEM

PART 1 GENERAL

1.01 SUMMARY

A. Section includes:
   1. Preparation of designated areas and installation of Moisture Vapor Emission Control System

B. Related Sections:
   1. Section 01 4525: Concrete Moisture Testing
   2. Section 03 3000: Cast-in-Place Concrete; under-slab vapor retarder and concrete floor sealers.
   3. Section 09 6500: Resilient Flooring

1.02 REFERENCES

A. ASTM International (ASTM):
   1. ASTM C 307 – Standard Test Method for Tensile Strength of Chemical-Resistant Mortar, Grouts, and Monolithic Surfacings
   2. ASTM C 579 – Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
   3. ASTM C 580 - Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
   4. ASTM D 2240 - Standard Test Method for Rubber Property—Durometer Hardness
   5. ASTM D 7234 – Standard Test Method for Pull-Off Strength of Coatings on Concrete Using Portable Adhesion Testers
   6. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials

B. Military Specifications (MIL):
   1. MIL-D-3134J – Deck Covering Materials

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications on cured system and individual components of Flooring System.
      a. Include data on physical and performance properties showing conformance with specified requirements in Article 2.01 D.
   2. Furnish information in quantities as specified in Section 01 3300.

B. Certifications:
   1. Moisture Vapor Emissions Control System manufacturer’s written approval of installer.

C. Copy of manufacturer's packing slip, tagged for this specific Project, along with calculations, signed by officer of primary material supplier demonstrating that quantity of material furnished for Project will achieve specified coverage and mil thickness.

D. Samples:
   1. Minimum of four 6 inches x 6 inches cured system samples for verification purposes and finish texture approval.

1.04 QUALITY ASSURANCE

A. Pre-Installation Meeting:
   1. Schedule meeting with Owner, Architect, Independent Testing Agency, and Construction Manager
      a. Comply with requirements of Section 01 3119.
      b. Arrange for attendance by floor covering installers and floor covering manufacturers' technical representatives.

   2. Meeting to include, but not limited to, following:
      a. Review of calcium chloride, relative humidity, and pH test results on floor slabs.
      b. Adhesive application instruction.
      c. Scheduling and procedures for periodic field inspections by floor covering manufacturers' technical representatives.
   3. Record minutes of meeting and promptly distribute copies of minutes to attendees and other interested parties as may be necessary.
   4. Record issues resolved during meeting
      a. Include copies of Drawings and application instructions used in meeting
      b. Record changes on Drawings and application instructions made at meeting.

B. Manufacturer's Qualifications:
   1. Obtain materials from single manufacturer with minimum of 5 years verifiable experience providing materials of type specified.

C. Installer Qualifications:
   1. Installer employing skilled mechanics having not less than three years satisfactory experience in installation of type of system specified, and approved in writing by system manufacturer.

D. Moisture Vapor Emissions Control System Thickness Verification:
   1. At Owner's discretion and under supervision by his Project Inspector, take one inch random cores per 1,000 square feet through system into substrate to verify proper system thickness.
   2. Remove and replace cored areas less than specified thickness or increase in thickness by installer, in manner that does not affect performance or integrity of system.
   3. Build up cored areas that comply with recommended system thickness to match surrounding surface elevation prior to applying seal coats.
   4. As cores taken and patched will be noticeable, take cores in areas where aesthetics are less critical.
   5. Perform coring and patching in accordance with requirements of Section 01 7329.

6. Cost associated with repair of cored areas that comply with specified thickness is responsibility of Owner.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver primary system materials in manufacturer's undamaged, unopened containers.
   1. Clearly mark each container with following:
      a. Product name and number.
      b. Manufacturer's name
      c. Component designation (A, B, and so on)
      d. Product Mix Ratio
      e. Health and Safety Information
      f. CHEMTREC Emergency Response Information

B. Provide equipment and personnel to handle materials by methods that prevent damage.
   1. Promptly inspect direct Project Site material deliveries to ensure that quantities are correct, comply with specified requirements, and are not damaged.

C. Responsibility for materials furnished by Contractor rests with Contractor.
   1. Replace, at Contractor’s expense, such materials that are found to be defective in manufacture or that have become damaged in transit, handling, or storage.

D. Store materials in accordance with manufacturer's instructions, with seals and labels intact and legible.
   1. Maintain temperatures within required range.
   2. Do not use materials that exceed manufacturer's maximum recommended shelf life.

1.06 PROJECT CONDITIONS

A. Site Visit:
   1. Prior to installation of Moisture Vapor Emission Control System visit Project Site to evaluate substrate condition, quantity and severity of cracking, and extent of repairs needed.
   2. Repair substrate imperfections only after mechanical preparation of substrate.
   3. Testing of concrete slabs is specified in Section 01 4525.
   4. Verify that moisture vapor transmission of substrate does not exceed Moisture Vapor Emission Control System manufacturer’s recommendations.
   5. Costs associated with repair, leveling, and remediation of substrate are responsibility of Contractor

B. Exercise care during surface preparation and system installation to protect surrounding substrates and surfaces, and in-place equipment.
   1. Prepare substrate to remove laitance and open surface achieved by light brush grit blasting.
   2. Produce surface profile similar to medium grit sandpaper and free from bond inhibiting contaminants.
   3. Costs incurred that are associated with damage from negligence or inadequate protection are sole responsibility of Contractor.

C. Slab Temperature:
   1. Condition slab to minimum 50 degrees F before commencing installation, during installation, and for at least 72 hours after installation is complete.
   2. Substrate temperature must be at least 5 degrees F above dew point during installation.

D. Maintain lighting at minimum uniform level of 50 or more foot candles in areas where Moisture Vapor Emission Control System is being installed.
   1. When practicable, it is recommendation of manufacturer that permanent lighting be in place and working during installation.

E. Correct leaks from pipes and other sources prior to installation of Moisture Vapor Emission Control System.

1.07 WARRANTY

A. Contractor and manufacturer to jointly furnish standard guarantee of moisture vapor emission control system for period of one year after date of Substantial Completion.
   1. Labor and material guarantee includes loss of bond and wear-through to concrete substrate from normal use.

B. Damage Not Covered by Warranty:
   1. Damage due to structural design deficiencies including, but not limited to, slab cracking from lateral, vertical or rotational movement, and gouging or other damage due to fork lifts, other equipment, Acts of God, or other elements beyond scope of protection of system nor causes not related to the system materials are not covered by warranty.

C. Warranty Claims:
   1. In event of warranty claim, Owner will notify manufacturer and contractor in writing within 30 days of first appearance of problems covered under warranty.
      a. Owner will provide free and unencumbered access to area during normal working hours for warranty rework.
      b. Property protection is also Owner's responsibility.
         1) Remedial work is limited to direct repair of Moisture Vapor Emission Control System.

PART 2 PRODUCTS

2.01 MOISTURE VAPOR EMISSION CONTROL SYSTEM

A. Basis-of-Design:
   1. Design of Moisture Vapor Emission Control System is based on KOSTER VAP I 2000 Moisture Mitigation System as manufactured by KOSTER American Corporation, Virginia Beach, VA
   2. System consists of:
      a. KOSTER VAP I 2000 Zero VOC - 12 hour setting time, Zero VOC 2-part epoxy resin coating.
   3. Color: Amber

B. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:
   1. Submit items listed in Article 1.04 and as specified in Section 01 3300, for evaluation of proposed system.
   2. Complete project shop drawings for similar project may be submitted for evaluation purposes, however shop drawings specific to this Project will be required from successful bidder.
   3. Copy of manufacturer's material warranty.

C. Conform to following physical properties:
   1. Adhesion, ASTM D 7234: 350 psi, concrete failure
   2. Hardness, ASTM D 2240, Shore D: 80
   3. Tensile Strength, ASTM C 307: 1,200 psi
   4. Compressive Strength, ASTM C 579: 5,800 psi
   5. Flexural Strength, ASTM C 580: 1,200 psi
   6. Permeability, ASTM E 96: Less than 0.09 perms
   7. Impact Resistance, MIL-D-3134J: Greater than 160 in/lb (160 lb load)

D. Provide at floor slabs scheduled to receive adhesive applied floor finishes such as carpet, vinyl composition tile, or other floor coverings, indicated in Finish Schedule, where concrete moisture testing indicates non-compliance with flooring manufacturer’s requirements for moisture vapor emissions.

PART 3 EXECUTION

3.01 MOISTURE VAPOR EMISSION CONTROL SYSTEM INSTALLATION

A. Surface Preparation:
   1. Abrasive blast concrete surfaces to remove surface contaminants and laitance.
   2. Prepare concrete surface with profile of CSP 3-4.
      a. Refer to manufacturer’s Form G-1 – Instruction for Concrete Surface Preparation
   3. Following initial preparation, inspect concrete for bug holes, voids, fins, and other imperfections.
      a. Grind protrusions smooth
      b. Fill voids with system compatible filler.
      c. For treatment of:
         1) Cracks in concrete substrates:
            a) Refer to manufacturer’s publication – Concrete 102.
         2) Control joints in concrete substrate:
            a) Refer to manufacturer’s publication – Concrete 103.

B. Installation Conditions:
   1. Throughout application process, maintain substrate temperature between 50 degrees F to 90 degrees F.
   2. Substrate temperature must be at least 5 degrees F above dew point.
   3. Perform application on concrete substrate while temperature is falling to lessen off-gassing.
   4. Isolation/Expansion and Other Joints Subject to Movement:
      a. Address expansion joints through flooring system.
      b. Refer to manufacturer’s publication – Concrete 105.

C. Application:
   1. Apply to flat concrete slabs-on-grade and upper level slabs, scheduled to receive adhesive applied floor finishes.
   2. Apply to concrete slabs after curing and drying in strict conformance with manufacturer's instructions and recommendations.
   3. Do not apply material in direct sunlight.

3.02 CURING

A. Cure materials in compliance with manufacturer's directions, taking care to prevent contamination during stages of installation and prior to completion of curing process.
   1. Allow to cure 18 hours minimum before applying subsequent flooring systems.
   2. Cure times vary depending on environmental conditions.

3.03 CLEANING

A. Clean up mixing and application equipment immediately after use with water.
   1. Observe fire and health precautions when handling or storing solvents.

B. Clean system just prior to inspection and installation of succeeding floor coverings, using materials and procedures suitable to system manufacturer.
   1. Follow manufacturer’s recommendations for testing and types of cleaners.

3.04 PROTECTION

A. Protect installed system from damage and wear during other phases of construction operation, using temporary coverings as recommended by manufacturer, as required.
   1. Remove temporary covering just prior to installation of succeeding floor coverings.

END OF SECTION 09 0562

SECTION 09 2216

NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Non-load bearing steel stud partition system
2. Vertical shaft (Shaft Wall) enclosure system.
3. Metal furring
4. Suspension system for gypsum board ceilings.
5. Deflection and Firestop top track systems.

B. Related Sections:

1.	Section 01 4100:	Regulatory Requirements; current Code edition.
2.	Section 05 4000:	Cold-Formed Metal Framing; load bearing studs
3.	Section 06 1053:	Miscellaneous Carpentry; wood blocking for wall-hung items.
4.	Section 09 2900:	Gypsum Board.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, current edition
1. Part 2 – California Building Code (CBC), Volumes 1 and 2.
   a. Chapter 25 – Gypsum Board and Plaster
2. Part 6 – California Fire Code (CFC)

B. ASTM International (ASTM):
1. ASTM A36 – Standard Specification for Carbon Structural Steel
2. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
3. ASTM A307 – Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
4. ASTM A 641 – Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
5. ASTM A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc Iron Alloy-Coated (Galvannealed) by Hot-Dip Process.
6. ASTM A 780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
7. ASTM A 1003 – Standard Specification for Steel Sheet, Carbon, Metallic- And Nonmetallic-Coated for Cold-Formed Framing Members
8. ASTM C 11 – Standard Terminology Relating to Gypsum and Related Building Materials and Systems
9. ASTM C 645 – Standard Specification for Non-Structural Steel Framing Members.
10. ASTM C 754 – Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
11. ASTM C954 – Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness

12. ASTM C 1002 – Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
13. ASTM C 1513 – Standard Specification for Steel Tapping Screws for Cold-Formed Steel Framing Connections.
14. ASTM E119 – Standard Test Methods for Fire Tests of Building Construction Materials.
15. ASTM E1190 – Standard Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members

C. American Iron and Steel Institute (AISI):
1. AISI S1 00 – North American Specification for the Design of Cold-Formed Steel Structural Members.

D. American Welding Society (AWS):
1. AWS D1.1 – Structural Welding Code Steel
2. AWS D1.3 – Structural Welding Code Sheet Steel

E. International Code Council Evaluation Service (ICC-ES):
1. ICC ES Reports (ESR):
   a. ICC ES Report No. ESR-3016 .
   b. ICC ES Report No. ESR-3064P.
   c. ICC ES Report No. ESR-2620

F. Steel Framing Industry Association (SFIA):
1. Technical Guide for Cold-Formed Steel Framing Products.
2. Intertek Code Compliance Research Report CCRR-0224

G. Certified Steel Stud Association (CSSA).

H. Steel Stud Manufacturers Association (SSMA):
1. Product Technical Guide.

1.03 DEFINITIONS

A. Gypsum Board Construction Terminology:
1. Refer to ASTM C 11 for definition of terms for gypsum board construction not defined in this Section.

1.04 SUBMITTALS

A. Product Data:
1. Manufacturer's product literature and data sheets and installation recommendations for specified products.

B. Certificates:
1. Manufacturer's certification that materials meet or exceed specification requirements.
2. Welder certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" Article.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Current member of SFIA, CSSA, or SSMA, with current Code Compliance Certification.
   2. Provide full time quality control over fabrication and erection complying with applicable codes, ordinances, rules and regulations of authorities having jurisdiction.

B. Installer Qualifications:
   1. Minimum 2 years experience in performing work of this Section on similar projects.

C. Welder Certification:
   1. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, when pertinent, has undergone recertification.

D. Coordinate with related Work to provide blocking for items mounted on finished surfaces and to provide allowances for pipes and other items inside partitions and walls.

E. Tolerances:
   1. Install walls and partitions on straight lines, plumb, free of twists or other defects, and contacting 10 foot straightedge for its entire length at any location within 1/8 inch tolerance.
   2. Install horizontal framing level within tolerance of 1/8 inch in 12 feet in any direction.

F. Fire Rated Assemblies:
   1. Where framing units are components of assemblies indicated for fire-resistance rating, including those required for compliance with governing regulations, provide units which have been approved by governing authorities having jurisdiction.
   2. Provide products to be used in assemblies carrying classification label from testing laboratory.

G. Fire Test Response Characteristics:
   1. For fire resistance rated assemblies that incorporate non-load-bearing steel framing.

H. Provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by independent testing laboratory.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in their original unopened packages and stored inside in dry, ventilated space, protected from damage.
   1. Do not store material directly on grade.
   2. Provide adequate support to prevent bowing of material prior to installation.

1.07 REGULATORY REQUIREMENTS

A. Comply with following as minimum requirements:
   1. CBC, Chapter 22A
   2. AWS D1.1 and D1.3.
   3. Welding and Cutting Equipment and Storage and Protection of Cylinders: California Fire Code (CFC), Article 4.9.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with specified requirements, provide cold-formed metal framing by current members of one of following:
   1. Steel Framing Industry Association (SFIA).
   2. Certified Steel Stud Association (CSSA)
   3. Steel Stud Manufacturers Association (SSMA).

2.02 MATERIALS

A. Galvanized Steel:
   1. Meet or exceed requirements of ASTM A 653 or ASTM A 1003.
   2. Coating Class:
      a. Minimum G40 galvanized coating, complying with ASTM C645.

B. Stud Punch-Outs:
   1. Minimum 10 inches between end of bearing point and near edge of web punch-out and 24 inches on center thereafter.

2.03 COMPONENTS

A. Metal Studs:
   1. Cold-Formed Nonstructural Studs:
      a. Galvanized, steel C studs complying with following:
         1) Flange Length: 1-1/4 inches.
         2) Web Depth: 4 inches
         3) Return Lip: 1/4 inch
         4) Minimum Material Thickness: 20 gage (0.0375 inch), unless otherwise noted.
         5) Minimum Yield Strength: 33 ksi.

B. Nonstructural Track:
   1. Cold-Formed galvanized steel runner tracks, complying with following:
      a. Flange Length: 1-1/4 inches.
      b. Web depth: 4 inches.
      c. Minimum Material Thickness: 16 gage (0.0625 inch), unless otherwise noted.
      d. Minimum Yield Strength: 33ksi.

C. Deflection Track and Firestop System:
   1. Provide at rated partitions.
   2. System by FireTrak Corporation, conforming to OSHPD Report No. R-0475.

D. Deep-Leg Deflection Track:
   1. Top runner with 2 inch deep flanges.
   2. Proprietary Deflection Track:
      a. Steel sheet top runner manufactured to prevent cracking of gypsum board applied to interior partitions resulting from deflection of structure above
      b. In thickness indicated for studs and in width to accommodate depth of studs.
      c. Subject to compliance with specified requirements, provide one of following:
         1) Slotted Track by Metal-Lite, Inc., conforming to OSHPD Report No. R-0370
         2) Slotted Track by Sliptrack Systems, conforming to ICC ES Report No. ESR-1042
         3) Slotted Track by California Expanded Metal Products Co, (Cemco) conforming to ICC ES Report No. ESR-2012.

E. Shaft Wall System:
   1. Coordinate specified materials with applications and materials specified in Section 09 2900.
   2. Comply with ASTM C 754 for conditions indicated.
      a. Non-Load bearing gypsum wall assemblies for use in following areas:
         1) Shaft Wall Application: Mechanical Shafts.
   3. Stud Width: CH Stud and E Stud with J Runner – 4 inches.
   4. Stud Material Thickness: 20 gage.
   5. Deflection: L/240.

F. Recycled Content of Steel Products:
   1. Provide products with average recycled content of steel products such that post-consumer recycled content plus one-half of pre-consumer recycled content is not less than 25 percent.

2.04 CEILING SUSPENSION / FURRING MATERIALS

A. General:
   1. Hanger Wire:
      a. Conforming to ASTM A 641, Class 1 galvanized.
   2. Hanger Anchorage Devices:
      a. Screws, clips, bolts, cast-in-place concrete inserts or other devices applicable to indicated method of structural anchorage for ceiling hangers.
      b. Whose suitability for use intended has been proven through standard construction practices or by certified test data.
      c. Size devices for 3 times calculated load supported except size direct pull-out concrete inserts for 5 times calculated loads.

B. Gypsum Board Ceilings:
   1. Size ceiling support components to comply with ASTM C 754 unless otherwise indicated.
   2. Main Runners:
      a. Steel channels with rust inhibitive paint finish, hot or cold rolled.
   3. Cross Furring:
      a. 25 gage screw-type hat-shaped section, complying with ASTM C 645.

2.05 METAL FURRING

A. General – Provide vertical furring complying with following requirements:
   1. Protective Coating:
      a. Conforming to ASTM A 653, G40 hot-dip galvanized coating.
   2. Channel Furring and Braces:
      a. Cold-rolled steel, minimum 0.0598 inch thick base (uncoated) metal and 3/4 inch deep by 7/16 inch wide flanges, 300 lb./1000 feet.
   3. Hat Channels:
      a. Hat-shape screwable furring channels, 7/8 inch deep, formed from zinc-coated (galvanized) steel sheet, minimum 0.0179 inch thick, Grade 33.
   4. Furring Brackets:
      a. Serrated-arm type, minimum 0.0329 inch thick base (uncoated) metal, adjustable from 1/4 to 2-1/4 inch wall clearance for channel furring.

2.06 ANCHORS, CLIPS AND FASTENERS

A. Steel Shapes and Clips:
   1. Conforming to ASTM A 36, zinc coated by hot-dip process according to ASTM A 123.

B. Cast-in-Place Anchor Bolts and Studs:
   1. Conforming to ASTM A 307, Grade A; carbon-steel hex head bolts and studs; carbon-steel nuts; and flat, unhardened-steel washers.
   2. Zinc coated by hot-dip process according to ASTM A 153.

C. Powder-Actuated Anchors:
   1. Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with capability to sustain, without failure, load equal to 10 times design load, as determined by testing per ASTM E 1190 conducted by qualified independent testing agency.

D. Mechanical Fasteners:
   1. Corrosion-resistant coated, self-drilling, self-threading steel drill screws.
   2. Head Type:
      a. Low-profile head beneath sheathing, manufacturer's standard elsewhere.

E. Welding Electrodes: Comply with AWS standards.

F. Framing Accessories:
   1. Provide standard related accessories including floor and ceiling tracks, clips, web stiffeners, anchors, and similar items, of same manufacture as each type of stud specified, and as required for complete installation.

G. Fasteners:
   1. Wafer-head screws, self-drilling type for 20 gage (0.0375 inch) metal and heavier.
   2. Conforming to ASTM C 954, self-drilling, self-tapping screws, Type S-12 pan head, 1/2 inch long unless noted otherwise.

H. Galvanizing Repair Paint:
   1. Organic zinc rich paint complying with SSPC-Paint 20, with dry film containing not less than 94 percent zinc dust by weight.

2. Provide for touch-up of galvanized surfaces.

I. Steel Backing:
   1. Provide minimum 6 inch wide by 16 gage sections of studs or stud track, welded or fastened to web of studs, except as otherwise indicated.
   2. Finish same as for studs.

PART 3 EXECUTION

3.01 EXAMINATION

A. Inspect supporting substrates and structures for proper conditions for installation and performance of cold-formed structural framing.

B. Verify that attachment surfaces are plumb, level, and in proper alignment to accept cold-formed structural framing.

3.02 FABRICATION

A. Cut framing components square for attachment to perpendicular members or as required for angular fit against abutting members.

B. Plumb, align and securely attach studs to flanges of both upper and lower runners.
   1. Interior, Non-Load Bearing Walls:
      a. Studs need not be attached to upper or lower runners, except where otherwise indicated.

C. Splices in members other than top and bottom runner track are not permitted, unless noted otherwise.

D. Provide temporary bracing where required, until erection is complete.

3.03 INSTALLATION

A. General – Walls and Partitions, unless noted otherwise:
   1. Fasten floor runners for interior partitions to concrete slab with required power driven fasteners.
      a. Spacing of fasteners not to exceed 24 inches on center, unless noted otherwise.
      b. Fasten ceiling runners to structure as indicated.
   2. Space studs not over 16 inch on center unless indicated otherwise.
      a. Locate studs approximately 2 inches from door frame jambs, abutting partitions and partition corners.
   3. Furnish and install manufacturer's standard floor track.
      a. Fasten track to floor by means of Low –Velocity Powder Driven Fasteners.
      b. Product and Manufacturer:
         1) Low-Velocity X-U Universal Powder Driven Fastener, conforming to ICC ESR-2269, by Hilti, Inc., or approved equal.
   4. Seat studs squarely in track with stud web and flanges abutting track web, plumbed and securely fastened with sheet metal screws, to flanges or web of both floor and top tracks.
      a. Provide 4 screws per stud.

5. Where there is no suspended ceiling, provide tops of stud walls with track and shoes and be fastened as indicated.
    a. Welding of studs to ceiling track will not be permitted except where bearing studs are installed.
6. Fasten bridging or horizontal bracing of 1-1/2 inch, cold-rolled channels in manner to prevent stud rotation.
    a. Furnish bridging as follows:
        1) Walls up to 10 feet high:
            a) One row at mid-height
        2) Walls exceeding 10 feet high:
            a) Bridging or bracing rows spaced not to exceed 5 feet on center.

B. Shaft Wall Framing:
1. Attach J-Runners plumb with one another, long leg on shaft side, at floor and structure overhead using power-driven fasteners located 2 inches from each end and 24 inches on center between.
    a. Cut C-H Studs not less than 3/8 inches nor more than 1/2 inch less than distance from floor to structure above.
    b. Fit first C-H Stud over leading edge of first liner board.
    c. Install remaining liner boards and C-H Studs.
    d. Do not attach C-H Studs to J-Runners.
2. Always fit liner boards tightly into studs or jamb runners and always fit studs tightly over liner boards.
3. Corners and Intersections:
    a. Position J-Runners or E-Studs at corners and intersections.
4. Do not exceed allowable stresses in C-H Studs, E-studs or J-Runners.

3.04 TOUCH-UP

A. Galvanized Surfaces:
1. Clean field welds, bolted connections, and abraded areas and repair galvanizing complying with ASTM A 780.

3.05 CLEANING

A. Remove and legally dispose of debris, rubbish, and waste material off Project Site.

3.06 PROTECTION

A. Protect Work until Substantial Completion.

END OF SECTION 09 2216

SECTION 09 2513

PORTLAND CEMENT PLASTER

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Portland Cement Plaster with Acrylic-Based Finish Coat.
      a. Exterior Plaster Walls and Soffits.
   2. Metal Lath and Accessories.
      a. Including PVC accessory trim
   3. Vapor Permeable Weather-Resistive Barrier.

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 07 2726: Fluid Applied Air and Water Barrier Membrane
   3. Section 07 9200: Joint Sealants
   4. Section 09 2216: Non-Structural Metal Framing
   5. Section 09 2900: Gypsum Board; glass mat exterior gypsum sheathing board

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
   1. Chapter 25 – Gypsum Board, Gypsum Panel Products, and Plaster

B. ASTM International (ASTM):
   1. ASTM A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   2. ASTM C 847 – Standard Specification for Metal Lath
   3. ASTM C 926 – Standard Specification for Application of Portland Cement Based Plaster
   4. ASTM C 933 – Standard Specification for Welded Wire Lath
   5. ASTM C 1063 – Standard Specification for Installation of Lathing and Furring to Receive Exterior Portland Cement-Based Plaster.
   6. ASTM D 779 – Standard Test Method for Water Resistance of Paper, Paperboard and Other Sheet Materials by the Dry Indicator Test Method
   7. ASTM D 882 – Standard Test Method for Tensile Properties of Thin Plastic Sheeting
   8. ASTM D 1784 – Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds
   9. ASTM D 4216 – Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) and Related PVC and Chlorinated Poly (Vinyl Chloride) (CPVC) Building Products Compounds
   10. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials
   11. ASTM E 96 – Standard Test Methods for Water Vapor Transmission of Materials

12. ASTM E 1677 – Standard Specification for Air Barrier (AB) Material or System for Low-Rise Framed Building Walls

C. Federal Specifications (FS):
   1. FS UU-B-790a, Type 1, Grade D, Style 2

D. International Code Council Evaluation Service (ICC ES):
   1. ICC ES Report: ESR-1027

E. International Association of Plumbing and Mechanical Officials (IAPMO):
   1. IAPMO Uniform Evaluation Service (UES):
      a. UES ES ER-2017

1.03 SYSTEM DESCRIPTION

A. Base Coats:
   1. Two Coat Stucco System:
      a. Applied in two layers
      b. 3 /8 inch thick scratch coat.
      c. 3 /8 inch brown coat
      d. Approximately 3 /4 inch system is applied by hand or machine over approved water-resistive barrier and metal lath.

B. Acrylic-Based Finish Coat:
   1. Consisting of 100 percent acrylic-based finish using latest Dirt Pick-up Resistance (DPR) technology.
      a. Formulated with high quality acrylic resins, graded quartz aggregates, and proprietary additives.
      b. Providing flexible, durable, integrally colored finish.
      c. Acrylic-based finish may be sprayed or troweled to achieve specified texture.

C. Portland Cement Plaster Soffits:
   1. Direct Applied Exterior Finishing System (DEFS):
      a. Sheathing Substrate:
         1) Fiber-Mat Reinforced Cementitious Backer Board:
            a) Complying with ASTM C 1325.
      b. Fasten sheathing to metal stud soffit framing.
      c. Install reinforcing mesh embedded in base coat applied to sheathing.
      d. Apply primer and finish plaster coat.

1.04 SUBMITTALS

A. Product Data:
   1. Manufacturer's product data and installation instructions for each product specified.

B. Material Certificates:
   1. Producer's certificate for each kind of plaster aggregate indicated evidencing that materials comply with requirements.

C. Samples:
   1. Prepare four 18 inch square sample plaques using materials and workmanship indicating proposed range of colors and texture to be expected in completed Work.
      a. Submit to Architect and obtain acceptance of color and texture.
      b. Accepted sample is to be used in construction of mock-ups.
   2. Do not begin construction of mock-up until samples have been reviewed and accepted by Architect.

1.05 QUALITY ASSURANCE

A. Comply with CBC, Chapter 25.

B. Mock-Ups:
   1. Prior to installing plaster work, construct panels for each type of finish and application required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution.
   2. Construct mock-ups to comply with following requirements, using materials indicated for final unit of Work:
      a. Locate mock-ups on-site in location and of size indicated or, when not indicated, as directed by Architect.
      b. Erect mock-ups consisting of minimum 4 by 4 foot panel by full thickness in presence of Architect using materials, including lath, support system, and control joints, indicated for final Work.
      c. Notify Architect 7 days in advance of dates and times when mock-ups will be constructed.
      d. Demonstrate proposed range of color aesthetic effects and workmanship expected in completed Work.
         1) Show cut-away in panel exposing weather barrier, metal lath and drainage weep of system on perimeter edge of panel.
         2) Obtain Architect's acceptance of visual qualities of sample panel.
   3. Obtain Architect's acceptance of mock-ups before start of plaster Work.
   4. Retain and maintain mock-ups during construction in undisturbed condition as standard for judging completed Portland cement plaster work.
   5. When directed, remove mock-ups from Project Site.
      a. Accepted mock-ups in undisturbed condition at time of Substantial Completion may become part of completed unit of Work.

C. Contact local architectural representative/technical consultant of plaster finish manufacturer to provide consultation with installer for application of finish on samples, mock-ups and during actual system application.

D. Pre-Installation Meeting:
   1. Conduct meeting one week prior to construction of mock-ups at Project Site.
   2. Meeting should be attended by Architect, Contractor, applicator of plaster system, and manufacturer's technical representative.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver manufactured materials in original packages, containers or bundles, bearing name of manufacturer and brand.

B. Keep plaster and cementitious materials dry until ready for use.
   1. Keep off ground, under cover, and away from damp surfaces.
   2. Protect metal goods against rusting.

1.07 PROJECT CONDITIONS

A. Exterior Plaster Work – General:
   1. Before, during, and following application of plaster system, ambient and surface temperatures must remain above 40 degrees F for minimum period of 24 hours.
   2. Do not apply plaster when ambient temperature is below 40 degrees F.
   3. Inclement Weather:
      a. Protect applied material from inclement weather until dry.

B. Cold-Weather Requirements:
   1. Provide heat and protection, temporary or permanent, as required to protect each coat of plaster from freezing for at least 24 hours after application.
   2. Distribute heat uniformly to prevent concentration of heat on plaster near heat sources; provide deflection or protective screens.

C. Warm Weather Requirements:
   1. Protect plaster against uneven and excessive evaporation and from strong flows of dry air, both natural and artificial.
   2. Apply and cure plaster as required by climatic and project conditions to prevent dry out during cure period.
   3. Provide suitable coverings, moist curing, barriers to deflect sunlight and wind, or combinations of these, as required.

D. Protect contiguous work from soiling, spattering, moisture deterioration and other harmful effects which might result from plastering.

1.08 WARRANTY

A. Portland Cement Plaster with Acrylic Modified Finish Coat.
   1. Warranty Period:
      a. Seven years from date of Substantial Completion

B. Vapor Permeable Weather-Resistive Barrier:
   1. Manufacturer warrants that product will perform to manufacturer's published specifications when installed according to manufacturer's installation procedures and accepted industry standards in standard weather-resistive barrier application.
   2. Warranty Period:
      a. Fifteen years from date of Substantial Completion.

C. Installer's Warranty:
   1. Two years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFCTURERS

A. Basis-of-Design:
   1. Design for Exterior Walls:
      a. Design of Portland cement plaster system is based upon Super Cement enhanced three coat system with OmegaFlex Acrylic-based finish coat as manufactured by Omega Products International, Inc., Corona, CA.
   2. Design for Plaster Soffits:
      a. Design of Portland cement plaster system is based upon Super Cement enhanced two coat system with Omega Akrogold DEF System as manufactured by Omega Products International, Inc., Corona, CA.

B. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:
   1. Submit items listed in Article 1.04 and as specified in Section 01 3300, for evaluation of proposed system.
   2. Copy of manufacturer's material warranty.

2.02 VAPOR PERMEABLE WEATHER-RESISTIVE BARRIER

A. Basis of Design:
   1. Single layer, single ply asphalt saturated kraft Grade D breather type sheathing paper as manufactured by Fortifiber Building Systems Group.
      a. Complying with ASTM E 1677.
      b. Exceeds FS UU-B-790a, Type 1, Grade “D”, Style 2
   2. Physical Properties:
      a. Water-Vapor Transmission, ASTM E 96, Method A: Minimum 75 grams / 11 perms
      b. Water Resistance, ASTM D 779: Greater than 60 minutes.
      c. Tensile Strength, ASTM D 828:
         1) MD – 70 lbf/inch
         2) CD – 60 lbf/inch
      d. System Air Leakage, ASTM E 283: 0.02 CFM/ft^2
      e. VOC, California Specification 01350: Pass.
   3. Type:
      a. Premier: Fortifiber / Super Jumbo Tex 60 Minute by Henry Company, or approved equal.

B. Accessories:
   1. Tape: Fortifiber Sheathing Tape
   2. Sealant: Fortifiber Moistop Sealant
   3. Fasteners: High quality galvanized construction staples.

C. Flexible Flashing:
   1. Self-adhesive, self-sealing, butyl waterproof membrane laminated to reinforced polymer membrane.
   2. For flashing window and door openings and sealing penetrations.
   3. Product and Manufacturer:
      a. Fortifiber FortiFlash Butyl Waterproof Flashing by Henry Company.

D. Exterior Sheathing
   1. Glass Mat Exterior Sheathing Board as specified in Section 09 2900.

2.03 LATH

A. Expanded Metal Lath:
   1. Fabricate expanded metal lath from zinc-coated (galvanized) steel sheet to produce lath complying with ASTM C 847 for type, configuration and other characteristics indicated below:
   2. Diamond Mesh Lath:
      a. Comply with following requirements
         1) Configuration: Self-furring.
         2) Weight: 3.4 lbs. per square yard.
      b. Do not use paper-backed lath

B. Tie and String Wire: 16-18 gage, galvanized.

C. Lath Attachment Devices:
   1. Devices of material and type required by referenced standards and recommended by lath manufacturer for secure attachment of lath to framing members and of lath to lath.

2.04 PLASTER ACCESSORIES FOR PORTLAND CEMENT PLASTER

A. General:
   1. Coordinate depth of accessories with thicknesses and number of coats required.
   2. Comply with material provisions of ASTM D 1784 and D 4216 for following:
      a. Provide PVC products as manufactured by Plastic Components, Inc., or approved equal.
   3. Do not use metal accessories with Acrylic Modified Plaster finish except where PVC type is not available, subject to Architect's review and acceptance.

B. Metal Corner Reinforcement:
   1. Expanded large mesh diamond mesh lath fabricated from zinc-alloy or welded wire mesh fabricated from 0.0475 inch diameter zinc-coated wire, specially formed to reinforce external corners of Portland cement plaster on exterior exposures while allowing full plaster encasement.
   2. Bullnose Corner Reinforcing:
      a. Complying with ASTM A 653.
      b. 7/8 inch radius Bullnose Corner Aid.

C. Corner Beads:
   1. Small nose corner beads fabricated from PVC, with 2-1/2 inch to 2-3/4 inch flanges of PVC to allow full encasement by plaster.

D. Casing Beads:
   1. Square-nose style of PVC, with 1-3/4 inch flange and removable protective tape.

E. Control Joints:
   1. Prefabricated of PVC.
   2. One-Piece Type:

a. Folded pair of non-perforated screeds in M-shaped configuration, with 3-3/8 inch flanges.

3. Two-Piece Type:
   a. Pair of casing beads with back flanges formed to provide slip joint action, adjustable for joint widths from 1/8 inch to 5/8 inch.
4. Cut lath and wire tie at control joints per ASTM C 1063.

F. Soffit Drip Screed/Stop:
1. One-Piece Type:
   a. Provide 1/2 inch reveal detail.
2. Design prevents water from running down fascia and back into soffit area.
3. Surface areas with striations to provide positive bonding of base coat to profile detail.
4. Stops:
   a. 1/8 inch stops to ensure proper thickness of base and finish.

G. Perforated Soffit Vent:
1. Perforated, 2 inch width.

H. Foundation Weep Screed:
1. Fabricated from PVC, with weep holes, 3-1/2 inch flange.

2.05 PORTLAND CEMENT PLASTER MATERIALS

A. Portland Cement:
1. Super Cement as manufactured by Omega Products International, Inc.
2. Do not use plastic cement.

B. Sand Aggregate:
1. Conforming to ASTM C 897.
   a. Clean, free from deleterious amounts of loam, clay, silt, soluble salts, organic matter and graded within following limits:

Percent Retained by Weight (plus or minus 2 percent) Retained on U.S. Standard Sieve	Minimum	Maximum
No.4	--	0
No.8	0	10
No. 16	10	40
No. 30	30	65
No. 50	70	90
No. 100	95	100

2.06 MISCELLANEOUS MATERIALS

A. Water for Mixing and Finishing Plaster:
1. Drinkable, free of substances capable of affecting plaster set or of damaging plaster, lath or accessories.

B. Bonding Agent for Portland Cement Plaster:
1. Conforming to ASTM C 932.

C. Miscellaneous Aluminum Moldings and Trim:
1. As manufactured by Fry Reglet Corp., or approved equal:

2. Style type indicated on Drawings.
3. Aluminum moldings:
    a. Extruded alloy 6063-T5.
    b. Provide with end caps.
4. Factory Finish:
    a. Factory applied prime coat, unless indicated otherwise.
5. Install in accordance with manufacturer's recommendations.
6. Field Finish:
    a. Field paint in accordance with specified system in Section 09 9100.
    b. Contractor's Option:
        1) Provide factory baked enamel finish coating in color as selected by Architect.

2.07 PORTLAND CEMENT PLASTER MIXES

A. General:
1. Comply with ASTM C 926 for Portland cement plaster base and finish coat mixes as applicable to plaster bases, materials and other requirements indicated.

B. Portland Cement Plaster Base Coat Mixes and Compositions:
1. Proportion materials for respective base coats:
    a. In parts by volume for cementitious materials.
    b. In parts by volume per sum of cementitious materials for aggregates, to comply with following requirements for each method of application and plaster base indicated.
2. Adjust mix proportions below within limits specified to attain workability.
3. Two Coat Work Over Metal Lath:
    a. Base coats as indicated.
        1) Scratch Coat: Omega Fibered Super Cement, 2-1/2 to 4 parts sand.
        2) Brown Coat: Omega Fibered Super Cement, 3 to 5 parts sand.

C. Provide Portland cement plaster with maximum allowable slump of 2-1/2 inches when tested in accordance with ASTM C 143.
1. Take material for slump test from nozzle of plastering machine hose.
2. Perform one slump test for each day of Portland cement plaster work.

2.08 PROPORTIONING AND MIXING

A. Proportion and mix following manufacturer's recommendations.

B. Mechanically mix cementitious and aggregate materials for plasters to comply with applicable referenced application standard and with recommendations of plaster manufacturer.
1. Mechanically mix at Project Site.
    a. Do not hand mix except where small amounts are needed, using less than one bag of plaster.
2. Use measuring devices with known volume with successive batches proportions alike.

2.09 ACRYLIC-BASED FINISH COAT

A. Acrylic Modified Plaster:
   1. Basis of Design:
      a. OmegaFlex System by Omega Products International, Inc.

B. Finish Coat:
   1. Level Coat:
      a. OmegaFlex StyroGlue DryBond.
   2. Base Primer:
      a. Omega Flex Primer.
   3. Finish Coat:
      a. OmegaFlex Fine 100 percent acrylic-based finish.
         1) Color and Texture:
            a) As selected by Architect.
               (.) Match approved mock-up.

2.10 PLASTER SOFFITS

A. Reinforcing Mesh:
   1. AkroFlex Meshes:
      a. Alkali-resistant woven glass fiber fabrics specially designed to be used with AkroGold DEF System.
      b. Standard Mesh (4.2 oz): For field locations.
      c. Starter Mesh (4.2 oz.): For back wrapping, board joints, and detail work.

B. Base Coat:
   1. Styroglue:
      a. 100 percent polymer-based base coat and adhesive.
         1) Field mixed in 1:1 ratio by weight with Portland cement complying with ASTM C150.

C. Primer:
   1. AkroFlex primer manufactured by Omega Products International.

D. Finish:
   1. AkroFlex Fine, 100 percent acrylic-based finish manufactured by Omega Products International.]

PART 3 EXECUTION

3.01 EXAMINATION

A. Prior to application of Portland cement system, review Site with plastering contractor to ensure that:
   1. Surface and Site conditions are ready to receive Work.
   2. Grounds and Blocking:
      a. Verify that items within walls for other sections of Work have been installed.

B. Substrates:
   1. Acceptable substrates must be securely fastened per applicable building code requirements.

2. Acceptable substrates and adjacent materials must be dry, clean, and sound.
    a. Substrate surface must be flat, free of fins or planar irregularities greater than 1/4 inch in10-feet.

C. Flashings:
1. Flashing around windows, at deck attachments, utility penetrations, roof lines, and kick-out flashing must be properly installed prior to application of Portland cement plaster system.

D. Report unsatisfactory conditions to Contractor, Architect, and Owner.
1. Do not proceed until unsatisfactory conditions have been corrected.
2. Beginning of installation constitutes acceptance of existing conditions.

3.02 PREPARATION – GENERAL

A. Substrate:
1. Clean substrate to which Portland cwement plaster system is to be applied.
    a. Ensure that there are no foreign materials present.
        1) Including, but not necessarily limited to:
            a) Oil, dirt, dust, form release agents, efflorescence, paint, wax, water repellants, moisture, frost, or extended nails that may rupture water-resistive barrier.

B. Surrounding Areas:
1. Protect surfaces near Work of this Section from damage, disfiguration, and overspray.
    a. Mask off dissimilar materials.

3.03 VAPOR PERMEABLE WEATHER-RESISTIVE BARRIER INSTALLATION

A. Install vapor permeable weather-resistive barrier over fluid-applied air and water barrier membrane in accordance with manufacturer's recommendations

B. Install weather-resistive barrier prior to installation of windows and doors.

C. Start weather-resistive barrier installation at building corner, leaving 6-12 inches of weather-resistive barrier extended beyond corner to overlap.
1. Install weather-resistive barrier in horizontally starting at lower portion of wall surface with subsequent layers installed in shingling manner to overlap lower layers.
2. Maintain weather-resistive barrier plumb and level

D. Sill Plate Interface:
1. Extend lower edge of weather-resistive barrier over sill plate interface 3 to 6 inches.
2. Secure to foundation with elastomeric sealant compatible with weather-resistive barrier and conforming to requirements of Section 07 9200.

E. Window and Door Openings:
1. Extend weather-resistive barrier completely over openings.
2. Overlap weather-resistive barrier as follows:
    a. Exterior corners: Minimum 12 inches.
    b. Seams: Minimum 6 inches.

F. Weather-Resistive Barrier Attachment:
   1. Attach weather-resistive barrier to studs through exterior sheathing.
   2. Secure using weather-resistive barrier manufacturer recommend fasteners, space 6 to 18 inches vertically on center along stud line, and 24 inches on center, maximum horizontally.

G. Seaming:
   1. Seal seams of weather-resistive barrier with seam tape at vertical and horizontal overlapping seams.
   2. Seal tears or cuts as recommended by weather-resistive barrier manufacturer.

H. Field Quality Control
   1. Notify manufacturer's designated representative to obtain periodic observations of weather-resistive barrier assembly installation.

I. Protection:
   1. Protect installed weather-resistive barrier from damage.

3.04 INSTALLATION OF LATH – GENERAL

A. Portland Cement Plaster Lathing and Furring Installation Standard:
   1. Install lathing and furring materials indicated for Portland cement plaster to comply with ASTM C 1063.

B. Exterior Cement Plaster over Metal Lath:
   1. Prior to installation of metal lath ensure that weather barrier and flashing have been installed.
   2. Exterior Stucco Mesh or Key Mesh (cement plaster):
      a. Provide wire, nails, screws and staples of type, minimum size, and maximum spacing along supports.

3.05 METAL LATHING

A. Metal Lath:
   1. Provide appropriate type, configuration and weight of metal lath selected from materials indicated which comply with referenced lathing installation standards.
   2. Install expanded metal lath for following applications where plaster base coats are required:
      a. Exterior Sheathed Wall Surfaces:
         1) Minimum weight of self-furring diamond mesh lath – 3.4 lbs. per square yard
   3. Monolithic surfaces indicated to receive metal lath or not complying with requirements of referenced plaster application standards for characteristics which permit direct bond with plaster.
      a. Provide self-furring metal lath.
   4. Apply metal lath over gypsum sheathing with fasteners extending through sheathing in to framing.

3.06 PLASTERING ACCESSORIES

A. General:
   1. Comply with referenced lathing and furring installation standards for provision and location of plaster accessories of type indicated.

2. Miter or cope accessories at corners:
    a. Install with tight joints and in alignment.
3. Attach accessories securely to plaster bases to hold accessories in place and alignment during plastering.

B. Accessory Attachment:
1. Attach each flange at 18 inches on center maximum, or as necessary to hold plumb, for vertical accessories and to coincide with framing for horizontal accessories.

C. Set accessories plumb, level and true to line, with tolerance of 1/8 inch in 10 feet.

D. Install metal or PVC corner beads at external corners as required.

E. Install casing beads at terminations of plaster work, except where plaster is indicated to pass through other work and be concealed by lapping work, and except where special screens, bases or frames act as casing beads including interior metal door frames.
1. For exterior work, set casing beads 1/4 inch from abutting frames and other work, for application of sealant.

F. Control and Expansion Joints:
1. Install control and expansion joints at locations indicated, or where not indicated, at locations complying with following criteria and approved by Architect:
    a. Where expansion or control joint occurs in surface of construction directly behind plaster membrane.
    b. Where distance between control joints in Portland cement plastered surface exceeds 10 feet in either direction.
    c. Where area within Portland cement panels exceed 100 square feet.
    d. Where Portland cement plaster panel sizes or dimensions change.
        1) Extend joints full width or height of plaster membrane.
2. Install prefabricated expansion joints of 2-piece design where shown as "Expansion Joint".
    a. 1/8 inch joint width for exterior work.

G. Separation Screeds:
1. Install at intersections of two types of plaster, plaster and tile, and where indicated.

3.07 PREPARATION FOR PLASTERING

A. Clean plaster bases and substrates for direct application of plaster, removing loose material and substances that may impair Work.

B. Install temporary grounds and screeds to ensure accurate rodding of plaster to true surfaces
1. Coordinate with scratch-coat work.

C. Surface Conditioning of Concrete and Concrete Unit Masonry Surfaces:
1. Immediately before plastering, dampen concrete and concrete unit masonry surfaces that are indicated for direct plaster application, except where bonding agent has been applied.

2. Determine and apply amount of moisture and degree of saturation that will result in optimum suction for plastering.

3. Bonding Agent:
   a. Where bonding agent is required, apply to concrete and concrete unit masonry surfaces indicated for direct plaster application.
      1) Comply with manufacturer's written instructions for application.

3.08 PORTLAND CEMENT PLASTER APPLICATION

A. Portland Cement Plaster Application Standard:
   1. Apply Portland cement plaster materials, compositions, and mixes to comply with ASTM C 926.

B. Number of Coats:
   1. Apply Portland cement plaster, of composition indicated, to comply with following requirements:
      a. Use two-coat work:
      b. Total Plaster Thickness:
         1) Over Plywood or Glass Mat Gypsum Sheathing, and Metal Lath:
            a) Nominal 7/8 inch thick, consisting of 3/8 inch scratch coat, 3/8 inch brown coat, and nominal 1/8 inch acrylic finish coat.

C. Do not join or lap brown coat over joining or laps in scratch coat.
   1. Do not join or lap finish coat over joining or laps in brown coat.
   2. Joining or lap marks or differences in texture where scaffolding changes occur are not acceptable.

D. Texture of Plaster Finishes:
   1. Except as otherwise indicated, apply finish coats as follows:
      a. Acrylic-Based Finish:
         1) Smooth fine finish, matching approved mock-up.

E. Curing:
   1. Provide proper continuous moist curing for Portland Cement plaster, including periods that extend over into holidays or weekends.
   2. Do not saturate or soak – use fine fog spray.
      a. Protect each coat from irregular or excessive drying.
      b. Protect plaster from hot dry winds to eliminate "dry-outs" and see that required heat and ventilation are provided as necessary to eliminate "sweat-outs".
   3. Scratch Coat:
      a. Moist cure for at least 48 hours.
   4. Brown Coat:
      a. Moist cure for 48 hours, then allow to dry for 5 days before applying finish coat.
   5. Cure finish coat per manufacturer's instructions.

3.09 ACRYLIC MODIFIED FINISH COAT APPLICATION

A. Two Coat Application:
   1. 1/16 inch minimum acrylic finish over 1/16 inch minimum basecoat over cured brown coat.
   2. Use primer only when recommended by manufacturer.
   3. Do not apply finish when ambient temperature is less than 40 degrees F and has been above 40 degrees for at least 24 hours prior.
   4. Do not apply finish materials to Portland cement brown coats when sun is directly on wall surface and temperature is 75 degrees or more.
   5. Protect plaster surfaces from precipitation prior to, during application, and through setting/curing period of finish coat.
   6. Mix and apply trowelable aggregated acrylic finish system in strict accordance with manufacturer's printed instructions and recommendations of manufacturer's field representative.
   7. Apply continuously and in one operation to entire wall area.
      a. Maintain wet edge.
   8. Bring finish minimum distance into sealant joints so that sealant material bonds to substrate but still covers edge of finish.
   9. Apply finish so that there are no scaffold lines or other marks due to application.

B. Application:
   1. Apply finish coat following manufacturer's directions, using stainless steel trowel and textured using conventional wood or plastic float to match approved sample.
   2. Leave finished base coat surface smooth and even and allowed to air cure for not less than 24 hours.
   3. Tolerance:
      a. Install finished wall surface true, straight, and plumb to 1/8 inch in 10 feet.
   4. Allow finish to dry at least 24 hours.
      a. Protect from weather, soiling, dust, and physical contact until fully dried.

C. Curing:
   1. Cure acrylic finish coat per manufacturer's instructions.

3.10 ACRYLIC MODIFIED FINISH COAT APPLICATION AT SOFFITS

A. Comply with requirements in Article 3.05 and following:.
   1. Apply acrylic modified finish coat in accordance with requirements in Article ~~3.07~~ **3.08**.

B. Installing Trim:
   1. Install square and drip edge track according to manufacturer’s written instructions and specifications.

C. Installing Sheathing:
   1. Install sheathing per local code and manufacturer’s instructions.

D. Installing Base Coat and Mesh:
   1. Openings and Penetrations:
      a. Apply minimum 9.5 x 12-inch diagonal strips of starter mesh at corners of penetrations.
      b. Embed mesh in base coat while avoiding wrinkles.
   2. Board Joints:
      a. Apply minimum of 9.5-inch wide strips of mesh at board joints.
      b. Embed mesh in base coat while avoiding wrinkles.
   3. Substrate:
      a. Once base coat from board joints, openings, and penetrations applications has dried, apply mesh to entire field.
         1) Use double layer of mesh at inside and outside corners.
            a) Overlap minimum of 2-1/2 inches at mesh joints.
            b) Embed mesh in base coat while avoiding wrinkles.
   4. Drying:
      a. Allow base coat to fully dry minimum of 24 hours before application of primer or finish.
   5. Installing Primer:
      a. Apply AkroFlex Primer with brush, roller, or sprayer.
         1) Avoid puddling.

E. Installing Finish Coat
   1. General:
      a. Apply per approved finish product data sheet.
   2. Verification:
      a. Verify desired color and texture.

Match approved sample and mock-up prior to installation

3.11 CUTTING AND PATCHING

A. Cut, patch, point-up and repair plaster as necessary to accommodate other work and to restore cracks dents and imperfections.
   1. Repair or replace work to eliminate blisters, buckles, excessive crazing and check cracking, dry-outs, efflorescence, sweat-outs and similar defects, and where bond to substrate has failed.
   2. Comply with requirements of Section 01 7329.

B. Sand smooth troweled finishes lightly to remove trowel marks and arises.

3.12 CLEANING AND PROTECTION

A. Remove temporary protection and enclosure of other work.
   1. Promptly remove plaster from door frames, windows, and other surfaces which are not to be plastered.
   2. Repair surfaces which have been stained, marred or otherwise damaged during plastering work.
   3. When plastering work is complete, remove unused materials, containers and equipment and clean floors of plaster debris.

END OF SECTION 09 2513

SECTION 09 2900

GYPSUM BOARD

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Gypsum board systems and accessory components for gypsum board partitions, ceilings, soffits, and shaft wall assemblies ..
      a. Gypsum board attached to metal framing.
      b. Glass Mat Exterior Gypsum Sheathing Board attached to metal framing
      c. Tile Backer Board
      d. Acoustical Sealant
      e. Gypsum board finishing.

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 06 1053: Miscellaneous Carpentry; wood blocking and nailers.
   3. Section 07 2900: Building Insulation; thermal, fire-rated, and sound insulation
   4. Section 07 5416: Thermoplastic Polyolefin (TPO) Membrane Roofing; glass mat]roof coverboard.
   5. Section 07 9200: Joint Sealants; other than acoustical sealant.
   6. Section 08 3100: Access Doors and Panels; occurring in gypsum board construction.
   7. Section 09 2216: Non-Structural Metal Framing
   8. Section 09 2513: Portland Cement Plaster
   9. Section 09 9100: Painting; priming and finish painting of gypsum board.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
   1. CBC, Chapter 25 – Gypsum Board, Gypsum Panel Products, and Plaster.

B. ASTM International (ASTM):
   1. ASTM C 473 – Standard Test Methods for Physical Testing of Gypsum Panel Products.
   2. ASTM C 518 – Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
   3. ASTM C 834 – Standard Specification for Latex Sealants
   4. ASTM C 840 – Standard Specification for Application and Finishing of Gypsum Board.
   5. ASTM C 1002 – Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.
   6. ASTM C 1047 – Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
   7. ASTM C 1177 – Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing.

8. ASTM C 1280 – Standard Specification for Application of Exterior Gypsum Panel Products for Use as Sheathing
9. ASTM C 1396 – Standard Specification for Gypsum Board.
10. ASTM D 3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Enviromnental Chamber.
11. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
12. ASTM E 90 – Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
13. ASTM E 119 – Standard Test Methods for Fire Tests of Building Construction and Materials
14. ASTM E 413 - Classification for Rating Sound Insulation

C. National Fire protection Association (NFPA):
   1. NFPA or UL requirements for fire-rated assemblies per ASTM E119.

D. UL, LLC (UL):
   1. Requirements and listings for fire-rated materials and products classification.

E. Gypsum Association (GA):
   1. GA 214 – Recommended Levels of Gypsum Board Finish.
   2. GA-216 – Application and Finishing of Gypsum Panel Products.
   3. GA-253 – Application of Gypsum Sheathing
   4. GA-600 – Fire Resistance Design Manual

1.03 SYSTEM DESCRIPTION

A. Design Requirements:
   1. Provide systems capable of deflection as required by current CBC and authorities having jurisdiction.

1.04 SUBMITTALS

A. Product Data:
   1. Manufacturer's catalog data for each product proposed for use.
   2. Manufacturer’s certification of compliance with fire and sound requirements indicated or specified.

B. Shop Drawings:
   1. Details of proprietary or non-proprietary components when included.

1.05 QUALITY ASSURANCE

A. Qualifications:
   1. Installer:
      a. Minimum 5 years experience in installing and finishing gypsum board.

B. Finishes:
   1. Conform to requirements of GA 214, and as specified.

2. Levels used on Project are described as follows:

LEVELS OF GYPSUM BOARD FINISH					
Level	**Joints**	**Interior Angles**	**Accessories**	**Fasteners**	**Surface**
1	Tape set in compound	Tape set in joint compound			Tool marks and ridges acceptable
4	After taping, cover with two separate coats of joint compound	After taping, cover with one separate coat of joint compound	Covered by 3 separate coats of joint compound	Covered by 3 separate coats of joint compound	Smooth and free of tool marks and ridges *
5	After taping, cover with two separate coats of joint compound	After taping, cover with one separate coat of joint compound	Covered by 3 separate coats of joint compound	Covered by 3 separate coats of joint compound	Skim coat of joint compound applied to entire surface. Surface free from tool marks and ridges. **

* At completion of specified taping and finishing, apply one coat of high solids primer as specified in Section 09 9100.

**Or use Sheetrock Brand Primer Surfacer “Tuff-Hide” in lieu of skim coat and primer.

C. Fire Resistance Rated Assemblies:
   1. Provide UL Design Number for basic systems.

D. Sound Rated Assemblies (STC):
   1. Provide sound-rated system whose materials and construction comply with requirements of ASTM E 90 and are classified according to ASTM E 413 by qualified testing agency.

E. Preinstallation Conference: Conduct conference at Project Site.
   1. Review methods and procedures for Work related to:
      a. Gypsum Board partition assemblies.
      b. Shaft Wall System assemblies.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original, factory sealed packages, containers or bundles bearing brand name and name of manufacturer.

B. Keep materials dry.
   1. Neatly stack gypsum board flat.
   2. Avoid sagging and damage to edges, ends. and surface

C. Use means necessary to protect gypsum board systems before, during and after installation.

1.07 PROJECT CONDITIONS

A. Install gypsum panels following environmental conditions, room temperatures and ventilation specified.

1.08 REGULATORY REQUIREMENTS

A. Comply with current CBC requirements for design and installation.
   1. CBC, Chapter 25.

B. Fire-Resistance Ratings:
   1. Comply with fire-resistance ratings as shown and as required by governing authorities and codes.
   2. Provide materials, accessories and application procedures which have been listed by UL or tested according to ASTM E 119 for type of construction shown.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products of following manufacturers form basis for design and quality intended.
   1. Georgia-Pacific Gypsum LLC, Atlanta, GA
   2. National Gypsum Company, Charlotte, NC.
   3. United States Gypsum Company (USG), Chicago, IL

2.02 MATERIALS

A. Gypsum Board Panels – **Type 1**
   1. Conforming to ASTM C 1396.
   2. Width: 48 inches.
   3. Thickness: 5/8 inch.
   4. Edges: Tapered.
   5. Type X as minimum.
      a. Comply with UL Type, SCX.
   6. Location:
      a. Provide at walls, soffits
         1) As part of shaft wall assemblies.
   7. Product and Manufacturer:
      a. Sheetrock Brand Firecode X Panels by USG, or approved equal.

B. Moisture and Mold Resistant Gypsum Panels – **Type 2**:
   1. Conforming to ASTM C 1396.
   2. Width: 48 inches.
   3. Thickness: 5/8 inch.
   4. Edges: Tapered.
   5. UL Type: SCX.
   6. Fire Resistance:
      a. Class A as defined in CBC Section 803.1
      b. When tested in accordance with ASTM E 84:
         1) Flame Spread Index: 15
         2) Smoke Developed Index: 0
   7. Average Water Absorption, ASTM C 473:
      a. Not greater than 5 percent by weight after two hour immersion.

8. Location:
    a. Provide at walls and ceilings in toilet rooms and janitor storage, not indicated to receive tile.
9. Product and Manufacturer:
    a. Sheetrock Brand Mold Tough Firecode X Panels by USG, or approved equal.

C. Abuse Resistant Gypsum Panels – **Type 3**
1. Conforming to ASTM C 1396 and C 1629, Level 1.
2. Width: 48 inches.
3. Thickness: 5/8 inch.
4. Edges: Tapered.
5. UL Type: X.
6. Fire Resistance:
    a. Class A as defined in CBC Section 803.1
    b. When tested in accordance with ASTM E 84 and ASTM E 119.
        1) Flame Spread Index: 15
        2) Smoke Developed Index: 5
7. Location:
    a. Provide at walls where indicated on Drawings.
8. Product and Manufacturer:
    a. Sheetrock Brand AR Firecode X Panels by USG, or approved equal.

D. Gypsum Liner Panels – **Type 4**:
1. Conforming to ASTM C 442 and C 1396.
2. Width: 24 inches.
3. Thickness: 1 inch.
4. Edges: Beveled.
5. UL Type: SLX
    a. Stamped with UL Classification label documenting UL Classifications for fire resistance, surface burning characteristics and noncombustibility.
6. Fire Resistance:
    a. When tested in accordance with:
        1) ASTM E136:
            a) UL classified as non-combustible.
        2) ASTM E 84:
            a) Flame Spread Index: 20
            b) Smoke Developed Index: 0
7. Location:
    a. Provide as part of shaft wall assemblies at elevator and mechanical shafts.
8. Product and Manufacturer:
    a. Sheetrock Gypsum Liner Panels by USG, or approved equal.

E. Tile Backer Board – **Type 5**:
1. Cementitious Backer Units:
    a. Water-resistant, non-combustible cementitious panels reinforced with fiberglass scrim, conforming to ANSI A118.9:
    b. Durock Brand Cement Board, 5/8 inch, by USG Corporation, or approved equal.
    c. Tape joints with Durock glass fiber tape and ANSI A136.1 Type I organic adhesive, or approved equal.

2. Fasteners for Cementitious Backer Units:
    a. Metal Studs, 20 gage: 1-1/4 inch Buildex Hi-Lo Bugle Head Type S screws
    b. Metal Studs, 18 gage: 1-1/4 inch Buildex T/3 self-embedding-head screws..

F. Glass Mat Exterior Gypsum Sheathing Board – **Type 6**:
1. Conforming to ASTM C 1177 and C1658 – Section 7.
2. Width: 48 inches.
3. Thickness: 1/2 inch
4. Edges: Square.
5. UL Type: SGX
6. Fire Resistance:
    a. When tested in accordance with:
        1) ASTM E136:
            a) UL classified as non-combustible.
        2) ASTM E 84:
            a) Flame Spread Index: 0
            b) Smoke Developed Index: 0
7. Silicone Emulsion Sealant: Complying with ASTM C 834, compatible with sheathing tape and gypsum sheathing.
    a. As recommended by sheathing and tape manufacturer for use with glass-fiber sheathing tape and for covering exposed fasteners.
8. Glass-Fiber Sheathing Tape: Self-adhering glass-fiber tape.
    a. Minimum 2 inches wide, 10 by 10 or 10 by 20 threads per inch.
    b. Type as recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing board with history of successful in-service use.
9. Product and Manufacturer: Sheetrock Brand Glass-Mat Mold Tough Firecode X Panel, Dens-Glass Gold by Georgia-Pacific, or approved equal.

G. Fastenings:
1. Steel Drill Screws:
    a. Self-drilling, self-tapping bugle-head drywall screws:
        1) Conforming to ASTM C 1002:
            a) For fastening gypsum board to steel members less than 0.03 inch thick.
        2) For fastening gypsum board to wood members.
        3) Type S, 1-5/8 inches long bugle head for steel framing
            a) For single-layer panels.
            b) Use longer screws for double-layer panels as recommended by manufacturer.
    b. Conforming to ASTM C 954:
        1) For fastening gypsum board to steel members from 0.033 to 0.112 inch thick.
    c. Furnish screws with corrosion-resistant treatment.

H. Metal Trim:
1. Conforming to ASTM C 1047:
    a. Metal trim and cornerbead fabricated from minimum 26 gage steel sheet zinc coated by hot-dip process or rolled zinc.
        1) Paper-faced where required.

2. Trim Units:
    a. Shapes indicated below by reference to Figure 1 designations in ASTM C 1047 of size and type to fit gypsum board construction:
        1) Cornerbead on outside corners, unless otherwise indicated.
        2) LC-bead with both face and back flanges:
            a) Face flange formed to receive joint compound.
            b) Use LC-beads for edge trim, unless otherwise indicated.
        3) L-bead with face flange only:
            a) Face flange formed to receive joint compound.
            b) Use L-bead where indicated.
        4) U-bead with face and back flanges:
            a) Face flange formed to be left without application of joint compound.
            b) Use U-bead where indicated.
    b. Control Joint:
        1) One-piece control joint formed with V-shaped slot and removable strip covering slot opening.
    c. Crimp-on type trim is not allowed.
3. Acceptable Manufacturers:
    a. USG, Beadex, National Gypsum Company, or approved equal.

I. Resilient Furring:
1. Conforming to ASTM C 645.
    a. Minimum 25 gage.
2. Provide manufacturer's special type designed to reduce sound transmission.

J. Acoustical Sealant:
1. Provide one of following products, or approved equal:
    a. DAP Sound Block, by DAP Products, Inc., Baltimore, MD
    b. GE RCS20 Siliconized Acrylic Sealant by MomentivePerformance Materials, Waterford, NY
    c. USG Sheetrock Brand Acoustical Sealant by United States Gypsum Company, Chicago, IL

K. Finishing Materials:
1. Gypsum Board Primer and Paint:
    a. As specified in Section 09 9100.
2. Contractor’s Option:
    a. Use Sheetrock Brand Primer Surfacer, Tuff-Hide in lieu, of skim coat and high solids primer.

2.03 PERFORMANCE

A. Provide systems that are UL Listed for fire resistance.
1. Shaft Wall Systems:
    a. UL Listed for fire damper application.

B. Air Pressure Loads:
1. Design for following, unless indicated otherwise, based on Project requirements.
    a. General – Minimum 5 psf,
    b. Elevator Shafts – Minimum 7.5 psf

C. Deflection Limit:
   1. L/240, unless indicated otherwise, based on Project requirements.

D. STC Rating:
   1. Minimum STC 40

PART 3 EXECUTION

3.01 INSTALLATION

A. Metal Framing:
   1. Refer to Sections 05 5400 or 09 2216.

B. Metal Trim:
   1. Provide following:
      a. Corner beads at outside corners and angles
      b. Metal casing where gypsum board terminates at uncased openings
      c. Metal edge trim where board edges abut horizontal and vertical surfaces of other construction.
   2. Install trim in accordance with manufacturer's directions and secure to framing with joint compound.
      a. Apply trim in longest practical pieces.

C. Gypsum Board:
   1. Install gypsum board in conformance with ASTM C 840 and the manufacturer’s recommendations.
   2. Install gypsum board tight to underside of structure at sound rated partitions.
   3. Cut gypsum board by scoring and breaking or by sawing, working from face side.
      a. Where board meets projecting surfaces, scribe and neatly cut.
      b. Cope gypsum board to conform to metal deck flutes at sound rated partitions.
         1) Refer to Section 07 2100 for installation of sound attenuation insulation in deck flutes.
      c. Unless conditions require otherwise, apply board first to ceilings, then to walls.
      d. End joints to occur over support.
      e. Use panels of maximum practical length so that minimum number of end joints occur.
   4. Stagger end joints and arrange joints on opposite sides of partition to occur on different studs.
      a. Make joint layout at openings so that no end joints will align with edges of openings.
   5. Except where specified otherwise, space fasteners not less than 3/8 inch from edges and ends of gypsum board.
      a. Do not stagger fasteners at adjoining edges and ends.
   6. Install gypsum board vertically or horizontally.
      a. Attach board with drywall screws spaced not to exceed 8 inches on center around perimeter of boards and 12 inches on center on intermediate studs.
      b. Space screws at 8 inches on centers along top and bottom runners.
      c. Drive screws to provide screwhead penetration just below gypsum board surface without breaking surface layer.

d. Where electrical outlet and switch boxes are indicated, provide adjustable attachment brackets between studs.
e. Nails are not permitted.

7. Install gypsum board to heights indicated, with long dimension at right angles to steel framing members.
   a. Attach with specified drywall screws spaced 6 inch to 7 inch on centers across board.
   b. Do not install screws less than 1/2 inch from side joints and 3/8 inch from butt end joints.
   c. Install so that abutting end joints occur over framing and that end joints of boards are staggered.
8. Install access doors, furnished under separate section, in correct location, plumb or level, flush with adjacent construction, and securely attached to framing.

D. Gypsum Board Shaft Wall:
1. Position steel J-runners at floor and ceiling with short leg toward finish side of wall.
2. Securely attach runners to structural supports with powder-actuated fasteners at both ends and maximum 24 inches on center, unless otherwise indicated.
3. For wall heights less than maximum available panel height, cut gypsum liner panels no more than 1 inch less than floor-to-ceiling height and erect vertically between J-runners.
4. Cut C-H studs 3/8 inch to not more than 1/2 inch less than floor-to-ceiling height.
5. Install C-H studs between gypsum liner panels with liner securely engaged.
6. Comply eith requirements of U415 or U469, one-hour fire-resistance rating.
7. Apply one layer 5/8 inch, Type X panels to studs and runners, as indicated, with 1 inch Type S screws.
   a. Fastener Spacing:
      1) 12 inches on center for vertical panel application.
      2) 8 inches on center for horizontal panel application.
8. Free edge of uppermost and lower liner panels attached to long leg of top and bottom J-runners with 1-5/8 inch long Type S steel screws spaced no greater than 12 inches on center.
9. Cut C-H studs to maintain 1/4 inch gap at each end of wall.

E. Glass Mat Exterior Gypsum Sheathing:
1. Install sheathing in accordance with manufacturer's instructions and applicable instructions in GA-253 and ASTM C 1280.
   a. Install Dens-Glass Gold with gold side out (towards exterior).
   b. Use maximum lengths to minimize joints.
2. Attachment to Metal Framing:
   a. Attach with screws spaced 8 inches on center:
      1) At perimeter where framing supports occur
      2) Along intermediate framing in field.
   b. Drive fasteners to bear tight against and flush with surface of sheathing.
      1) Do not countersink.
   c. Locate fasteners minimum 3/8 inch from edges and ends of panels.

3.02 TOLERANCES

A. Install gypsum board flat within 1/8 inch in 10 feet.

3.03 JOINT TREATMENT AND FINISHING

A. Conform to GA 214 and following.
   1. Apply tape bedding compound, tape, and finishing cement on joints in gypsum board, interior angles, flanges of cornerbead, edge trim, control joints, penetrations, fasteners heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for for specified levels of finish.
   2. Apply joint tape over gypsum board joints, except those with trim accessories having flanges not requiring tape.
   3. Prefill open joints, rounded or beveled edges, and damaged areas using setting-type joint compound.

B. Level 1:
   1. Embed tape in joint compound.

C. Levels 4 and 5:
   1. Apply joint cement and finishing cement over screw heads.
      a. Treat inside corners with joint cement, tape, and finishing cement.
      b. Treat outside corners with corner beads and finishing cement.
   2. Provide metal casing beads at edges of gypsum board which abut ceiling, wall, or column finish, and elsewhere as required.
      a. Make exposed joints, trims and attachments non-apparent following application of paint or other finishes.
      b. Where joints and fasteners are apparent, correct defects as directed.
   3. Seal raw edges of plumbing openings and boards that have been cut to fit with brushed on sealing compound.

D. Additional Finish Requirements:
   1. When entire installation is completed and prior to installation of finish materials by other trades, correct and repair broken, dented, scratched or damaged gypsum board
   2. Level 4:
      a. Apply one coat of high solids primer over entire surface.
   3. Level 5:
      a. Apply one coat of skim coat of topping compound over entire surface, followed by one coat of high solids primer over entire surface.

3.04 REQUIRED LEVELS OF FINISH

A. Levels of finish required are as follows, unless otherwise indicated or specified:
   1. Level 1:
      a. Ceiling plenum areas above ceilings, fire-taped areas, insides of shafts, and other concealed areas, unless higher level of finish is required for fire-resistance-rated assemblies and sound-rated assemblies..
   2. Level 4:
      a. Exposed, painted gypsum board in classrooms, utility rooms, corridors and areas receiving vinyl wall covering.

3. Level 5:
    a. Exposed, painted gypsum board in restrooms and corridors where semi gloss enamel is used.

3.05 REPAIR OF DAMAGED GYPSUM BOARD

A. Upon completion of gypsum board installation, examine areas of Wotk and make necessary repairs as follows:
    1. Reset protruding or loose fasteners.
    2. For each screw in fractured area or protruding screws, replace with specified screw placed in undamaged area near loose screw.
    3. Remove loose gypsum, paper, and joint compound.
    4. Refinish to match existing texture.
        a. Paint entire wall plane.
            1) Color to match existing.

3.06 CLEANING

A. Upon completion, repair damage caused by Work and remove debris, surplus materials and tools of Work from Project Site.

B. Leave installation clean and ready for finishing.

END OF SECTION 09 2900

SECTION 09 3000

TILE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Porcelain tile.
   2. Crack isolation and waterproofing membranes for tile.
   3. Setting beds for floor and wall tile:
      a. Cured mortar bed with thinset floor tile
      b. Thinset for floor and wall tile
   4. Mock-ups

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 03 3000: Cast-In-Place Concrete.
   3. Section 07 9200: Joint Sealants
   4. Section 08 3100: Access Doors and Panels; occurring in tile walls.
   5. Section 09 2900: Gypsum Board; tile backer board
   6. Section 09 6500: Resilient Flooring

C. Releated Requirements:
   1. Access doors and panels specified in Plumbing and HVAC Sections and indicated on Drawings as occurring in tile walls are to conform to requirements of Section 08 3100 for type and finish.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
   1. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.

B. ASTM International (ASTM):
   1. ASTM A1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
   2. ASTM C 91 – Standard Specification for Masonry Cement
   3. ASTM C 144 – Standard Specification for Aggregate for Masonry Mortar
   4. ASTM C 150 – Standard Specification for Portland Cement
   5. ASTM C 206 – Standard Specification for Finishing Hydrated Lime
   6. ASTM C 207 – Standard Specification for Hydrated Lime for Masonry Purposes
   7. ASTM C645 – Standard Specification for Nonstructural Steel Framing Members
   8. ASTM D 2047 – Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
   9. ASTM D 4551 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane

C. American National Standards Institute, Inc. (ANSI):
   1. ANSI A108 – Standard Specifications for the Installation of Ceramic Tile.
   2. ANSI A118 – Standard Specifications for Ceramic Tile Installation Materials.
   3. ANSI A137.1 – Standard Specifications for Ceramic Tile.

D. Tile Council of North America (TCNA):
   1. TCNA Handbook for Ceramic, Glass, and Stone Tile Installation, latest edition.

1.03 DEFINITIONS

A. Regular Tile:
   1. Defined as tile of nominal size of 15 inches or less.

B. Large Format Tile:
   1. Defined as tile of nominal size greater than 15 inches up to 1 square meter.

1.04 SUBMITTALS

A. Product Data:
   1. Manufacturer's data, standard specifications, and other technical information for each product specified.

B. Samples:
   1. Minimum of four samples, or four sample sets for each type of tile and for each color and texture required:
      a. Not less than 12 inches square.
         1) Mounted on plywood or hardboard backing and grouted as required.
      b. Provide minimum of four board-mounted tiles for sizes 4-1/4 inches and larger.
   2. Full size samples for each type of trim, accessory and for each color.
   3. Minimum of four 6 inch long sample of stone thresholds.
   4. Samples of metal edge strips.

C. Installation Instructions:
   1. Manufacturer's preparation and installation instructions.

D. Certificates:
   1. Manufacturer's certification that grout materials being provided are suitable for intended use, meet or exceed referenced standards.
   2. DCOF AcuTest friction test reports for floor tile.

E. Reference Methods:
   1. Copies of TCNA and ANSI Methods and Standards.

1.05 QUALITY ASSURANCE

A. Laboratory Testing:
   1. Test tile for compliance with ASTM C 2047 by testing laboratory approved by [DSA] [Owner].

B. Qualifications of Tile Manufacturer:
   1. Company specializing in types of tile specified.
      a. Including trim units, and thresholds when required, with five years minimum experience.

b. Obtain tile and trim components from single source for each type and color of tile with resources to provide products of consistent quality in appearance and physical properties.

C. Qualification of Installation System Manufacturer:
1. Company specializing manufacturing of installation systems and materials:
a. Including mortars, grouts, and adhesives
b. With ten years minimum experience.
2. Obtain grout and setting materials from single source manufacturer to ensure consistent quality and compatibility.

D. Qualifications of Installer:
1. Company specializing in installation of types of tile and installation systems specified.
a. Including trim units, and thresholds when required, with five years minimum experience with installations of similar scope, materials, and design.

E. Pre-Installation Meetings:
1. Following approval of submittals and prior to start of Work and setting of tile:
a. Schedule on-site meeting with Contractor, Owner, Architect, Project Inspector, and representatives of material manufacturer and tile installer:
1) Review following for conformance with specified requirements:
a) Conditions and Drawings for each substrate.
b) Tile, tile installation materials, and finishing equipment.
c) Mock-ups

F. Mock-Ups:
1. Construct mock-ups of tile installations when requested by Architect.
a. Provide one mock-up for each type, class, and color of tile specified.
b. Each mock-up to include:
1) Type of installation required.
2) Tile pattern, including special patterns and accent tiles.
3) Joint alignment between floor and wall tile and base.
c. Locate in area on Project Site approved by Architect,
2. Make mock-up approximately 4 by 4 feet.
3. Blend tiles to achieve smooth transition within range approved in advance by Architect.
4. Accepted mock-ups in undisturbed condition at time of completion may be used as part of Work, and may be included in finished work, when so directed by Architect.
5. Revise as necessary to secure Architect's acceptance.
6. Mock-ups, when accepted by Architect, will be used as basis for comparison with remainder of tile work for purposes of acceptance or rejection.
7. When mock-up panels are not permitted to be part of finished Work, completely demolish and remove them from Project Site upon completion and acceptance of tile Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged tile materials in original in manufacturer's sealed containers, with seals unbroken and manufacturer's labels intact until time of use.

1. Prevent damage or contamination to materials by water, foreign matter or other causes.

B. Keep materials clean and dry.

1.07 PROJECT CONDITIONS

A. Maintain environmental conditions and protect Work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

B. Maintain temperatures at not less than 50 degrees F in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard, or manufacturer's instructions.

C. Shade Work area from direct sunlight during installation as needed to prevent rapid evaporation caused by excessive heat.

D. Observe manufacturer's recommended safety precautions, including those pertaining to ventilation.

E. Illuminate Work area during installation, providing same level and angle of illumination as will be available for final inspection.

F. Protection:
1. Protect adjacent surfaces during progress of Work of this Section.
2. Close rooms and spaces to traffic until mortar and grout have set for minimum of 72 hours.

1.08 REGULATORY REQUIREMENTS

A. Comply with requirements of current California Building Code and Chapter 11B

B. Comply with applicable parts of following codes or standards as minimum requirement:
1. ANSI A108.
2. ANSI A118.
3. ANSI A137.1, Section 9.6 – DCOF AcuTest.

1.09 EXTRA MATERIAL

A. Provide minimum of 5 percent of each type and color of tile and accessory shapes, from same run or lot as installed tile.
1. Furnish full size units matching units installed, packaged with protective covering for storage, in manufacturers’ cartons identified with appropriate labels.

1.10 WARRANTY

A. Manufacturer’s Warranty:
1. For tile products and installation materials.
a. Provide 5 year material warranty.

B. Installer’s Warranty:
1. Provide 5 year labor warranty on tile installation.

C. Manufacturer's Warranty:
   1. For Crack Isolation and Waterproofing Membranes:
      a. Provide 10 year material warranty for crack isolation and waterproofing membrane installation.
         1) Includes tile setting and grouting materials.

PART 2 PRODUCTS

2.01 PRODUCTS – GENERAL

A. Comply with ANSI A137.1 for types, compositions, and grades of tile indicated.
   1. Furnish tile complying with "Standard Grade" requirements unless otherwise indicated.

B. Comply with ANSI standard referenced with products and materials indicated for setting and grouting

C. Dynamic Coefficient of Friction (DCOF): Provide floor tiles with coefficient of friction equal to or greater than 0.42 when tested in accordance with provisions of ANSI A137.1, Section 9.6 – DCOF AcuTest.

D. Condition of Surfaces to Receive Tile:
   1. Verify that surfaces to receive mortar setting bed and tile are firm, dry, clean, and free from oily or waxy films and curing compounds.

2.02 TILE PRODUCTS

A. Porcelain Floor Tile: **PT-1**
   1. Porcelain Floor Tile – Field
   2. Face Size: Nominal 12 inches by 12 inches
   3. Nominal Thickness: 5/16 inch
   4. Surface/Texture: Matte
   5. Collection: Color Story Floor
   6. Color: Storm Gray 0017
   7. Manufacturer: American Olean.
   8. Stacked Bond Pattern .

B. Porcelain Floor Tile: **PT-2**
   1. Glazed Porcelain Wall Tile – Field
   2. Face Size: Nominal 12 inches by 24 inches
   3. Nominal Thickness: 5/16 inch
   4. Surface/Texture: Polished
   5. Collection: Style II
   6. Color: Pure White.
   7. Manufacturer: Emser Tile
   8. Stacked Bond Pattern.

C. Porcelain Wall Tile – Accent: **PT-3**
   1. Bullnose Trim for Tile TT-1: Daltile S-43F9
   2. Face Size: Nominal 4 inches by 12 inches.
   3. Surface/Texture: Glossy
   4. Collection Color Story Wall
   5. Color: Grace 0068

6. Manufacturer: American Olean.
7. Stacked Bond Pattern ..

D. Porcelain Tile Coved Base: **PT-4**
1. Base for Floor Tile PT-1
2. Face Size: Nominal 6 inches by 12 inches.
3. Nominal Thickness: 5/16 inch
4. Surface/Texture: Matte
5. Collection: Color Story Floor
6. Color: Storm Gray 0017
7. Manufacturer: American Olean

E. Marble Threshold: **MT-1**
1. Double Bevel Threshold
2. Size: Nominal 4 inches wide by 36 inches long.
3. Nominal Thickness: 3/8 inch
4. Surface/Texture: Polished
5. Style: Natural Stone
6. Color: Carrara White M701.
7. Manufacturer: American Olean.

2.03 INSTALLATION MATERIALS

A. Mortar Sand:
1. Conforming to ASTM C 144.

B. Cement:
1. Portland Cement:
   a. Conforming to ASTM C 150, Type I.
2. Masonry Cement:
   a. Conforming to ASTM C 91, Type S or M.

C. Hydrated Lime:
1. Conforming to:
   a. ASTM C 206, Type S
   b. ASTM C 207, Type S

D. Water:
1. Clean and potable.

E. Welded Wire Fabric Reinforcing:
1. For installation in cured mortar bed.
2. Welded Wire conforming to ASTM A 1064.
   a. Two x Two inch mesh, 16/16

F. Waterproof Membrane:
1. Cold-applied laminated CPE composite sheet membrane waterproofing for thin-set tile setting application of latex-modified mortar and grout.
2. Products and Manufacturer:
   a. NobleSeal TS Membrane Waterproofing System by Nobel Company, or approved equal.
      1) Zero VOC
3. Liquid applied membranes are not acceptable.

G. Crack Isolation Membrane:
1. Sheet membrane product specifically manufactured for use in thin-set tile installations at slab-on-grade conditions as crack isolation sheet to prevent cracks in concrete slab from telegraphing through to tile.
2. Products and Manufacturer:
a. NobleSeal® TS or CIS Membrane by Noble Company, or approved equal.
1) Zero VOC
3. Liquid applied membranes are not acceptable.

2.04 MORTAR

A. Polymer-Modified Portland Cement Mortar:
1. Polymer -Modified Portland Cement Dry-Set Mortar:
a. Conforming to ANSI A 118.4.
1) Gauged with Acrylic Mortar Admix
b. Conforming to ANSI A 118.15:
1) Gauged with improved modified Acrylic Mortar Admix for large format tiles.

2.05 GROUT

A. Manufacturers:
1. Basis-of-Design:
a. Design for grout materials is based on products as manufactured by Mapei North America, Deerfield Beach, FL.

B. Wall Grout:
1. Polymer-Modified Portland Cement Grout:
a. Approved standard factory mixed and packaged Portland cement tile grout material containing waterproofing and curing admixtures.
1) Conforming to ANSI A118.7
b. For use as wall grout, unless noted otherwise.

C. Floor Grout:
1. Chemical-resistant, water-cleanable, grouting epoxy:
a. Conforming to ANSI A118.3
2. Provide product capable of withstanding continuous and intermittent exposure to temperatures up to 140 degrees F and 212 degrees F, respectively.
a. Certified by grout manufacturer for intended use.

D. Grout Joints:
1. Unsanded grout on joints less than than 1/8 inch.
2. Sanded grout on joints 1/8 inch or greater.

E. Grout Colors:
1. As selected/scheduled by Architect.

2.06 MISCELLANEOUS MATERIALS

A. Separation Material:
1. For expansion joints indicated to receive sealant.
a. Including perimeters and floor mortar beds.

2. Quality Foam, QF 200 White:
    a. Size: 3/8 inch wide x 5 inches high.

B. Sealant and Backer Rod:
1. Comply with specified requirements in Section 07 9200
2. Provide sealant and primer from one manufacturer, acceptable to tile and grout manufacturers.
3. Provide backer rod as specified for compatibility with sealants.

C. Accessory Materials:
1. Premolded accessories for crack isolation and waterproofing membranes.
    a. Including, but not necessarily limited to premolded corners.

D. Cleaner and Sealer:
1. General:
    a. Provide materials from one manufacturer, acceptable to tile and grout manufacturers.
    b. Basis-of-Design:
    c. Provide cleaner and sealer products manufactured by one following manufacturers:
        1) Aqua Mix Inc., Torrington, CT
        2) Custom Building Products, Huntington Beach, CA
        3) Miracle Sealants Company, div. of Rust-Oleum Corporation, Vernon Hills, IL
        4) Approved equal may be provided, subject to compatibility with specified tile and grout materials..
2. Cleaner:
    a. Neutral Phosphate-Free Cleaner:
        1) Concentrated Tile Cleaner by Aqua Mix Inc.
        2) Tile Lab Concentrated Tile/Stone Cleaner by Custom Building Products.
        3) Tile & Stone Cleaner by Miracle Sealants Company.
3. Sealer:
    a. Fungus and Bacteria Resistant, Stain and Slip-Resistant as specified for Tile:
        1) Penetrating Sealer by Aqua Mix.
        2) Tile Lab Surface Gard by by Custom Building Products
        3) 511 Impregnator by by Miracle Sealants Company

2.07 SOURCE QUALITY CONTROL

A. Source of Materials:
1. Obtain materials from single source with resources to provide products of consistent quality in appearance and physical properties.

PART 3 EXECUTION

3.01 EXAMINATION AND PREPARATION

A. Examine substrates, areas, and conditions under which Work will be performed for compliance with specified requirements for installation tolerances and other conditions affecting performance of installed tile.

1. Coordinate with other trades as needed to ensure that proper substrata are provided to receive work
2. Verify that vents, drains, piping, and other projections through substrate have been installed.
3. Correct conditions detrimental to timely and proper completion of Work.
4. Do not proceed until unsatisfactory conditions are corrected.

B. Verify that substrates for setting tile are firm; dry, clean and within flatness tolerances required by relevant ANSI A108 tile installation standards and following:
   1. Where Portland cement mortar setting bed will be installed, do not commence installation of setting bed until substrata are within following tolerances:
      a. Horizontal Surfaces:
         1) Level within 1/4 inch in 10 feet in any direction.
      b. Vertical Surfaces:
         1) Plumb within 1/4 inch in 8 feet in any direction.
   2. Where tile units will be thin-set directly to substrata, do not commence installation of tile units until substrata are within following tolerances:
      a. Horizontal Surfaces:
         1) Level within 1/8 inch in 10 feet in any direction, except for slope to floor drains.
      b. Vertical Surfaces:
         1) Plumb within 1/8 inch in 8 feet in any direction.

C. Surface Preparation:
   1. Condition of Surfaces to Receive Tile:
      a. Concrete Floors:
         1) Allow concrete floors to cure for 28 days minimum before beginning tile and grout installation.
         2) Verify that surfaces to receive mortar setting bed and tile are firm, dry, clean, and free from oily or waxy films and curing compounds.
         3) Remove laitance, sand, dust, and loose particles with air blast.
         4) Where coatings, such as curing compounds and other substances containing soap, wax, oil, or silicone remain and are incompatible with tile-setting materials, remove them using terrazzo or concrete grinder, drum sander, polishing machine equipped with heavy-duty wire brush, or shot-blast system.
      b. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical items of Work, and similar items located in or behind tile have been completed before installing tile.

3.02 SUBSTRATA AND SETTING BEDS

A. Floors:
   1. Install polymer-modified Portland cement mortar setting bed over cured concrete slab.
      a. Do not abut against vertical surfaces.
         1) Install foam separation material at perimeters and expansion joint locations for sealant joints.
   2. Mix setting mortar in accordance with ANSI A.108.1a.2.2.
   3. Once begun, continue mortar installation until room is completely filled.
      a. Discard batch not floated and finished within 1/2 hour of mixing.
      b. Firmly compact before screeding.
      c. Screed to true plane and pitch as indicated.

d. Slope mortar bed sufficiently that water flows to drain and no puddling will occur.
e. Slope mortar down to floor drains for proper installation of waterproof or crack isolation membrane.
f. After screeding, firmly rub down with steel or wood float.

4. Cure mortar bed with light fog spray of water and cover with 6 mil polyethylene for 72 hours.

B. Crack Isolation and Waterproof Membranes:
1. Crack Isolation Membrane:
a. Install crack isolation membrane over cured mortar bed in accordance with TCNA Method F122 at Ground Level (slab-on-grade) rooms scheduled to have tile.
1) Use of liquid products is not permitted.
2. Waterproof Membrane:
a. Install waterproof membrane over concrete slab in accordance with TCNA Method F122 at upper floor rooms scheduled to have tile.
1) Use of liquid products is not permitted.

C. Walls:
1. Substrate for Wall Tile and Base:
a. Cementitious tile backer board, as specified in Section 09 2900
2. Installing cementitious backer units on walls:
a. Pre-cut units to size, and make necessary cutouts.
b. Fasten units at 8 inches on center where joints occur over stud, using manufacturer's approved fasteners and washers.
1) Use fastener combined with countersunk washer to secure two abutting units.
3. Where two units abut, leave gap from 1/8 inch to 3/16 inch wide.
a. Fill solid with mortar, and cover with fiberglass tape embedded in skim coat of mortar.

D. Verify that joints in tile substrates are coordinated with sealed tile joint locations
1. Where not coordinated, adjust as required by Architect.

E. Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained to comply with referenced standards and manufacturer's written instructions.

F. Protect adjacent surfaces during progress of the Work.

3.03 TILE INSTALLATION – GENERAL

A. General:
1. Conform to manufacturers printed instructions, and applicable requirements of ANSI and TCNA Standards.
2. Install tile by pressing and beating tile into place to obtain 100 percent coverage by mortar on back of each tile.
a. Back-butter tiles if necessary to achieve 100 percent coverage.
3. Maintain minimum temperature limits and installation practices recommended by setting materials manufacturers.
4. Minimum Coverage of Bond Mortar: 80 percent.
a. 95 percent in shower areas or exterior installations

B. Limits of Tile:
   1. Extend tile into recesses and under equipment and fixtures to achieve complete covering without interruptions, unless otherwise indicated.
   2. Terminate tile neatly at obstructions, edges, and corners, without disruption of pattern or joint alignment.

C. Joining Pattern:
   1. Install tile in grid pattern, unless otherwise indicated.
   2. Layout tile work, and center tile fields both directions in each space or on each wall area.
      a. Adjust to minimize tile cutting.
   3. Provide uniform joint widths in accordance with manufacturers recommendations, unless indicated otherwise.

D. Joint Alignment:
   1. Align joints when adjoining tiles on floor, base, trim, and walls are same size.
   2. Adjust joints widths as necessary for different size tiles to maintain patterns from floors to base to walls.
   3. Nominal joint width is 1/8 inch, but they may be adjusted plus or minus as necessary.
      a. Do not attempt to make same joint width work consistently for every surface.
   4. If joint widths on walls need to be less than that for floor tile to maintain alignment with floor tile pattern, then reduce joints as necessary.
   5. Joints widths are to be uniform within each surface.
      a. Floor and wall plane are to have consistent joint widths.
         1) Widths will be permitted to vary from floor to base and wall to make them align.
         2) Use 1/16 inch, 1/8 inch, 3/16 inch or 1/4 inch joint spacers where necessary.

E. Tile Mounted in Sheets:
   1. Install joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished Work.

F. Accurately form intersections and returns.
   1. Perform cutting and drilling of tile without marring visible surfaces.
   2. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints.
   3. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.

G. Allowable Variations in Finished Work:
   1. Do not exceed following deviations from level and plumb, and from elevations, locations, slopes, and alignments shown:
      a. Horizontal surfaces: 1/8 inch in 10 feet in any direction.
      b. Vertical surfaces: 1/8 inch in 8 feet in any direction.

3.04 TILE INSTALLATION – FLOOR

A. Install tile over properly cured setting bed and crack isolation or waterproof membrane utilizing thin-set method with polymer-modified Portland cement bond mortar, in accordance with manufacturer's printed instructions and ANSI A108.5.
   1. Confirm substrate is completely clean and free of dust.
   2. Cut foam at floor perimeters flush with top of mortar bed.
   3. Ensure that bond coats do not intrude into joints to receive sealant.

B. Placement Method:
   1. Place tile into fresh mortar and move and press or beat in tile to ensure full contact.
   2. Before setting proceeds, set and remove three tiles or sheets of tiles to confirm specified coverage of bond mortar.
   3. When coverage is insufficient, utilize larger toothed trowel or back butter tiles until proper coverage is provided.

3.05 TILE INSTALLATION – WALLS

A. Install wall tile over properly installed tile backer board, utilizing thin-set method with polymer-modified Portland cement bond mortar, in accordance with manufacturer's printed instructions and ANSI A108.5.
   1. Confirm substrate is completely clean and free of dust.
   2. Ensure that bond coats do not intrude into joints to receive sealant.

B. Lay out tile wainscots, where occurring, to next full tile beyond dimensions indicated.

C. Spot tile backer board substrate with mortared tile, set plumb and true, to accurately indicate plane of finished tile surfaces.

D. Set tile with horizontal joints level and vertical joints plumb, with surfaces true and plumb, and edges of tiles flush.

E. Rub exposed cuts smooth with fine stone.
   1. Do not set cut edge against fixture or adjoining surface without 1/16 inch sealant joint.

3.06 ACCESS DOOR AND PANEL INSTALLATION

A. Install access doors and panels, furnished under other sections, where required, in correct location, plumb or level, flush with adjacent construction, and securely fastened to framing.

3.07 EXPANSION / CONTROL JOINTS

A. Comply with TCNA Handbook, Method EJ171.
   1. Locate expansion, control, contraction, or isolation joints where indicated on Drawings, and as follows:
      a. Interior: 20 feet to 25 feet in each direction
      b. Exterior: 8 feet to 12 feet in each direction
      c. Interior tilework exposed to direct sunlight or moisture:
         1) 8 feet to 12 feet in each direction.

B. Other Sealant Filled Joints:
   1. Directly above joints in concrete substrates where tile abuts restraining surfaces such as perimeter walls, dissimilar floors, curbs, columns, pipes, ceilings, and where changes occur in backing materials.
   2. At horizontal and vertical changes in plane.
   3. At perimeter walls in rooms and spaces larger than 12 feet on one side.
   4. As continuation of expansion joints, control joints, cold joints, and seismic joints in building structure which occur in tiled areas, making such joints in tile work not less in width than joint which is being continued.
   5. Where indicated during installation of mortar beds.
   6. Do not saw-cut joints after installing tiles.

C. Extend openings for joints completely through tile, mortar, mortar bed, and reinforcing.
   1. Make openings for joints same width as tile joints.
   2. Keep joints open and free from mortar and grout until filled with sealant.
   3. Apply joint primer in wet areas, and apply elsewhere as recommended by sealant manufacturer.
   4. Make joint edges free from dirt, oils, wax, and other contaminants.

3.08 GROUTING

A. General:
   1. Do not begin grouting floor tiles until they are firmly set and, in no case, in less than 48 hours after they have been installed.
   2. Remove spacers, ropes, glue, and similar foreign matter prior to grouting.
   3. When using proprietary grout, adhere strictly to manufacturer's directions unless otherwise specified or acceptable in advance by Architect.
   4. Prior to start of grouting, ensure that wall and floor tile surfaces are clean and excessive bond mortar is scraped and vacuumed from joints.
      a. Approximately 2/3 depth of tile should be open for grouting.

B. Installation – General:
   1. Follow manufacturer’s instructions and following for mixing grout:
      a. Mix grout by hand or with slow-speed drill motor not exceeding 300 rpm, achieving stiff non-slumping consistency, and using minimum amount of liquid to achieve workable mix.
   2. Once grout Work commences, proceed until complete wall or floor area is finished utilizing one batch of grout.

C. Polymer-modified Portland Cement Grouting:
   1. Dampen tile surface and joints with water using sponge, but leaving no puddles in joints.
   2. Force maximum amount of approved grout into joints in accordance with pertinent recommendations contained in ANSI A 108.10
      a. Use sufficient pressure on rubber float so as to fill joints completely.
         1) Fill joints of cushion-edge tile to depth of cushion.
         2) Fill joints of square-edge tile flush with surface.
      b. Scrape excess grout off tile surface with rubber float.
      c. Smooth or tool grout to uniform joint finish.
      d. Do not over water.
   3. Fill gaps and skips.
      a. Do not permit mortar or mounting mesh to show through grouted joints.

b. Provide hard finished grout which is uniform in color, smooth, and without voids, pin holes, or low spots.
c. Leave tile clean.

3.09 CURING OF TILE INSTALLATION AND GROUT

A. Damp cure tile installations, including polymer-modified Portland cement grouts, for 72 hours minimum.
1. Remove final grout haze with clean soft cloth.
2. Cover with 40 lb. kraft paper.
3. Leave paper in place for protection.
4. Do not use polyethylene sheets directly over tile on horizontal surfaces.

3.10 SEALANT INSTALLATION

A. Prepare and clean joints to receive sealant to ensure joints are free and clear of setting and grouting materials and construction debris.

B. Install sealants in accordance with requirements of Section 07 9200.

C. Seal between tile and penetration and restraining surfaces with sealant matching color of grout/joint filler.

3.11 CLEANING AND SEALING OF TILE AND GROUT

A. After completion of tile installation and curing, thoroughly clean tile using neutral cleaner acceptable to manufacturers of tile and grout, complying with manufacturer's instructions.
1. Do not use acid or acid cleaners to clean tile.

B. Apply specified sealer in accordance with manufacturer's instructions.
1. Avoid overlapping, puddling, and rundown.
2. Completely wipe surface dry within 3 to 5 minutes using cotton or paper towels.
3. Do not allow sealer to dry on tile.
4. After 2 hours, test surface by applying water droplets to surface.
a. When water is absorbed, apply second coat.
5. Avoid surface traffic for 24 hours.

3.12 REPLACEMENT

A. Remove and replace cracked, chipped, broken, and otherwise defective tiles with proper material.
1. Replace grout as neccessary due to replacement of tile.
2. Match existing color without evidence of replacement.

B. Remove Work not complying with requirements of Contract Documents or referenced standards, and promptly replace with Work which does comply.

3.13 CLEANING

A. Remove and legally dispose of rubbish, debris, and waste material off Project Site.
1. Comply with requirements of Sections 01 7419 and 01 7423.

3.14 PROTECTION

A. Do not permit foot traffic on installed tile until mortar and grout has set for minimum of 72 hours.

B. Do not permit foot traffic on installed sealant for minimum of 48 hours or protect with hardboard strips.

C. Protect Work until Substantial Completion.

END OF SECTION 09 3000

SECTION 09 5100

ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Lay-in acoustical ceiling systems:
      a. Consisting of following materials:
         1) Wet-formed mineral fiber
         2) Related suspension systems
   2. Metal suspension systems for gypsum board ceilings.

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 06 1053: Miscellaneous Carpentry.
   3. Section 09 2216: Non-Structural Metal Framing
   4. Section 09 2900: Gypsum Board; gypsum board ceilings.

C. Related Requirements:
   1. Refer to respective Sections of Divisions 23 and 26 for related ceiling work, air distribution devices, and lighting fixtures.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
   1. Chapter 8 – Interior Finishes.
      a. Section 808 – Acoustical Ceiling Systems.

B. ASTM International (ASTM):
   1. ASTM A 641 – Standard Specification for Zinc–Coated (Galvanized) Carbon Steel Wire.
   2. ASTM C 423 – Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method.
   3. ASTM C 635 – Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings
   4. ASTM C 636 – Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
   5. ASTM D 3273 – Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
   6. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
   7. ASTM D 1779 – Standard Specification for Adhesive for Acoustical Materials
   8. ASTM E 1264 – Standard Classification for Acoustical Ceiling Products.
   9. ASTM E 1414 – Standard Test Method for Airborne Sound Attenuation Between Rooms Sharing a Common Ceiling Plenum
   10. ASTM E 1477 – Standard Test Method for Luminous Reflectance Factor of Acoustical Materials by Use of Integrating-Sphere Reflectometers

C. UL, LLC (UL):
   1. UL 723 – Standard Test for Surface Burning Characteristics of Building Materials.

D. The Ceilings & Interior Systems Construction Association (CISCA):
   1. Ceiling Systems Handbook.
   2. Acoustical Ceilings Use & Practice.

E. South Coast Air Quality Management District (SCAQMD):
   1. Rule 1168 – Adhesive and Sealant Applications

F. DSA Interpretations of Regulations (IR):
   1. IR 25-2 – Suspended Lay-In Panel Ceiling: 2022 CBC (Revised 11-03-23)

G. California Department of Public Health (CDPH):
   1. Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.2

1.03 SUBMITTALS

A. Product Data:
   1. Lay-in Ceiling Panels and Ceiling Tiles:
      a. Printed Product Data Sheets for each type of ceiling tile/panels.
   2. Suspension System for Lay-in Ceiling:
      a. Printed data for suspension system components, including load tests.

B. Shop Drawings:
   1. Complete plan layouts and installation details.
      a. Indicate related Work of other sections that is installed in, attached to, or penetrates ceiling areas, such as air distribution and electrical devices.

C. Samples:
   1. Each type of exposed finish required, prepared on samples of sizes indicated.
   2. Where finishes involve normal color and texture variations, include sample sets showing full range of variations expected.
   3. Lay-in Panels:
      a. Minimum of four 6 inch square samples of each acoustical panel type, pattern and color.
      b. Furnish full size samples of each acoustical tile/panel type upon Architect's request.
   2. Lay-in Systems:
      a. Suspension Assembly System
         1) Minimum of four sets of 12 inch long samples of exposed runners and moldings for each color and system type required.
         2) Include typical members, connections, splices, wall angle, and colors.

D. Maintenance Materials:
   1. Provide extra tiles/panels equal to 1 percent of area of each typical module size of acoustical panel, but not less than 8 of each size, style and color.

1.04 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Experienced installer with minimum 5 years experience in installing acoustical ceiling systems similar in material, design, and to extent indicated for this Project, with record of successful in-service performance.

B. Design Criteria:
   1. Deflection of Finished Surface:
      a. 1/360 of span or less.
   2. Maximum Permissible Variation:
      a. 1/8 inch from true plane measured from 10 foot straightedge placed on surface of finished acoustical fiber units.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project site in original sealed packages.

B. Storage:
   1. Store materials in building area where they will be installed, in original package.
   2. Keep clean and free from damage due to water or deteriorating elements.

C. Handle in manner to prevent damage during storage and installation.

1.06 PROJECT CONDITIONS

A. Environmental Requirements:
   1. Maintain temperature in space at 55 degrees F or above for 24 hours before, during, and after installation of materials.

B. Scheduling:
   1. Before concealing Work of other sections, verify required tests and inspections have been completed.
   2. Coordinate with related Work of other sections.
      a. Coordinate location and symmetrical placement of air distribution devices, electrical devices, and penetrations with related Work section.

1.07 REGULATORY REQUIREMENTS

A. Comply with requirements of CBC, Chapter 8, Section 808, current edition.

B. Comply with UL 723

1.08 WARRANTIES

A. Manufacturer’s Warranty:
   1. Provide manufacturer’s 10 year material warranty.

B. Installer’s Warranty:
   1. Provide installer’s 2 year labor warranty.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design:
   1. Design of acoustical ceiling systems are based upon products as manufactured by Armstrong Ceiling and Wall Solutions, div. of Armstrong World Industries, Lancaster, PA.
   2. Alternate Acceptable Manufacturers:
      a. USG Interiors, LLC, div. USG Corporation, Chicago, IL

B. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:
   1. Submit items listed in Article 1.03 and as specified in Section 01 3300, for evaluation of proposed system.
   2. Complete project shop drawings for similar project may be submitted for evaluation purposes, however shop drawings specific to this Project will be required from successful bidder.
   3. Manufacturer's 10 year material warranty.

2.02 MATERIALS – GENERAL

A. Provide ceiling systems consisting of acoustical ceiling tile/panels and suspension systems manufactured by same company.

2.03 ACOUSTIC CEILING PANEL TYPE 1 (ACP-1)

A. Acoustical Ceiling Panel:
   1. Conforming to ASTM E 1264, Type III, Form 2, Pattern C E:
      a. Size: 24 by 48 inches by 3/4 inch thick.
      b. Fire Resistance: UL Class A when tested per ASTM E 84.
         1) Flame Spread Index: 25 or less.
         2) Smoke Developed Index: 50 or less.
      c. NRC: 0.70
      d. CAC: 40
      e. Light Reflectance: 0.82
      f. Color: White.
      g. Edge: Square
      h. Mold and Mildew Resistance:
         1) Surface and back of panel treated with BioBlock paint coating containing biocide additive to inherently inhibit or retard mold and mildew.
      i. Humidity/Sag Resistance: Humigard Plus coating.
   2. Product and Manufacturer:
      a. School Zone Fine Fissured, Item 1714, by Armstrong World Industries, or approved equal by USG Interiors, Inc., Ceilings Division.

B. Suspension System for ACP-1:
   1. Exposed Direct Hung:
      a. Main runner and cross tee, conforming to Heavy Duty Classification of ASTM C 635, of cold rolled steel double-web construction, 15/16 inch face, with white factory applied paint finish.

2. Product and Manufacturer:
   a. Prelude XL, by Armstrong World Industries, or approved equal by USG Interiors, Inc., Ceilings Division.
   b.

2.04 ACCESSORIES

A. Hanger Wire:
   1. Galvanized carbon steel per ASTM A 641, soft tempered, prestretched.
      a. Yield-stress load of at least 3 times design load, but not less than 12 gage
      b. Minimum 9 gage for pendant fixtures.

B. Edge Moldings:
   1. Manufacturer's standard channel molding for edges and penetrations of ceiling, with single flange of molding exposed.
   2. Finish: Baked enamel.
      a. Color to match main runner.

C. Brace Attachment Clip:
   1. Manufacturers' standards to fit system furnished for acoustical tiles/panels, as indicated.

D. Vertical Compression Strut:
   1. Provide types and designs complying with requirements of authorities having jurisdiction and seismic requirements.
   2. USG Donn Compression Post, or approved equal, or as indicated.

2.05 MATERIALS FOR DRYWALL SUSPENSION SYSTEM

A. Drywall Suspension System:
   1. Commercial quality, cold-rolled steel, hot dipped galvanized finish.
      a. Main Tees:
         1) Fire-Rated Heavy Duty classification.
         2) Size:
            a) Nominal 1-5/8 inches high x 12 feet long.
         3) Integral reversible splice with knurled face.
         4) USG DGLW26 or approved equal by Armstrong World Industries, subject to acceptance by Architect.
            a) Face: 1-1/2 inches.
            b) Height: Nominal 1-5/8 inches.
      b. Cross Tees:
         1) Fire-Rated members with knurled face.
         2) Size:
            a) 1-1/2 inches high x 4 feet long, with 1-1/2 inches wide face
         3) Quick release cross tee ends for positive locking and removability without tools
         4) USG DGLW-424 or approved equal by Armstrong World Industries, subject to acceptance by Architect.
      c. Wall Moldings:
         1) Single web with knurled face.
         2) Size:
            a) Face: 1 inch
            b) Height: 1-1/2 inches

c) Length: 12 feet

3) USG DGWM24 or approved equal by Armstrong World Industries, subject to acceptance by Architect.

B. Board Materials:

1. Gypsum board and accessories conforming to requirements specified in Section 09 2900.
   a. Includes fasteners and finishing of gypsum board.

2.06 SOURCE QUALITY CONTROL

A. Single-Source Responsibility for Ceiling Units and Suspension Systems:
1. Obtain each type of acoustical ceiling tile/panel and suspension system from single source with resources to provide products of consistent quality in appearance and physical properties without delaying Work.

2.07 FIRE PERFORMANCE

A. Fire Performance Characteristics:
1. Provide acoustical ceiling components that are identical to those tested for specified fire performance characteristics, according to ASTM test method indicated, by UL, or other testing and inspecting agency acceptable to authorities having jurisdiction.
   a. Identify acoustical ceiling components with appropriate marking of applicable testing and inspecting agency.

B. Fire Test Response Characteristics:
1. Provide acoustical panel ceilings that comply with following requirements:
   a. Surface-burning characteristics of acoustical tiles/panels complying with ASTM E 1264 for Class A materials as determined by testing identical products in accordance with ASTM E 84.

2.08 PERFORMANCE REQUIREMENTS FOR GYPSUM BOARD SUSPENSION SYSTEM

A. Fabricate and install systems as indicated, but not less than that required to comply with ASTM C 754 under the following conditions:
1. Drywall suspension system consisting of:
   a. Straight main tees and straight furring cross tees, joined together to support screw attached interior gypsum panels and independently supported light fixtures, where applicable.
2. Maximum deflection of L/360 of distance between supports.
3. Design and construct nonstructural components that are permanently attached to structures and their support attachments, to resist effects of earthquake motions in accordance with CBC seismic requirements.

PART 3 EXECUTION

3.01 PREPARATION

a. Furnish layouts for inserts, clips or other supports and struts required to be installed by the Work of other trades that depend upon support by suspended ceiling system.

A. Coordinate related Work to ensure completion prior to installation of clips or fasteners.

B. Lay-In Ceiling Systems:
   1. Compare layouts with construction conditions.
   2. Space tile/panels symmetrically about centerlines of room or space
      a. Start with tile/panel or joint line as required to avoid narrow tiles at finish edges unless indicated otherwise.
      b. Make joints tight with joint lines straight and aligned with walls.
      c. Provide ceiling moldings where tile abuts wall with matching caulking to close space between molding and wall.

3.02 INSTALLATION OF SUSPENSION SYSTEMS

A. General:
   1. Provide complete system with joints neatly and tightly joined and securely fastened.
      a. Install suspension members so they are square, in true, flat, level plane and securely interlocked with one another.
      b. Remove and replace dented, bent, or kinked members.
   2. Suspend ceiling hangers from building's structural members and as follows:
      a. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
   3. Wire:
      a. Minimum 12 gage, unless otherwise indicated.
   4. Attachment of Wires:
      a. Fasten wires with tight turns:
         1) Make turns in 1-1/2 inch maximum distance.

B. Hanger Wires – General:
   1. Secure hanger wires to ceiling suspension members and to supports above with minimum of three tight turns.
      a. Comply with most stringent requirements of fabricator, CBC current edition, and as indicated on Drawings
      b. Connect hangers directly either to structures or to inserts, screw eyes, or other devices that:
         2) Are secure
         3) Are appropriate for substrate
         4) Will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
   2. Install wire within 6 inches of ends of main runners and cross-tees at ceiling perimeters.
   3. Maintain wires 6 inches minimum clear of non-braced ducts, pipes, and other items.
      a. Splay hangers only where required to clear obstructions.
      b. Brace wires exceeding 1:6 out-of-plumb with counter-splaying wires.
   4. Where obstructions prevent direct suspension, provide trapezes or equivalent devices.
      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards and publications.
      b. Minimum 1-1/2 inch cold-rolled channels back to back may be installed for spans up to 6 feet max.
   5. Wire to be straight, without extraneous kinks or bends, and tolerate 200 pound pull without stretching or shifting suspension clip.

C. Bracing Wires to Resist Seismic Forces:
   1. System for Bracing Ceilings:
      a. Lay-In Ceiling Systems:
         1) Install one four-wire set of sway-bracing wires and vertical strut for each 144 square feet maximum of ceiling area.
            a) Locate wire-sets and struts at 12 feet maximum on center.
            b) At ceiling perimeters, install wire-sets within 6 feet of walls.
         2) Install four-wire sets and struts within 2 inches of cross-runner intersection with main runner; space wires 90 degrees from each other.
         3) Do not install sway bracing wires at angle greater than 45 degrees with ceiling plane.
         4) Make wires tight, without causing ceiling to lift.
         5) Secure bracing wires to ceiling suspension members and to supports with minimum of four tight turns.
            a) Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs.
            b) Fasten bracing wires into concrete with cast-in-place or post installed anchors.
         6) Fasten compression struts in accordance with CBC requirements.
         7) Provide additional wires, 12 gage minimum, necessary to properly support suspension at electrical devices, air distribution devices, vertical soffits, and other concentrated loads.

D. Suspension – General:
   1. Fasten suspension members to 2 adjacent walls.
      a. Maintain 1/2 inch minimum clear of other walls.
   2. Interconnect suspension members not fastened to walls to prevent spreading, near their free end, with horizontal metal strut or 7445 stabilizer bar or 16 gage taut tie wire.
   3. Provide additional tees or sub-tees to frame openings for lights, air distribution devices, electrical devices, and other items penetrating through ceiling, which do not have integral flange to support and conceal cut edges of acoustic panels.
      a. Provide cross-bracing necessary to securely support surface mounted fixtures or other items.
   4. Attachment of Wires:
      a. To Wood Framing Members:
         1) Install as required by current code.
      b. Fasten wires with tight turns.
         1) Minimum three tight turns for hanger wires.
         2) Minimum four tight turns for bracing wires.
         3) Make turns in 1-1/2 inches maximum distance.

E. Suspension System for 24 inch x 48 inch, Lay-in Acoustical Ceilings:
   1. Main Runners:
      a. Install main runners 48 inches apart with minimum 12 gage hanger wires space 48 inches on center maximum along runners, and within 6 inches of ends.
   2. Cross-Tees:
      a. Install between main runners in repetitive pattern of 2 foot spacing.

3. Sub-Tees:
   a. Install at edges of penetrations.
4. Edge Moldings and Trim:
   a. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

3.03 INSTALLATION OF SUSPENDED ACOUSTICAL PANELS

A. Install panels into suspension system.
   1. Comply with ASTM C 636, referenced publications, and manufacturer's written instructions.
   2. Neatly cut partial panels and fit to suspension system and around penetrations and obstructions.
   3. Duplicate edges at partial panels and cut to be straight.
   4. Repaint cut tiles to match color or as directed by manufacturer for Mylar facing at visually exposed conditions, or as required by Architect.

B. Install acoustical panels with undamaged edges and fitted accurately into suspension system runners and edge moldings.
   1. Scribe and cut panels at borders and penetrations to provide a neat, precise fit.
   2. Arrange directionally patterned acoustical panels as follows:
      a. Install panels with pattern running in one direction parallel to long axis of space.
   3. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension system runners and moldings.

C. Install hold-down clips in areas indicated, in areas required by authorities having jurisdiction, and for fire-resistance ratings.
   1. Space as recommended by panel manufacturer's written instructions, unless otherwise indicated or required.

3.04 AIR DISTRIBUTION DEVICES

A. Refer to and coordinate with Division 23 Sections.

B. Install air distribution grilles and other devices into suspension system.
   1. Install 4 taut wires, each 12 gage minimum, to each device within 3 inches of device corners, to support their weight independent of suspension system.

3.05 LIGHT FIXTURES

A. Refer to and coordinate with Division 26 Sections.

B. Fixtures weighing less than 56 Pounds:
   1. Install fixtures into suspension systems and fasten earthquake clips to suspension members.
   2. Install minimum 2 slack safety wires, each 12-gage minimum, to each fixture at diagonally opposite corners, to support their weight independent of system.

C. Fixtures weighing more than 56 Pounds:
   1. Install fixtures into suspension system and fasten earthquake clips to suspension system members.

2. Install not less than 4 taut 2 gage wires capable of supporting four times fixture load.

3.06 CLEANING

A. General:
   1. Upon completion of installation of acoustical material, clean surfaces of material, removing dirt or discolorations.
   2. Comply with requirements of Section 01 7423.

B. Acoustical Panels:
   1. Touch-up minor abraded spots and cut edges with same paint as was used for factory applied finish of lay-in panels.

C. Remove and legally dispose rubbish, debris and waste materials off Project Site.
   1. Comply with requirements of Section 01 7419.

3.07 PROTECTION

A. Protect the Work until Substantial Completion.

END OF SECTION 09 5100

SECTION 09 6500

RESILIENT FLOORING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Vinyl composition tile flooring and accessories as indicated on Drawings and Schedules.

B. Related Sections:
   1. Section 01 4100:Regulatory Requirements; current Code edition.
   2. Section 01 4525:Concrete Moisture Testing
   3. Section 09 0562:Moisture Vapor Emission Control System

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
   1. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.

B. ASTM International (ASTM):
   1. ASTM D 2047 – Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
   2. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials
   3. ASTM E 648 – Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
   4. ASTM E 662 – Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
   5. ASTM F 710 – Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
   6. ASTM F 1066 – Standard Specification for Vinyl Composition Tile
   7. ASTM F 1861 – Standard Specification for Resilient Wall Base

C. National Fire Protection Association (NFPA):
   1. NFPA 253 – Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
   2. NFPA 258 – Standard Test Method for Measuring the Smoke Generated by Solid Materials

1.03 DEFINITIONS

A. Pop-Up:
   1. Defined as surface deviation or looseness of substrate that is equal to or greater than 1/64 (0.015625) inch above concrete floor level, regardless of size.

1.04 SYSTEM DESCRIPTION

A. Resilient Tile Flooring:
   1. Flooring manufactured, fabricated, and installed to specified performance criteria certified by manufacturer, without defects, damage, or failure.

1.05 SUBMITTALS

A. Product Data:
   1. Manufacturer's published technical data describing materials, construction, and recommended installation directions.
      a. Include technical data and installation instructions for each adhesive material.
   2. Furnish list and Product Data of recommended finish materials.

B. Samples:
   1. Minimum of four full size samples of each selected color and pattern.
      a. Include four pint cans of each type of adhesive.
         1) Furnish written verification of compliance with SCAQMD Rule 1168.

C. Maintenance Materials:
   1. Prior to Substantial Completion, deliver one unopened carton of each color and pattern of vinyl composition tile in each color and pattern installed.
      a. Label each container indicating locations installed.
   2. Include unopened cans of adhesives adequate to install maintenance materials.

D. Maintenance Instructions:
   1. Furnish manufacturer's recommendations for maintenance, care, and cleaning of vinyl composition tile.

E. Installer's Experience Qualifications:
   1. Furnish list of not less than 5 projects, extending over period of not less than 5 years, indicating installer's experience record.
   2. Include letter from manufacturer indicating manufacturer's approval for installer of specified products.

1.06 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Minimum 5 years experience in successfully installing same or similar flooring materials, and use of flooring manufacturer's subfloor preparation products.
   2. Engage installers certified as flooring manufacturer's Certified Installers
      a. Confirm installer's certification by requesting their credentials.

B. Pre-installation Meeting:
   1. Conduct on-site pre-installation meeting to verify project requirements, substrate conditions, manufacturer's installation instructions, and manufacturer's warranty requirements.
      2. Comply with requirements of Section 01 3119.

C. Pre-installation Testing:
   1. Conduct pre-installation testing in accordance with requirements specified in Section 01 4525.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

B. Deliver materials to Project Site in manufacturer’s original, unopened packaging clearly labeled with manufacturer’s name, brand, project identification, and shipping and handling instructions.

C. Store materials in clean, dry, enclosed space, and off ground.
   1. Store flooring, adhesives, and accessories in spaces where they will be installed for not less than 48 hours before beginning installation.
      a. At temperature and humidity conditions recommended by manufacturer, but not less than 70 degrees F

D. Protect materials from harmful weather conditions:
   1. Protect adhesives from freezing

1.08 PROJECT CONDITIONS

A. Ventilation and Temperature:
   1. Verify areas that are to receive new flooring are ventilated to remove fumes from installation materials, and areas are within temperature range recommended by various material manufactures for Project Site installation conditions.

1.09 SEQUENCING

A. Sequencing and Scheduling:
   1. Do not install flooring over concrete slabs until they are sufficiently dry to achieve bond with adhesive.
   2. Perform tests in accordance with requirements of Section 01 4525, and manufacturer's recommendations.
   3. Install flooring and accessories after other finishing operations, including painting, have been completed.
   4. Close spaces to traffic during and after installation of flooring in accordance with manufacturer’s recommendations..

1.10 REGULATORY REQUIREMENTS

A. Comply with following as minimum requirement:
   1. Furnish materials that are compliant with accessibility requirements.
   2. Provide resilient flooring that is stable, firm. and slip resistant complying with CBC Section 11B-302.1.
   3. Fire Performance Characteristics:
      a. In accordance with ASTM E 648 and E 662.

1.11 WARRANTY

A. Manufacturer’s Limited Warranty:
   1. Written warranty executed by resilient flooring manufacturer, agreeing to repair or replace resilient flooring that fails within warranty period.
      a. Limited Warranty Period: 5 years from date of Substantial Completion.

2. Limited Warranty does not deprive Owner of other rights the Owner may have under other provisions of Contract Documents and will be in addition to and run concurrent with other warranties made by Contractor under requirements of Contract Documents.
3. For Limited Warranty to be valid, this product is required to be installed using appropriate flooring manufacturer's guaranteed installation system.
    a. Products installed not using specific instructions from manufacturer's guaranteed installation system will void warranty.

B. Installer's Warranty:
1. Provide 2-year labor warranty.

1.12 EXTRA MATERIALS

A. Furnish extra materials from same production run as products installed.
1. Packaged with protective covering for storage and identified with appropriate labels.
2. Quantity:
    a. Furnish quantity of flooring units equal to 5 percent of amount installed, unless otherwise requested by Owner.
3. Delivery, Storage, and Protection:
    a. Deliver extra materials to Owner.
    b. Comply with Owner's requirements for delivery, storage, and protection of extra material.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design:
1. Design of resilient flooring is based upon products as manufactured by Armstrong Flooring Inc., Lancaster, PA

B. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:
1. Submit items listed in "Submittals" Article for evaluation of proposed system.
2. Complete project shop drawings for similar project may be submitted for evaluation purposes, however shop drawings specific to this Project will be required from successful bidder.
3. Furnish tests that have been made for identical systems within ranges of specified performance criteria.
4. Copy of manufacturer's material warranty.

2.02 MATERIALS

A. Resilient Flooring:
1. Vinyl Composition Tile conforming to ASTM F 1066, Composition 1, asbestos free, Class 2 (through pattern), 12 inch by 12 inch by minimum 1/8 inch thick, colors and patterns as indicated.
    a. Colors: As selected by Architect.
    b. Accent Colors:
        1) Provide random pattern for Architect's review and approval.

2. Product and Manufacturer:
    a. Standard Excelon Imperial Texture Tile Flooring as manufactured by Armstrong Flooring, Inc., Lancaster, PA

B. Crack Filler and Leveling Compound:
1. Cementitious Type:
2. Provide one of following:
    a. Webcrete 95 by Bostik, Inc., Wauwatosa, WI
    b. Ardex Fether Finish by ARDEX Americas, Aliquippa, PA
    c. Armstrong S-194 Fast-Setting Patch Underlayment & Embossing Leveler by Armstrong Flooring, Inc.
    d. As recommended by flooring manufacturer.

C. Concrete Primer:
1. Non-staining type recommended by manufacturer of vinyl composition tile.

D. Adhesive:
1. Water based, low odor type formulated specially for installation with vinyl composition tile, as recommended by manufacturer.
2. Compliant with requirements of SCAQMD Rule 1168.

E. Reducer Strips:
1. Tapered rubber not less than one inch wide
    a. Thickness to match tile.

F. Floor Finish:
1. As recommended by vinyl composition tile manufacturer.

2.03 RESILIENT BASE

A. Rubber Base:
1. Conform to ASTM F 1861; Group 1, solid (homogeneous).
    a. Type TS, thermoset vulcanized rubber>
        1) 4 inches high unless otherwise indicated.
        2) Non-shrinking, with matching molded corners and end stops.
2. Flammability:
    a. Critical Radiant Flux:
        1) 0.45 watts/cm^2 or greater, Class I, when tested in accordance with ASTM E 648
    b. Flame Spread/Smoke Density:
        1) Flame Spread Index: Class B
        2) Smoke Developed Index: Less than 450.
    c. When tested in accordance with ASTM E 84.
3. Acceptable Manufacturers:
    a. Johnsonite/Tarkett Inc., Solon, OH (Basis-of-Design)
    b. Burke Flooring Products, Division of Burke Industries, San Jose, CA
    c. Roppe Corporation, U.S.A, Fostoria, OH
4. Thickness: Minimum 1/8 inch.
5. Height: As indicated.
6. Length: Provide in rolls.
    a. Pre-cut 4-foot strips are not acceptable.
7. Style:
    a. Standard top set cove base at resilient flooring.

8. Color: As selected by Architect.

B. Base Adhesive:
1. Water based, low odor type formulated specially for use with rubber base, and manufactured or recommended by manufacturer of rubber base.
2. Complying with requirements of SCAQMD Rule 1168.

2.04 SOURCE QUALITY CONTROL

A. Single-Source Responsibility:
1. Provide types of flooring and accessories supplied by one manufacturer.
a. Including primers, leveling and patching compounds, and adhesives.

2.05 PERFORMANCE

A. Performance Requirements – General:
1. Provide flooring which has been manufactured, fabricated, and installed to performance criteria certified by manufacturer, without defects, damage, or failure.

B. Fire Performance Characteristics:
1. Provide resilient vinyl composition tile flooring with fire performance characteristics as determined by testing material in accordance with following ASTM test methods by certified testing laboratory or other testing agency acceptable to authorities having jurisdiction:
a. ASTM E 648 and ASTM E 662

PART 3 EXECUTION

3.01 COORDINATION

A. Coordinate with related Work to assure level, smooth, and clean finish surfaces to receive vinyl composition floor tile.

3.02 MANUFACTURER'S INSTALLTION INSTRUCTIONS

A. Compliance:
1. Comply with manufacturer's product data:
a. Including, but not necessarily limited to, technical bulletins, product catalog, installation instructions, and product carton instructions for installation and maintenance procedures as needed.

3.03 EXAMINATION

A. Site Verification of Conditions:
1. Verify that substrate conditions previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.
a. Including, but not necessarily limited to:
1) moisture testing, bond testing, and pH testing..
2. Field verify dimensions and other conditions affecting this Work before commencing Work.
3. Visually inspect flooring materials, adhesives, and accessories prior to installation.

a. Do not install flooring material with visual defects.
    1) This will not be considered as legitimate claim.
4. Examine subfloors prior to installation to determine that surfaces are smooth and free from cracks, holes, ridges, and other defects that might prevent adhesive bond or impair durability or appearance of flooring material.
5. Inspect subfloors prior to installation to determine that surfaces are free from following:
    a. Curing, sealing, parting, and hardening compounds
    b. Residual adhesives
    c. Adhesive removers
    d. Other foreign materials that might prevent adhesive bond.
    e. Visually inspect for evidence of moisture, alkaline salts, carbonation, dusting, mold, or mildew.
6. Report conditions to Architect and Owner that are contrary to contract requirements and that would prevent proper installation.
    a. Do not proceed with installation until unsatisfactory conditions have been corrected.
7. Failure to call attention to defects or imperfections will be construed as acceptance and approval of subfloor.
    a. Installation indicates acceptance of substrates with regard to conditions existing at time of installation.

3.04 PREPARATION OF CONCRETE SLABS

A. Do not start preparation until adjacent concrete floor slabs are at least 90 days old.

B. Leveling:
1. Check sub-floors for true to level and plane within tolerance of 1/4 inch in 10 feet.
2. Test floor areas both ways with 10 foot straightedge and repair high and low areas exceeding allowable tolerance.
3. Hammer out Pop-Ups and fill floor with cementitious leveling compound.
4. Remove high areas by power sanding, stone rubbing, or grinding, chipping off and filling with leveling compound, or equivalent method.
5. Fill low areas with leveling compound.
6. Repair and level surfaces having abrupt changes in plane, such as trowel marks or ridges, whether or not within allowable tolerance.

C. Cleaning:
1. After leveling, clean areas and substrates where repairs were performed of deleterious substances and foreign matter.

D. Cracks or Depressions:
1. Fill voids with cementitious leveling compound of type recommended by flooring manufacturer for specific Work conditions.

3.05 INSTALLATION OF TILE

A. Color and Pattern:
1. Install tiles in pattern indicated on Drawings.
2. Where no pattern is indicated, install tiles in rectangular pattern, in one color.

B. Install vinyl composition floor tile when ambient temperature is 70 degrees F or higher.

C. Install tile adhesive in thin film evenly with notched trowel.
   1. Trowel Notches:
      a. As recommended by flooring manufacturer.
   2. Mix adhesive in accordance with manufacturer's instructions.
      a. Provide safety precaution during mixing.
   3. Install adhesive only in area that can be covered by flooring material within adhesive manufacture's recommended working time.
   4. Remove adhesive that has dried or filmed over.
   5. Adhesive Application Rate:
      a. As required to avoid telegraphing trowel lines to surface after maintenance coatings are applied.
      b. Adjust tile runoff during installation if necessary.

D. Provide reducer where floor covering edges are exposed, such as at center of door or where floor coverings terminate.

E. Install vinyl composition tile in accordance with manufacturer's recommendations.
   1. Fit tiles snugly at wall.
   2. Closely trim to pipes, jambs, outlets, and similar conditions.

F. Install tiles symmetrically about centerlines of areas progressing toward walls.
   1. Adjust border tiles as required.
   2. Make tiles straight and joints close.
   3. Cut tile to fit snugly at doorframes, and walls.

G. Mechanically cut flooring material to produce square true edges.

H. As floor tile is installed, roll with clean, 150 pound roller in both directions.

3.06 CLEANING

A. Keep flooring surfaces clean as installation progresses.

B. Clean flooring when sufficiently seated and remove foreign substances.

C. Clean adjacent surfaces of adhesive or other materials.
   1. Replace damaged or defective Work to specified condition.

3.07 CLEANING

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

3.08 PROTECTION

A. Protect Work until Substantial Completion.

END OF SECTION 09 6500

SECTION 09 7200

WALL COVERINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Woven-Backed Vinyl Wall Covering – **VWC-1**
   2. Wall Covering Accessories:
      a. Primer and adhesive.

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 09 2900: Gypsum Board
   3. Section 09 9100: Painting; for prime painting of gypsum board.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
   1. Chapter 8 – Interior Finishes.

B. ASTM International (ASTM):
   1. ASTM D 751 – Standard Test Method for Coated Fabrics
   2. ASTM D1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
   3. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials
   4. ASTM E 603 – Standard Guide for Room Fire Experiments
   5. ASTM F 793 – Standard Classification of Wall Coverings by Use Characteristics
   6. ASTM G 21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

C. Wallcoverings Association (WA):
   1. W-101 – WA Quality Standard for Polymer Coated Fabric Wallcovering

D. National Fire Protection Association (NFPA):
   1. NFPA 255 – Standard Method of Test of Surface Burning Characteristics of Building Materials.
   2. NFPA 286 – Standard Methods of Fire Tests For Evaluating Contribution of Wall And Ceiling Interior Finish to Room Fire Growth.

E. UL, LLC (UL):
   1. UL 723 – Standard Test for Surface Burning Characteristics of Building Materials.

F. South Coast Air Quality Management District (SCAQMD):
   1. Rule 1113 – Architectural Coatings
   2. Rule 1168 – Adhesive and Sealant Applications.

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's product data for each type of product specified.
      a. Include data on physical characteristics, durability, fade resistance, and flame resistance characteristics.

B. Installation Instructions:
   1. Manufacturer's written installation instructions for each type of product specified.

C. Samples:
   1. Minimum of four 12 inches by 12 inches samples of each color, texture, and pattern specified for verification.
      a. Showing full range of variations expected in these characteristics.
      b. Include digitally printed wall covering.
   2. Minimum of three full-width samples:
      a. Minimum of 54 inches wide by not less than 36 inches long.
      b. For each wall covering, including digitally printed..
   3. Prepare samples from same dye lot to be used for Work

D. Certification:
   1. Product certificates signed by manufacturers of wall coverings certifying that their products comply with specified requirements.
   2. Provide written evidence that materials proposed for use, conform to recommendations of vinyl wall covering manufacturer for warranted installations.

E. Maintenance Instructions:
   1. Two copies of manufacturer's printed instructions for maintenance of installed Work.
      a. Include one copy for inclusion in maintenance manuals specified under Division 01.

1.04 QUALITY ASSURANCE

A. Substitutions:
   1. Wall coverings submitted for approval as equal to specified wall covering must be equal in every respect, including color selection.
   2. Submittals to include full range of colors and manufacturer's written specification.
   3. Color/Pattern Texture:
      a. Match Architect's samples for color, pattern and texture.
   4. Comply with requirements for substitutions in Division 01.

B. Imperfections in Material:
   1. Imperfections such as engraving roller die marks, roller repeat marks, glossy surface appearance, or other features deemed not in conformance with specified materials, will be cause for rejection by Architect.
      a. When evidenced in either submitted samples, or manufactured material delivered to Project Site.

C. Testing:
   1. Perform tests in accordance with W-101, except as follows:
      a. Adhesion of vinyl coating to the fabric backing shall be tested in accordance with ASTM D 751.
      b. Test resistance to strong cleaning solutions by immersing one-half of material into solution of 1 percent sodium hydroxide (NaOH), or mild non-abrasive spray household cleaner for period of 24 hours, then rinse, dry and observe for possible discoloration.
      c. Provide materials that have zone inhibition rating of “0" on face, and “1" on backing to resist growth of mildew and bacteria, as determined by test method ASTM G 21

D. Applicators Qualifications:
   1. Perform Work of this Section by firm regularly engaged in installation of vinyl wallcoverings of types and qualities specified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project Site in original packages or containers clearly labeled to identify manufacturer, brand name, quality or grade, and fire performance characteristics.

B. Store materials inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

C. Maintain room temperature within storage area above 55 degrees F during period materials are stored.

1.06 PROJECT CONDITIONS

A. Space Enclosure and Environmental Limitations:
   1. Do not install wall covering until completion of following:
      a. Space is enclosed and weatherproof.
      b. Wet-work in space is completed and nominally dry
      c. Work above ceilings is complete.

B. Maintain ambient-temperature within building at constant minimum temperature of not less than 60 degrees F for at least seven days prior to and throughout installation period and for seven days after completion of installation.
   1. Ensure that ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.
   2. Do not apply adhesive when substrate surface temperature or ambient temperature is below 55 degrees F.
   3. Room Humidity: Not to exceed 90 percent.

C. Lighting:
   1. Do not install wall covering until permanent lighting is in place.
   2. Provide not less than 80 foot candles per square foot minimum, measured mid-height on surfaces to receive wall coverings.

D. Ventilation:
   1. Provide continuous ventilation during installation

a. For not less than time recommended by wall covering manufacturer for full drying or curing.

E. Wall Conditions:
1. Ensure that wall surface is clean, dry, structurally sound, and free of mildew, grease, dust, or other stains.
2. Prime wall surfaces with quality wall covering primer as approved by manufacturer.
a. Comply with requirements specified in Section 09 9100.

1.07 REGULATORY REQUIREMENTS

A. Fire Performance Characteristics:
1. Provide materials bearing UL label and marking and complying with following fire resistance characteristics:
a. Woven-Backed Vinyl Wall Covering – **VWC-1**
1) Class A Rating in accordance with ASTM E 84/NFPA 255 (Tunnel Test).
2) NFPA 286 (Corner Burn Test):
a) Flame Spread Index: 15
b) Smoke Developed Index: 25

B. Fire Detection Characteristics:
1. Provide materials containing thermoparticulating ingredients that have been laboratory tested for Early Warning Effect in accordance with ASTM E 603.
2. Submit test results certifying that when one square foot section of material is heated to 3000 degrees F, wallcovering emits odorless, colorless non-toxic vapor that will activate ionization smoke detector.

1.08 WARRANTY

A. Submit manufacturer's limited five-year written warranty against manufacturing defects.
1. Warrant wall covering materials, when adhered to sound surface with manufacturer’s recommended procedures and adhesive, to be free of manufacturing defects for period of 5 years from date of Owner’s acceptance of Project.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design:
1. Design of wall covering materials is based on products as manufactured by Koroseal Interior Products, LLC, Fairlawn, OH

B. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:
1. Submit items listed in Article 1.04 and as specified in Section 01 3300, for evaluation of proposed system.
2. Approval is subject to availability of acceptable color and pattern.
3. Manufacturer’s 5 year material warranty for wall covering.

2.02 MATERIALS

A. Woven-Backed Vinyl Wall Covering – **VWC-1**:
   1. Conforming to WA 101, Type II, and ASTM F 793, Category V, Type II.
   2. Color: India Ink 5921-76
      a. Total Weight: 20.0 oz./ linear yard
         13.3 oz. / square yard.
      b. Roll Width: 52 inches to 54 inches.
      c. Backing: Osnaberg
      d. Gauge: 0.025 inch
      e. Tensile Strength: 50 x 55 lbr, minimum.
      f. Tear Strength: 25 x 25 lbr, minimum.
   3. Repeat:
      a. Vertical and Horizontal: N/A
      b. Nominal Pattern Width: 51 inches
      c. Match Information: Random Match, Reverse Hang.
   4. Manufacturer:
      a. Koroseal Interior Products, LLC

2.03 ACCESSORIES

A. Primer and Adhesive:
   1. Manufacturer's recommended adhesive, primer, and sealer, manufactured expressly for use with each type of wall covering on substrate as indicated.
   2. Provide materials conforming to SCAQMD Rules 1113 and 1168, and which are mildew-resistant and non-staining to wall covering.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates for compliance with requirements for moisture content and other conditions affecting performance of Work of this Section.
   1. Complete finishing operations, including painting, before beginning installation of wall covering materials.
   2. Ensure that wall surfaces specified to receive wall covering materials are dry and free from dirt, grease, loose paint, and scale.
   3. Do not proceed with installations until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Preparation:
   1. Gypsum Board Surfaces:
      a. Recess screws.
      b. Repair irregular tape joints, sand and remove dust.
   2. Sand high spots and spackle low areas of gypsum board surfaces to eliminate imperfections that may telegraph through fabric or affect wall covering installation.
   3. Ensure gypsum board surfaces scheduled to receive wall covering are properly primed under Section 09 9100.
      a. Apply surface sealer to gypsum drywall which will permit subsequent removal of wall covering without damage to paper facing.

b. Prime substrate as recommended by manufacturer.

B. Clean substrates of substances that could impair wall covering bond, including mold, mildew, oil, grease, incompatible primers, and dirt.

C. Remove switch plates, wall plates, and surface-mounted fixtures in areas where wall covering is to be applied.

D. Acclimatize wall covering materials by removing from packaging in area of installation not less than 24 hours before application.

3.03 INSTALLATION – GENERAL

A. Comply with wall coverings manufacturer's written installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Place wall covering panels consecutively in order cut from rolls, including filling of spaces above or below openings as required.
1. Hang by reversing alternate strips except on match patterns.

C. Apply adhesive to back of wall covering and place in accordance with manufacturer's instructions:
1. Install seams vertically and plumb and at least 6 inches away from corners
2. Horizontal seams will not be permitted.
3. Place wall covering continuously over internal and external corners.
4. Overlap seams and double-cut to assure tight closure.
5. Work from top to bottom then side to side.
6. Roll sheet firmly into adhesive for positive contact
   a. Roll, brush, or use broad knife to remove air bubbles, wrinkles, blisters, and other defects.
   b. Cut wall covering evenly to edges of outlet boxes or support.

D. Trim selvages as required to assure uniformity and pattern match at seams.

E. Lap and double cut seams.

F. Remove excess adhesive and residue along finished seams in accordance with manufacturer's instructions.

G. Replace removed plates and fixtures; verify cut edges of wall covering are completely concealed.

3.04 CLEANING

A. Use cleaning methods recommended by wall covering manufacturer.

B. Replace strips that cannot be cleaned.

C. Upon completion of Work, remove surplus materials, rubbish, and debris resulting from wall covering installation and leave areas of Work in neat, clean condition.

END OF SECTION 09 7200

SECTION 09 9100

PAINTING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Surface preparation, priming, and field painting of following:
      a. Exposed exterior and interior items and surfaces as indicated.
      b. Installation of paintable caulking in interior dry areas.

B. Related Sections:

1.	Section 05 0513:	Shop-Applied Coatings for Metal; shop finishes for extruded aluminum and coil-coated metal
2.	Section 05 1200:	Structural Steel Framing; shop prep and priming of steel.
3.	Section 05 5500:	Metal Fabrications; shop prep and priming of galvanized and ferrous metal.
4.	Section 06 1053:	Miscellaneous Carpentry; preservative and fire retardant treatment
5.	Section 07 9200:	Joint Sealants
6.	Section 08 1113:	Hollow Metal Doors and Frames.
7.	Section 08 1400:	Wood Doors
8.	Section 08 3100:	Access Doors and Panels
9.	Section 09 2900:	Gypsum Board
10.	Section 09 9600:	High Performance Coatings ; painting of AESS and other exposed metal surfaces.
11.	Section 32 1723:	Pavement Markings; traffic paint

C. Related Requirements:
   1. Surface preparation, priming, and finish coats specified in this Section are in addition to shop priming and surface treatment specified in other Sections.

1.02 REFERENCES

A. California Air Resources Board (CARB):
   1. South Coast Air Quality Management District (SCAQMD):
      a. Rule 1113 – Architectural Coatings
      b. Rule 1168 – Adhesive and Sealant Applications

B. California Department of Public Health (CDPH):
   1. Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.2 – 2017

C. United States Environmental Protection Agency (EPA):
   1. 40 CFR Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings
      a. Method 24 – Surface Coatings

D. The Society of Protective Coatings (SSPC):
   1. SSPC-SP 1 – Solvent Cleaning.
   2. SSPC-SP 2 – Hand Tool Cleaning.
   3. SSPC-SP 3 – Power Tool Cleaning.
   4. SSPC-SP 6 – Commercial Blast Cleaning
      a. For shop preparation only.
   5. SSPC-SP 7 – Brush-Off Blast Cleaning
   6. SSPC-SP 11 – Power Tool Cleaning to Bare Metal.

1.03 DEFINITIONS

A. Paint – As used in this Section:
   1. Means coating systems materials, including primers, emulsions, enamels, stains, sealers, and other applied materials whether used as prime, intermediate, or finish coats.

1.04 SYSTEM DESCRIPTION

A. Paint exposed surfaces except where material is obviously intended and specifically noted as surface not to be painted:
   1. Where items or surfaces are not specifically mentioned, paint item or surface same as adjacent similar materials or surfaces whether or not schedules indicate colors.
      a. When system, color, or finish is not designated, Architect will select from standard colors and finishes available.
   2. Refer to Finish/Color Schedules and notations on Drawings.
   3. Painting Includes:
      a. Field painting of exposed bare and covered pipes, ducts (including color coding), and hangers.
      b. Exposed steel and iron work.
      c. Conduit, and metal surfaces of mechanical and electrical equipment as indicated.
      d. Exposed piping, ductwork, equipment, and other such items as designated or required.

B. Work Not to be Painted:
   1. Do not include painting when factory finishing or installer finishing is specified for such items as, but not limited to, following:
      a. Acoustic materials
      b. Decorative laminate casework
      c. Factory-finished elevator doors and frames.
      d. Aluminum with shop-applied finish.
         1) Includes high performance coatings and anodizing.
      e. Stainless steel, chromium plate, brass, bronze and similar finish materials.
      f. Factory-finished mechanical and electrical equipment including light fixtures, switchgear and distribution cabinets.
   2. In general, following items will not require finishing unless specifically specified, scheduled, or indicated:
      a. Flexible conduit connections to equipment, miscellaneous nameplates, stamping, and instruction labels and manufacturer's data.

b. Do not paint moving parts of operating units, including, but not limited to:
   1) Mechanical and electrical parts, such as valves and damper operators, linkages, sensing devices, motor and fan shafts.
c. Do not paint over code required labels, such as Underwriters' Laboratories and Factory Mutual, or equipment identification, performance rating, name, or nomenclature plates.
d. Finish Hardware, except prime coated items.
e. Walking Surfaces:
   1) Painted concrete curbs and pavement markings are specified in Section 32 1723.
f. Concealed Surfaces:
   1) Painting is not required on wall or ceiling surfaces in concealed areas and inaccessible areas, such as furred areas, pipe spaces, duct shafts, and elevator shafts, as applicable to Project.
g. Exterior concrete and masonry

3. Portland Cement Plaster:
   a. Unless direct otherwise by Architect at request of District, do not paint following:
      1) Integrally colored polymer-modified (acrylic) finish.
   b. In lieu of painting, apply fog coat to integrally colored Portland cement plaster in accordance with plaster specification section.
   c. When directed to paint Portland cement plaster, refer to Schedule of Exterior Paint Systems in this Section for appropriate paint system.

C. Shop Priming:
   1. Unless otherwise specified, shop priming of ferrous metal items is included under various sections for metal fabrications, hollow metal work and similar items.

1.05 SUBMITTALS

A. Product Data:
   1. Provide for each paint system specified; include primers.
   2. Material List:
      a. Provide inclusive list of required coating materials:
         1) Indicate each material and cross-reference specific coating, finish system, and application.
         2) Identify each material by catalog number and general classification.
         3) In addition to manufacturer’s name, product name and number, include following:
            a) Primers, thinners, and coloring agents.
            b) Manufacturers’ catalog data fully describing each material as to content, recommended installation, and preparation methods.
      b. Identify surfaces to receive various paint materials.
   3. Manufacturer’s Information:
      a. Provide manufacturer’s technical information, including label analysis and instructions for handling, storing, and applying each coating material proposed for use.
   4. Certification by manufacturer that products supplied comply with local regulations controlling use of Volatile Organic Compounds (VOC).

B. Samples:
   1. After receipt of Architect's Color Schedule, submit following for Architect's review for color and texture only:
      a. Draw-Downs:
         1) Manufacturer-produced draw-downs for each color sample required
      b. Stepped Samples:
         1) Defining each separate coat, including primers.
         2) Use representative colors when preparing samples for review.
         3) Resubmit until required sheen, color, and texture are achieved.
   2. Furnish list of materials and applications for each coat of each sample.
         1) Label each sample for location and application.
   3. Furnish minimum of four 8-1/2 by 11 inch painted samples of each color and material, with texture to simulate actual conditions.
      a. On Metal – Provide minimum of four 4 by 8 inch samples for each type of finish and color, defining prime and finish coat.
      b. Do not proceed with painting work until color samples have been accepted.

C. Field Samples:
   1. When and as directed by Architect, apply one complete coating system for each color, gloss and texture required.
   2. When approved, sample panel areas will be deemed incorporated into Work and will serve as standards by which subsequent Work of this Section will be judged.

D. Provide list of solid volume factors for each type of material if so requested by Architect.

1.06 QUALITY ASSURANCE

A. Approved Equal:
   1. Provide materials or products specified by trade name as specified.
   2. Interpret references to brand names as establishing standard of quality.
      a. Such interpretation is not to be construed as limiting competition.
   3. Presume brand names, where used in specifications, to be followed by words "or approved equal".
   4. Such approval will be granted only as set forth in Contract Documents and with certification that materials are equal or superior to brand named in specifications in construction, efficiency, and utility.
   5. In making submittals for approval as equal, include manufacturer's product data sheet for each product indicating composition and percent by weight.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Project Site in original, new, and unopened packages and containers bearing manufacturer's name and label, and following information:
   1. Name or title of material.
   2. Product Description (Generic Classification or Binder Type).
   3. Federal Specification number, if applicable.
   4. Manufacturer's stock number and date of manufacture.
   5. Manufacturer's name
   6. Contents by volume, for major pigment and vehicle constituents.
   7. Thinning instructions.

8. Application instructions.
9. Color name and number.
10. VOC Content
11. Concurrently provide local representative of approved paint products with copies of invoices of purchased materials.

B. Storage and Mixing of Materials:
   1. Store and mix paint materials in single suitable place in compliance with health and fire regulations.
   2. Open and mix ingredients on premises in presence of Project Inspector.
   3. Maintain such storage spaces clean and neat.
   4. Remove oily rags, waste, and like materials from building each night and take every precaution to avoid danger of fire.

1.08 PROJECT CONDITIONS

A. Apply primers and paints only when temperature of surfaces to be painted and surrounding air temperatures are within range permitted by paint manufacturer's printed instructions.

B. Do not apply paint in rain, fog, mist or to damp or wet surfaces; or when relative humidity exceeds 85 percent, unless otherwise specified by paint manufacturer.

C. Do not apply paint, interior, or exterior, when temperature is below 50 degrees F or above 90 degrees F, or when dust conditions are unfavorable for application.

D. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature ranges specified by paint manufacturer during application and drying periods.

E. Painting Work by Other Trades:
   1. Examine Drawings and Specifications, including requirements specified in other sections for painting work by other trades.
   2. Notify Architect in writing of conflicts between Work of this Section and that of other trades and sections, and errors, omissions, or impractical requirements.
   3. Paint or finish surfaces that are left unfinished by requirements of their specification as Work of this Section.

1.09 REGULATORY REQUIREMENTS

A. Codes and Standards:
   1. Conform work and materials to regulations of State Fire Marshal, Safety Color Coding in conformance with OSHA, Cal/OSHA, and local or State Ordinances having jurisdiction.
      a. Conform to most stringent requirements and authorities having jurisdiction.

B. Comply with applicable codes and regulations of governmental agencies having jurisdiction including those having jurisdiction over airborne emissions and industrial waste disposal.
   1. Where those requirements conflict with this Specification, comply with more stringent provisions.

2. Regulatory changes may affect formulation, availability, or use of specified coatings.
    a. Confirm availability of coatings to be used prior to Project bid and before start of painting on Project.
3. Comply with current applicable regulations of following:
    a. California Air Resources Board (CARB)
    b. South Coast Air Quality Management District (SCAQMD)
    c. California Department of Public Health (CDPH)
    d. U.S. Environmental Protection Agency (EPA), as applicable.

1.10 MAINTENANCE STOCK

A. Upon completion of Work of this Section, deliver to Owner, extra stock consisting of one gallon of each color, type, and gloss of finish (topcoat) paint used in Work.
    1. Tightly seal each container and clearly label contents and location where used.

PART 2 PRODUCTS

2.01 MATERIAL QUALITY

A. Provide best quality commercial grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers.
    1. Materials not displaying manufacturer's identification as standard, best grade product will not be acceptable.

B. Factory mix paint materials to correct color, gloss, and consistency for installation to maximum extent feasible.

C. Do not use paints in Work which have been packaged longer than six months, except when such products are known to have long package stability when unopened and only when guaranteed by manufacturer.

2.02 MANUFACTURERS

A. Manufacturer's catalog names and numbers as listed are used to aid in establishing kind and quality of material required and are not used as indication of color desired.

B. Opaque Paint Finish Materials:
    1. Basis-of-Design:
        a. Paint Systems specified are products of Dunn-Edwards Corporation, Los Angeles, CA, unless indicated otherwise.

C. Paint Systems as listed are District Standard.
    1. Substitutions are not permitted.

2.03 SOURCE QUALITY CONTROL

A. Single-Source Responsibility:
    1. Obtain products of only one paint manufacturer unless otherwise specified or approved.

a. Obtain primers, thinners, coloring agents, and catalysts for each painting system from same manufacturer as finish coats, or as approved for use by manufacturer of paint, except for materials furnished with shop prime coat by other trades.
    1) Use approved thinners only within recommended limits.
2. Furnish materials as supplied from paint manufacturer's branded paint store or manufacturer-approved dealer.
3. Furnish copies of invoices from paint supplier to manufacturer's representative and Architect.
    a. Furnish to Owner when requested.

2.04 COLORS AND FINISHES

A. Surface treatments and finishes are shown on Drawings and indicated in Schedules on Drawings.
    1. Paint colors are shown on Architect's Color Schedule.

B. Colors required or listed by Architect are not necessarily stock colors available in one particular manufacturer's range.
    1. Non-availability of colors selected by Architect will be sufficient reason to disqualify manufacturer not capable of providing such colors.

C. Paint Coordination:
    1. Provide finish coats which are compatible with prime paints used.
    2. Review other sections of these specifications in which prime paints are to be provided to ensure compatibility of total coatings system for various substrates.
    3. Upon request from other subcontractors, furnish information on characteristic of specified finish materials, to ensure that compatible prime coats are used.
    4. Provide barrier coats over incompatible primers or remove and reprime as required.
    5. Notify Architect in writing of anticipated problems using specified coating systems with substrates primed by others.

2.05 PAINTABLE CAULK

A. Acrylic latex, one-part, non-sag, mildew resistant, non-bleeding and non-staining, acrylic emulsion component compound conforming to ASTM C 834, Type OP, Grade NS, formulated to be paintable.
    1. For use as interior caulk in nonworking joints only.
    2. Must be able to accommodate joint movement of not more than 5 percent in both extension and compression for total of 10 percent.
    3. Backup and Bond Breaker: Products recommended by caulking manufacturer.
    4. Provide one of following products:
        a. AC-20: Pecora Corporation.
        b. Bostik Home Painter's Caulk: Bostik Construction Products.
        c. GE RCS20: Momentive Performance Materials.
    5. VOC compliant per SCAQMD Rule 1168.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions under which painting will be performed for compliance with requirements for application of paint.
   1. Do not begin paint application until unsatisfactory conditions have been corrected and surfaces scheduled to receive paint are thoroughly dry.

B. Starting of painting will be construed as applicator’s acceptance of surfaces and conditions within particular area.

3.02 SURFACE PREPARATION

A. Clean and prepare surfaces to be painted following paint manufacturer's written instructions and as specified, for each particular substrate condition.

B. Clean surfaces to be painted before applying paint or surface treatments.
   1. Remove oil and grease prior to mechanical cleaning.
   2. Program cleaning and painting so contaminants from cleaning process will not fall onto wet, newly painted surfaces.
   3. Cover surfaces and equipment as necessary to prevent contaminants from cleaning process from falling onto equipment.

C. Clean floors and surfaces in room being painted of loose dirt and dust before painting is started.

D. Moisture Content:
   1. Measure moisture content of surfaces using electronic moisture meter.
   2. Do not apply finishes unless moisture content of surfaces are below maximum levels specified, or as otherwise recommended by manufacturer.

E. Remove hardware, hardware accessories, switch and receptacle plates, surface-mounted lighting fixtures, escutcheons and plates, surface-mounted equipment, free-standing equipment blocking access to painted surfaces, and other items as required prior to surface preparation and painting operations.
   1. Following completion of painting of each space or area, reinstall removed items.

F. Provide barrier coats over incompatible primers or remove and reprime.

G. Gypsum Board:
   1. Remove dust, loose particles or other matter that would prevent proper paint adhesion.
   2. Check to see that joints and screw heads have been properly covered with joint compound and sanded smooth and flush with adjacent surfaces.
   3. Before finishing untextured smooth gypsum board, use damp sponge along edge of joints where nap of paper has been raised by sanding.

H. Wood:
   1. Ensure that surfaces are clean and dry.
   2. Sandpaper wood *(except saw-textured wood, when specified)* smooth to provide even surface and then dust off and wipe clean.

3. Touch up knots and pitch pockets with shellac on interior wood.
4. After priming coat has been applied, thoroughly fill nail holes, irregularities and cracks using plastic wood filler for stained or natural finish, and putty for painted work.

I. Ferrous Metals:
1. Clean ungalvanized ferrous metal surfaces that have not been shop coated or are not otherwise specified to receive high performance coatings.
2. Remove oil, grease, dirt, loose mill scale, and other foreign substances.
3. Use solvent (SSPC SP-1) or mechanical cleaning methods (SSPC SP-2 and SP-3) that comply with The Society for Protective Coatings (SSPC) recommendations.
4. Where rust or scale is present, wire brush and sandpaper clean.
5. Clean field welds and abraded portions of field welded and erected ferrous metal components.

J. Galvanized Surfaces:
1. When indicated to be painted, clean galvanized surfaces with non-petroleum-based solvents complying with SSPC SP-1, so surface is free of oil and surface contaminants.
   a. When necessary, brush blast surfaces complying with SSPC SP-7 to remove burrs and rough spots.
2. Remove pretreatment from galvanized sheet metal fabricated from coil stock by mechanical methods.
3. Spot prime field connections, welds, soldered joints, and burned and abraded portions.
4. Sand or etch factory finished surfaces indicated to be repainted to increase adherence of finish coats.

K. Paintable Caulk Installation:
1. Comply with general sealant installation requirements in Section 09 9200.
2. Use only for caulking of followings joints in dry areas:
   a. Perimeter caulking of:
      1) Interior door frames.
      2) Casework not subject to moisture.
3. Joint Design:
   a. Width of joint should be approximately12 times anticipated movement and fall within range of 1/4 inch to 3/4 inch

3.03 MATERIAL PREPARATION

A. Mix and prepare painting materials in field following manufacturer's directions.

B. Store materials not in actual use in tightly covered containers.
1. Maintain containers used in storage, mixing and application of paint in clean condition, free of foreign materials and residue.

C. Stir materials before application to produce mixture of uniform density:
1. Stir as required during application.
2. Do not stir surface film into material.
3. Remove film and, if necessary, strain material before using.

3.04 APPLICATION

A. Apply paint following manufacturer's directions.
   1. Use applicators and techniques best suited for substrate and type of material being applied.
   2. Mix to proper consistency.
   3. On brush-applied work, brush out smooth leaving minimum of brush marks, with paint uniformly flowed on.

B. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, and conditions otherwise detrimental to formation of durable paint film.

C. Apply paint to clean, dry, prepared surfaces only.
   1. Apply paint material evenly, smoothly flowed on without runs, sags, or holidays.

D. Provide finish coats compatible with primers used.

E. Minimum Coating Thickness:
   1. Apply each material at not less than manufacturer's recommended spreading rate, to provide a total dry film thickness of not less than 5.0 mils for entire coating system of prime and finish coats for 3 coat work.
   2. Provide total dry film thickness of not less than 3.5 mils for entire coating system of prime and finish coat for 2 coat work.

F. Number of coats and film thickness required is same regardless of application method.
   1. Do not apply succeeding coats until previous coat has cured as recommended by manufacturer.
   2. Sand between applications where sanding is required to produce even smooth surface following manufacturer's directions.

G. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance.
   1. Give special attention to ensure that surfaces, including edges, corners, crevices, welds, and exposed fasteners, receive dry film thickness equivalent to that of flat surfaces.
   2. Number of coats specified herein are minimum to be applied.
      a. Apply additional coats in event full coverage is not obtained or required total thickness of paint does not comply with mil thickness recommended by paint manufacturer.

H. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces.

I. Included Work:
   1. Finish tops, bottoms, and edges of doors same as balance of door.
   2. Where walls are specified to be painted, include columns, arrises, reveals, soffits, returns, and like surfaces.

J. Priming:
   1. Where shop coats and touch-up painting are specified under other sections of Work, omit prime coat.

K. Completed Work:
   1. Match approved samples for color, texture, and coverage.
   2. Remove, refinish, or repaint work not in compliance with specified requirements.

3.05 CLEANING AND PROTECTION

A. Cleaning:
   1. At end of each work day, remove empty cans, rags, rubbish, and other discarded paint materials from Project Site.
   2. Remove paint, varnish and brush marks from glazing material
   3. Upon completion of painting work, wash and polish glazing material both sides.
      a. Remove and replace glazing material, which has been damaged by painting operations, with new material.
   4. Comply with additional cleaning requirements specified in Section 01 7423.

B. Protection:
   1. Protect work of other trades, whether to be painted or not, against damage by painting.
   2. Correct damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect.

C. Protect floors and adjacent surfaces from paint smears, spatters, and droppings:
   1. Use dropcloths to protect floors.
   2. Cover fixtures and mask off areas where required.

D. Provide “Wet Paint” signs and barricades to protect newly painted finishes.
   1. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations.

E. At completion of work of other trades, touch-up and restore damaged and defaced painted surfaces.

3.06 PAINT SYSTEM SCHEDULES – GENERAL

A. Provide following paint systems for substrate indicated.
   1. Products must meet or exceed current applicable regulations of agencies listed in Regulatory Requirements Article.

3.07 SCHEDULE OF EXTERIOR PAINT SYSTEMS

A. **Paint System Type 2:**
   1. Type and Gloss: 100 percent Acrylic, Eggshell
   2. Use: Portland Cement Plaster
      a. Primer (1st Coat):
         1) SLPR00-2-WH SUPER-LOC Premium
      b. 2nd and 3rd Coats:
         1) EVSH30-3 EVERSHIELD Exterior Eggshell

B. **Paint System Type 5:**
   1. Type and Gloss: 100 percent Acrylic, Semi-Gloss
   2. Use: Concrete Masonry Units (CMU)
      a. Primer (1st Coat):
         1) SBPR00 Smooth BLOCFIL Premium
      b. 2nd and 3rd Coats:
         1) SSHL50 SPARTASHIELD Semi-Gloss Exterior Semi-Gloss

C. **Paint System Type 8:**
   1. Type and Gloss: Water-based Acrylic Urethane, Semi-Gloss
   2. Use: Exterior Hollow Metal Doors and Frames, except where otherwise specified.
      a. Primer:
         1) UGPR00 ULTRA-GRIP Interior/Exterior, *or*
         2) BRPR00 Block Rust Premium, *or*
         3) ENPR00 ENDURAPRIME Metal Primer
      b. 2nd and 3rd Coats:
         1) ENCT50 ENDURA-COAT Semi-Gloss

D. **Paint System Type 10:**
   1. Type and Gloss: Enamel, Semi-Gloss
   2. Use· Galvanized Metal, where indicated
      a. Pretreatment:
         1) SC-ME-01 Krud Kutter Metal Clean & Etch
      b. Primer (1st Coat):
         1) UGPR00 ULTRA-GRIP Premium, *or*
         2) ULGM00-WH ULTRASHIELD Interior/Exterior Galvanized Metal Primer
      c. 2nd and 3rd Coats:
         1) ENCT50 ENDURA-COAT Semi-Gloss

E. **Paint System Type 12:**
   1. Type and Gloss: Enamel, Semi-Gloss
   2. Use: Ferrous Metal, (other than sheet metal flashing and trim), except where specified to be prefinished or to receive high performance coatings specified in Section 09 9600.
      a. Primer (1st Coat):
         1) ENPR00 ENDURAPRIME Metal Primer
      b. 2nd and 3rd Coats:
         1) ENCT50 ENDURA-COAT Semi-Gloss

F. **Paint System Type 13:**
   1. Type and Gloss: Aliphatic Urethane; Semi-Gloss
   2. Use: Exterior ferrous metal sheet metal flashing and trim, except where specified to be prefinished or to receive high performance coatings specified in Section 09 9600.
      a. Primer (1st Coat):
         1) Epoxy Mastic:
            a) Carboline Carbomastic 15
      b. 2nd Coat:
         1) Aliphatic Acrylic-Polyester Polyurethane:
            a) Carboline Carbothane 133 MC

G. **Paint System Type 14:**
1. Type and Gloss: Aliphatic Urethane; Semi-Gloss
2. Use: Exterior galvanized metal sheet metal flashing and trim, where indicated.
   a. Spot Primer:
      1) Epoxy Mastic:
         a) Carboline Carbomastic 15
   b. Primer (1st Coat):
      1) Polymeric Epoxy Amine:
         a) Carboline Rustbond
   c. 2nd Coat:
      1) Aliphatic Acrylic-Polyester Polyurethane:
         a) Carboline Carbothane 133 MC

3.08 SCHEDULE OF INTERIOR PAINT SYSTEMS

A. **Paint System Type 24:**
1. Type and Gloss: Semi-Gloss
2. Use: Exposed, interior ferrous metal surfaces indicated, including hollow metal doors, frames, access doors, panels, and other metal surfaces indicated.
   a. Primer (1st Coat):
      1) UGPR00-1 ULTRA-GRIP Premium, Multi Purpose Primer
   b. 2nd and 3rd Coats:
      1) SWLL50 SPARTAWALL Low Odor, Zero VOC, Interior Semi-Gloss,

B. **Paint System Type 29:**
1. Type and Gloss: Eggshell
2. U se: Gypsum Board
   a. Primer (1st Coat):
      1) VNPR00-1 VINYLASTIC Premium Interior Wall Sealer
   b. 2nd and 3rd Coats:
      1) SWLL30 SPARTAWALL Low Odor, Zero VOC, Interior Eggshell

C. **Paint System Type 30:**
1. Type and Gloss: Semi-Gloss
2. Use: Gypsum Board
   a. Primer (1st Coat):
      1) VNPR00-1 VINYLASTIC Premium Interior Wall Sealer
   b. 2nd and 3rd Coats:
      1) SWLL50 SPARTAWALL Low Odor, Zero VOC, Interior Semi-Gloss

D. **Paint System Type 31:**
1. Type and Gloss: Semi-Gloss
2. Use: Wood Doors, Opaque (Medium Density Overlay (MDO), or as specified
3. RolIer application by shortnap roller.
   a. Primer (1st Coat):
      1) UGPR00 ULTRA-GRIP Premium Primer
   b. 2nd and 3rd Coats:
      1) SWLL50 SPARTAWALL Low Odor, Zero VOC, Interior Semi-Gloss

3.09 SPECIAL TREATMENT OF SPECIFIC SURFACES

A. **Paint System Type 38:**
1. Type and Gloss: Flat Black
2. Use:
   a. Ducts visible through grilles and registers
   b. Reveals at ceiling edges
   c. Structure visible through glass above ceiling line, unless indicated otherwise
   d. Primer (1st Coat): UGPR00 ULTRA-GRIP Premium
   e. 2nd Coat:
      1) SZRO10 SPARTAZERO Low Odor, Zero VOC, Interior Flat

B. **Paint System Type 39:**
1. Type and Gloss: Waterborne, Acrylic, Flat.
2. Use: Concrete Play Courts-Striping, exterior concrete stair treads
   a. One Coat:
      1) VSZM10-1 VIN-L-STRIPE Interior/Exterior Zone Marking Paint
3. Allow concrete to cure as required by paint manufacture before applying paint.
4. Cleaning: Sweep and clean surface to eliminate loose material and dust.
5. Apply paint with mechanical equipment to produce uniform straight edges.
   a. Use painting equipment, masking and templates specifically designed for this purpose.
   b. Protect adjoining work from damage.
6. Layout play courts to exact requirements of Owner.
   a. Verify layout line widths, and colors prior to painting.

C. **Paint System Type 42:**
1. Miscellaneous Mechanical and Electrical Work:
   a. Paint exposed surfaces of mechanical and electrical Work not otherwise specified, including but not limited to following:
      1) Interior plumbing, HVAC, and electrical, factory-primed equipment, apparatus, pipes and fittings.
      2) Vents, ducts, miscellaneous supports and hangers.
      3) Electrical conduit, fittings, pull boxes, outlet boxes, and other unfinished surfaces of mechanical and electrical Work.
      4) Miscellaneous factory-primed metal cabinets, and panels.
2. Provide paint systems for each type of material in accordance with paint manufacturer's recommendations, unless otherwise indicated.
   a. Make submittals of each system for Architect's review, in accordance with requirements of this Section and Section 01 3300.
3. Colors: As scheduled.

END OF SECTION 09 9100

SECTION 09 9600

HIGH PERFORMANCE COATINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Preparation, priming, and application of high performance coatings, including but not necessarily limited to, following:
      a. Architecturally Exposed Structural Steel (AESS) and related steel components
      b. Exterior steel stair support framing
      c. Exterior steel handrails and guardrails

B. Related Sections:

1.	Section 05 0513:	Shop-Applied Coatings for Metal; factory applied high performance finishes on aluminum and coil-coated steel.
2.	Section 05 1200:	Structural Steel Framing; shop cleaning and priming of structural steel (AESS) and fireproofed steel specified to receive high performance coatings
3.	Section 05 3000:	Metal Decking
4.	Section 05 5000:	Metal Fabrications; shop cleaning and priming of miscellaneous metal specified to receive high performance coatings
5.	Section 08 1113:	Hollow Metal Doors and Frames
6.	Section 09 9100:	Painting; galvanized/ungalvanized ferrous metal not specified to receive high performance coatings.

1.02 REFERENCES

A. National Association of Architectural Metal Manufacturers (NAAMM):
   1. AMP 500 – Metal Finishes Manual

B. The Society for Protective Coatings (SSPC):
   1. SSPC SP 1 – Solvent Cleaning.
   2. SSPC SP 2 – Hand Tool Cleaning.
   3. SSPC SP 3 – Power Tool Cleaning.
   4. SSPC SP 6 – Commercial Blast Cleaning.
      a. For shop preparation only
   5. SSPC-SP11 – Power Tool Cleaning to Bare Metal.

C. South Coast Air Quality Management District (SCAQMD):
   1. Rule 1113 – Architectural Coatings

1.03 SUBMITTALS

A. Product Data:
   1. For each coating system specified; including primers.
   2. Material List:
      a. Provide inclusive list of required coating materials.

1) Indicate each material and cross-reference specific coating, finish system, and application.
2) Identify each material by manufacturer's catalog number and coating material proposed for use.

3. Manufacturer's Information:
   a. Provide manufacturer's technical information, including instructions for handling, storing and applying each coating material proposed for use.
4. Certification by manufacturer that products supplied comply with local regulations controlling use of Volatile Organic Compounds (VOC).

B. Samples:
1. Applied finishes on steel, for color and finish.
2. Provide minimum 4 by 8 inch pieces, and 8 inch lengths of larger sizes as required to show finished work.

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

1.04 QUALITY ASSURANCE

A. Applicator Qualifications:
1. Engage experienced applicator who has completed high performance coating system applications similar in material and extent to that indicated for this Project with record of successful in-service performance.

B. Coating manufacturer's technical representative will perform following:
1. Conduct periodic inspections of surface preparation and coating operations in shop and field, as required to obtain specified warranty.
2. Coating contractor is responsible for contacting coating manufacturer's technical representative to arrange for required inspections.
3. Notify Architect when Contractor fails to meet any portion of specification.

1.05 WARRANTIES

A. Special Finish Warranty:
1. Manufacturer's standard form in which manufacturer agrees to repair or replace components on which finishes fail within specified warranty period.
2. Warranty does not include normal weathering.
3. Warranty Period:
   a. 10 years from date of Substantial Completion for Type A coating
   b. 5 years from date of Substantial Completion for Type B coating system.

B. Jointly warrant completed high performance coatings by respective coating manufacturer and coating applicator to meet weathering tests and performance requirements as specified.
1. Coating applicator must apply for coating warranty at time of application.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design Products:
   1. High Performance Coatings on steel are based on following systems as manufactured by The Carboline Company:
      a. Type B: Organic Zinc-Rich EpoxylWaterborne Acrylic Polyurethane System.

B. Alternate Basis-of-Design Products:
   1. High Performance Coatings on steel may be based on following systems as manufactured by Tnemec Company:
      a. Type B: Zinc-Rich Aromatic Urethane/Waterborne Acrylic Polyurethane System

C. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 1600 and following:
   1. Submit items listed under Submittals and as specified in Section 01 3300, for evaluation of proposed system.
   2. Document that tests have been made for identical systems within ranges of specified performance standards and criteria for application to specified substrates.
   3. Acceptance is also subject to availability of acceptable color matching specified color.
   4. Copy of manufacturer's minimum 10 year finish and material warranty.

2.02 COATING MATERIALS – GENERAL

A. Material Compatibility:
   1. Provide primers and finish coat materials that are compatible with one another and substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

B. Material Quality:
   1. Provide manufacturer’s highest grade of various high performance coatings specified; of uniform color throughout and color-fast.
   2. Materials not displaying manufacturer’s product identification are not acceptable.

C. Coating manufacturers and coating applicators are required to develop jointly methods and procedures for surface preparation, priming, and finish coating of materials.

2.03 HIGH-PERFORMANCE COATING SYSTEMS

A. High Performance Coating System Type B:
   1. High performance pigmented two component system consisting of shop-applied organic zinc-rich epoxy primer and field-applied aliphatic acrylic polyurethane finish coat, as manufactured by Carboline Company, which meets or exceeds following performance provisions:
      a. Resistant to abrasion, corrosion, and chemical exposure.

b. Repel surface dirt and contaminates.

2. Provide two coat system consisting of:
   a. Primer Coat: Carbozinc 859 VOC Organic Zinc-Rich Epoxy Primer at 3.0 to 5.0 mils dry film thickness.
      1) VOC Value: 95 g/l, as supplied/unthinned.
   b. Finish Coat: Carbothane 133 MC Aliphatic Acrylic-Polyester Polyurethane at 3.0 to 5.0 mils dry film thickness
      1) VOC Value: 97 g/l, as supplied/unthinned.
      2) Color: As selected by Architect.

B. Alternate High Performance Coating System Type B:
   1. High performance pigmented two component system consisting of shop-applied aromatic zinc-rich urethane primer and field-applied aliphatic acrylic polyurethane finish coat, as manufactured by Tnemec Company, which meets or exceeds following performance provisions:
      a. Resistant to abrasion, corrosion, and chemical exposure.
      b. Repel surface dirt and contaminates.
   2. Provide two coat system consisting of:
      a. Primer Coat: Tnemec Hydro-Zinc Series 94-H_2O Zinc-Rich Aromatic Urethane Primer at 2.5 to 3.5 mils dry film thickness.
         1) VOC Value: 89 g/l, as supplied/unthinned.
      b. Finish Coat: Tnemec Endura-Shield Series 1095 Aliphatic Acrylic Polyurethane at 2.0 to 5.0 mils dry film thickness.
         1) VOC Value: 88 g/l, as supplied/unthinned.
         2) Color: As scheduled.

C. Apply Coating System Type B to:
   1. Architecturally Exposed Structural Steel (AESS) and related steel components exposed to view at completion of Work.
   2. Steel pipe handrails and guardrails.

2.04 SOURCE QUALITY CONTROL

A. Source Limitations:
   1. Obtain primers for each coating system from same manufacturer as finish coats.

2.05 PERFORMANCE REQUIREMENTS

A. Provide coating systems suitable for shop and field application to steel.

B. Conform to applicable performance standards of following where referenced in specification:
   1. National Association of Architectural Metal Manufacturers (NAAMM): “Metal Finishes Manual”
   2. ASTM International (ASTM).
   3. The Society for Protective Coatings (SSPC).

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Surfaces to receive high performance coating must be free of grinding marks and weld splatter.
   1. Grind welds smooth.

B. Finish visible surfaces of exposed Work.
   1. Visible surfaces are defined as surfaces which will be exposed to view from exterior and in interior of completed building.

C. Perform finishing after fabrication, forming, fitting, and welding have been completed.

D. Finishes on Exposed Work:
   1. Be uniform in appearance.
   2. Members are to match each other exactly throughout installed Work.

E. Specified finishes establish type and quality required.
   1. Applied finishes are subject to Architect's acceptance.

3.02 SHOP CLEANING AND PRIMING OF EXPOSED STEEL

A. Exposed Structural Steel:
   1. Comply with requirements of Sections 05 1200, 05 5000, and following:
      a. Clean surfaces just prior to painting in accordance with SSPC-SP1 – Solvent Cleaning to remove dirt and contaminants, followed by dry-blast cleaning in accordance with SSPC-SP 6 – Commercial Blast Cleaning.
   2. Fill small pit marks in otherwise smooth, sound surfaces with metallic compound, finish flush and smooth.
   3. Apply one coat of specified zinc-rich primer after fabrication and cleaning.
      a. Apply two coats to surfaces that will be inaccessible after fabrication or after installation.

3.03 FIELD CLEANING OF EXPOSED STEEL

A. Exposed structural steel and other metal surfaces specified to receive high performance coatings must be free of grinding marks and weld splatter.
   1. Welds are to be ground smooth.
   2. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, resulting from Work of this Section in accordance with SSPC-SP 11 as required.

3.04 FIELD TOUCH-UP OF SHOP PRIMER

A. Field Touch-Up of Shop Primer:
   1. Touch up by spot priming shop-applied primer as necessary in exposed areas with same paint used for shop prime painting.
      a. Apply by brush or spray to provide minimum dry film thickness of 2.0 mils.

3.05 FIELD FINISH PAINTING OF EXPOSED STEEL AND OTHER METAL COMPONENTS

A. Field apply one finish coats of Type B high performance finish specified, to exposed surfaces of interior and exterior stair support framing, and exterior steel handrails and guardrails, in accordance with coating manufacturer's recommendations and instructions.

3.06 CLEANING

A. Comply with Section 01 7423 and following:
   1. Clean in accordance with coating manufacturer’s recommendations.
   2. Do not use materials or methods which may damage finishes or surrounding construction.

3.07 PROTECTION

A. Protect finished surfaces from damage until acceptance by Owner.

END OF SECTION 09 9600

SECTION 10 1100

VISUAL DISPLAY UNITS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Wall mounted markerboards of size indicated.

B. Related Sections:
   1. Section 06 1013: Miscellaneous Carpentry.
   2. Section 06 4000: Architectural Woodwork.
   3. Section 09 7200: Wall Covering; tackable wall covering.
   4. Section 09 9100: Painting.

1.02 REFERENCES

A. ASTM International (ASTM):
   1. ASTM C346 – Standard Test Method for 45-deg Specular Gloss of Ceramic Materials.
   2. ASTM D1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes.

B. Porcelain Enamel Institute (PEI):
   1. Technical Manuals:
      a. PEI-1001 – Specifications for Architectural Porcelain Enamel
      b. PEI-1002 – Manual and Performance Specifications for Porcelain Enamel Writing Surfaces
   2. Property Bulletins:
      a. PEI 501 – Appearance Properties
      b. PEI 502 – Mechanical and Physical Properties

1.03 SUBMITTALS

A. Shop Drawings:
   1. Indicate gages, profiles, sections of materials, details of construction, hardware, methods of attachment or anchoring, as applicable for specified materials.

B. Samples:
   1. Minimum of four 3 inch x 5 inch samples of markerboard.
   2. Colors as selected or scheduled by Architect from manufacturer's full range of available colors.

C. Product Data:
   1. Manufacturer's technical data, product specifications, installation instructions, and other pertinent information as applicable for each product or material specified.

D. Test Reports:
   1. Certified laboratory test reports as applicable to indicate compliance with specified requirements.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Has been regularly engaged in business of manufacturing markerboards for at least 5 years.

B. Markerboard Finish:
   1. Comply with requirements and recommendations of applicable portions of Porcelain Enamel Institute Technical Manuals.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to the Project site with manufacturer's labels intact and legible.

B. Deliver factory-built units completely assembled in one piece without joints, whenever possible.
   1. Where dimensions exceed panel size, provide 2 or more pieces of equal length, as acceptable to Architect.
   2. When overall dimensions require delivery in separate units, prefit at factory, disassemble for delivery, and make final joint at a site.
   3. Use splines at joints to maintain surface alignment and smooth joints.

C. Provide means necessary to protect markerboards before, during and after installation.

1.06 PROJECT CONDITIONS

A. Sequencing, Scheduling:
   1. Coordinate with related Work of other sections including gypsum board and tackboards.
   2. Do not install markerboards and tackboards until surfaces concealed behind them have been painted.

1.07 SPECIAL PROJECT WARRANTY

A. Manufacturer’s Warranty:
   1. Material Warranty for Markerboards:
      a. Warranty Period:
         1) 50 years from date of Substantial Completion..

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design:
   1. Design of Markerboards is based on products as manufactured by Claridge Products and Equipment, Inc., Harrison, AR

B. Alternate Acceptable Manufacturers:
   1. A-1 Visual Systems, Gardena, CA

2. Chatfield-Clarke Company, Fontana, CA
3. Platinum Visual Systems, Corona, CA

2.02 MATERIALS

A. Wall-Mounted Markerboards:
   1. Dry Markerboards:
      a. Porcelain enamel steel manufactured to exceed performance specifications for porcelain enamel per PEI-1002 of Porcelain Institute.
      b. Capable of supporting papers by means of magnets.
      c. Writing Surface:
         1) Resist wear and damage from shock and abrasion and not dent, shatter or crack.
         2) Retain original color, writing, and erasing qualities and not become glossy or shiny in normal use.
         3) Gloss Variation of Surface:
            a) Not to exceed 3 units when measured by 45 degree gloss meter in accordance with PEI 501 – Appearance Properties and ASTM C 346.
   2. Steel:
      a. Base Metal:
         1) High quality enameling iron or steel of low metalloid and copper content, especially manufactured and processed for temperatures over 1,400 degrees F
         2) Used in coating porcelain on steel units for architectural purposes. minimum 24 gage.
   3. Facing Surfaces:
      a. Board surfaces consisting of following:
         1) Vitreous-porcelain writing surface coating of 0.0025 inch minimum thickness.
         2) Reverse side of steel base sheet to receive ground coat of 0.0005 inch thickness and spray coat of silicon.
         3) Panel edges at butt joints: Porcelain enamel.
         4) Fuse cover and ground coats to steel at manufacturer's standard firing temperature, but not less than 1,250 degrees F.
   4. Dry markerboard surfaced steel:
      a. Factory laminated to 7/16 inch thick fiberboard core.
      b. Provide moisture blocking backing sheet.
      c. Core:
         1) 45 pound particle board.
      d. Moisture Barrier Backer Sheet:
         1) Minimum 0.015 inch aluminum or 28 gage galvanized steel.
         2) Backer sheet:
            a) Factory laminated to core under pressure.
   5. Lamination:
      a. Surface facing and backing bonded to core material by means of special flexible adhesive developed for this purpose with no unbonded area.
      b. Face and Back:
         1) Not able to be removed without rupturing core material.
      c. Panels:
         1) Will not delaminate under normal use.

6. Joints:
    a. Where vertical joints occur, fit 14 gage continuous concealed steel spline tightly into grooves in core material.
    b. Factory rabbet to produce smooth butt joint.
    c. Do not furnish exposed trim.

B. Trim and Accessories:
1. General:
    a. Fabricate frames and trim of not less than 0.062 inch thick aluminum alloy, size and shape as indicated, to suit type of installation.
    b. Provide straight, single-length units wherever possible and keep joints to minimum.
    c. Miter corners to a neat, hairline closure.
    d. Finish for Exposed Aluminum Trim, Accessories and Fasteners:
        1) Satin anodized AA-M31A31.
2. Edge Trim*:*
    a. Extruded aluminum, Alloy 6063-T5.
3. Accessories Tray:
    a. Furnish manufacturer's standard continuous flat-ribbed or box-type with slanted front, aluminum accessories tray with cast aluminum end closures for each markerboard.
    b. Extend accessories tray to end of both vertical edges of board.
    c. On flat-rib tray, provide 3/4 inch radius on comers and polish at ends.
4. Map Rail:
    a. Furnish map rail at top of each unit, complete with following accessories:
5. Display Rail:
    a. Provide continuous cork display rail two inch wide, as indicated, integral with map rail.
        1) Extend display rail to end of both vertical edges.
6. End Stops:
    a. Provide one end stop at each end of map rail.
7. Map Hooks:
    a. Provide 2 map hooks with flexible metal clips for each 4 feet of map rail or fraction thereof.

2.03 FABRICATION

A. Assembly:
1. Provide factory-assembled units unless field-assembled units are indicated.

2.04 SYSTEM PERFORMANCE

A. System comprised of factory assembled markerboards, in configurations and sizes indicated or as specified.

B. Laminations of panel components performed by face sheet manufacturer.

PART 3 EXECUTION

3.01 PREPARATION

A. Field Measurements:
   1. Take field measurements prior to preparation of shop drawings and fabrication where possible, to ensure proper fitting of Work.
   2. Allow for trimming and fitting wherever taking of field measurements before fabrication might delay Work.

3.02 INSTALLATION

A. Install boards in locations and mounting heights as shown and in accordance with manufacturer's instructions and reviewed Shop Drawings
   1. Provide grounds, clips, backing materials, brackets and anchors, trim, and accessories required for complete installation.
   2. Fasteners for assembly of trim and frame units:
      a. Truss head aluminum or stainless steel self-tapping screws with double cadmium-plated finish.

B. Coordinate site-assembled units with grounds, trim, and accessories.
   1. Join parts with neat, precision fit.

C. Install units with concealed hangers plumb and level, in accordance with manufacturer's printed instructions.

D. Install panels after finish painting of wall surfaces has been completed and paint is cured.
   1. Install panels level, plumb and neatly assembled.
   2. Prior to Substantial Completion, completely clean trim of dirt, finger-marks, or other foreign material.

3.03 ADJUST AND CLEAN

A. Verify that accessories required for each unit are properly installed and operating units properly functioning.

B. Clean units in accordance with manufacturer's instructions.

C. Remove and legally dispose of rubbish, debris, and waste materials off Project Site.

3.04 PROTECTION

A. Protect Work until Substantial Completion.

END OF SECTION 10 1100

SECTION 10 1400

SIGNAGE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Furnishing materials, labor, and equipment necessary for completion of signage as indicated on Drawings and as specified.
   2. Types of signage include, but is not necessarily limited to following:
      a. Interior and exterior room signs and directional signs
      b. Geometric restrooms signs
      c. Evacuation plans
      d. Exterior regulation and directional signage.
      e. Exterior building signs.
         1) Includes Premises Identification signage.
   3. Engaging independent Braille reading consultant.

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 05 0513: Shop-Applied Coatings for Metal
   3. Section 32 1723: Pavement Markings; accessible parking striping

C. Related Requirements:
   1. Refer to Division 26 Sections for illuminated exit signs.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, current edition.
   1. Part 2, California Building Code (CBC), Volumes 1 and 2.
      a. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.
   2. Part 9, California Fire Code (CFC):
      a. Chapter 5, Section 505 – Premises Identification.

1.03 DEFINITIONS

A. Accessible Route:
   1. Continuous unobstructed path that complies with California Building Code (CBC).

B. Characters:
   1. Letters, numbers, punctuation marks, and typographic symbols.

C. Circulation Path:
   1. Exterior or interior way of passage from one place to another for pedestrians, including, but not limited to, walks and hallways.

D. Common Use:
   1. Interior and exterior rooms, spaces, or elements made available for occupancy by students, staff, or others visiting or utilizing facilities.

E. Facility:
   1. Portions of buildings, structures, equipment, walks, passageways, or other real or property located on Project Site.

F. ISA:
   1. International Symbol of Accessibility

G. Pictogram:
   1. Pictorial symbol, which is recognized as representing activities, facilities, or concepts.

H. Premises Identification:
   1. Building address identification complying with CFC Section 505.1

I. Sign:
   1. Architectural element composed of displayed text, symbolic, tactile or pictorial information.

J. Space:
   1. Definable area, such as room, toilet room, hall, entrance, storage room, or lobby.

K. Tactile:
   1. Object that can be perceived through sense of touch.

1.04 SYSTEM DESCRIPTION

A. Comply with most stringent requirements of CBC, current edition, Chapter 11B for following:
   1. Tactile character type and size.
   2. Finish and contrast.
   3. Raised and visual characters.
   4. Visual character and line spacing height and installation height.
   5. Braille:
      a. Use California (Contracted) Grade 2 Braille wherever Braille is required.
   6. Tactile sign inst allation height and location.
   7. Parking lot entrance signs and accessible parking space identification signs.
   8. Circulation path signs leading from public right of ways, public transportation, and parking lots.
   9. Identify accessible building entrances with ISA per CBC Section 11B-216.6.
   10. Identify each permanent room and space required to be identified by sign with sign installed adjacent to door it identifies, with raised characters and Braille.
   11. Tactile Exit Signs: Required per CBC Section 1013.4
   12. Signs indicating provision of special equipment for hearing impaired (i.e. TTY phone, volume control phones, and Assistive Listening Systems (ALS).

1.05 SUBMITTALS

A. Product Data:
   1. Manufacturer's technical data and installation instructions for each type of sign required.

B. Samples:
   1. Each sign form and material showing finishes, colors, surface textures and qualities of manufacturer and design of each sign component including graphics.
      a. Full-size sample units, when requested by Architect.
      b. Acceptable units may be installed as part of Work.

C. Shop Drawings:
   1. For fabrication and erection of signs.
      a. Include plans, elevations, and large scale details of sign wording and lettering layout.
      b. Show anchorages and accessory items.
      c. Furnish location template drawings for items supported or anchored to permanent construction.
      d. Furnish full-size spacing templates for individually mounted letters.

1.06 QUALITY ASSURANCE

A. Uniformity of Manufacturer:
   1. For each separate type of sign required, obtain signs from one source from single manufacturer.

B. Accessibility:
   1. Comply with CBC, Chapter 11B.
      a. Provide tactile exit signage complying with CBC Section 1013.4.

C. Independent Braille Reading Consultant:
   1. Engage independent Braille Reading Consultant to read and confirm that Braille on signage matches words on signs.
   2. Fabricate signs prior to Braille reading consultant reading signs.
      a. Physical fingertip to sign verification is required.
      b. Exceptions to this requirement are not permitted and will not be approved.
   3. When signs have been fabricated, they are to be sent to Braille Reading Consultant for verification and confirmation of compliance.
      a. Signs not in compliance are to be brought to attention of District/Owner and Architect prior to refabrication.
      b. Upon completion of review of non-compliant signs by District/Owner and Architect, those signs are to be refabricated at no additional cost to District/Owner.
      c. A final review of newly fabricated signs are to be verified and confirmed in compliance by the Braille Reading Consultant prior to installation.
   4. Provide letter from Braille Reading Consultant to District/Owner and Architect that complete review of Braille signage has been performed in accordance with requirements set forth in these Specifications.
   5. Braille Reading Consultant:
      a. Following agency has been approved by District/Owner:
         1) Wayfinder Family Services, 5300 Angeles Vista Blvd., Los Angeles, CA 90043.
         2) Contact:
            a) Allison Burdett, 323-295-4555, aburdett@wayfinderfamily.org
      b. Other Braille reading consultants may be used but will require prior approval by Architect before award of Contract.
         1) No consultants will be approved after award of Contract.

PART 2 PRODUCTS

2.01 GENERAL

A. Letter Style:
   1. Helvetica Medium, unless indicated otherwise..
   2. Upper Case Letters only.

B. Letter Style for Premises Identification Signs:
   1. Arabic Numbers and alphabetical letters.
   2. Upper Case Letters only.

2.02 CAST METAL PLAQUES

A. Manufacturer:
   1. One of following or approved equal:
      a. Gemini, Inc.
      b. Metal Arts; Div. of L & H Mfg.
      c. Mills Manufacturing, Inc.
      d. Southwell Co.

B. Type:
   1. Cast bronze plaques using lead-free red brass.

C. Fabricate cast metal plaques of size, shape and thickness shown.
   1. Provide units free of pits, scale, and sand holes or other defects, with required raised letters, numbers, and characters.
   2. Hand tool and buff to provide clean, sharp figures with bright finish.
   3. Protect exposed surfaces with 2 coats of clear, non-yellowing lacquer.
   4. Letters raised 1/8 inch.
   5. Background Texture: Dark pebbled texture.
   6. Border: Straight edge.
   7. Size: 16 by 20 inches.

D. Provide rosette covers and expansion bolts for mounting.

E. Provide plaque with following text; verify exact wordage.
   1. Building Name.
   2. School District Board of Education.
   3. Architect's Name.
   4. Contractor's Name.
   5. Date of Dedication.

2.03 DIMENSIONAL METAL LETTERS

A. Manufacturer:
   1. One of following or approved equal:
      a. ASI Sign Systems
      b. Gemini, Inc.
      c. Metal Arts; Div. of L & H Mfg.
      d. Mills Manufacturing, Inc.
      e. Southwell, Co.

B. Type:
   1. Individual cast aluminum letters.

C. Furnish cast metal letters and numbers of size, identification as shown on drawings.
   1. Furnish cast units with smooth flat faces, sharp corners, true lines and accurate profiles.
   2. Provide units free of pits, scale, sand holes, or other defects.

D. Finish:
   1. Metal Finish Type A as specified in Section 05 0513..

2.04 PLASTIC SIGNS

A. Basis-of-Design:
   1. Design for interior plastic room signs is based on Best Sign Systems standard HC 300 ADA System plaque signs and accessories as manufactured by Best Plastics, Inc., Montrose, CO.

B. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:
   1. Submit items listed in “Submittals” Article and as specified in Section 01 3300, for evaluation of proposed system.
   2. Complete project shop drawings for similar project may be submitted for evaluation purposes, however shop drawings specific to this Project will be required from successful bidder.
   3. Copy of manufacturer's finish and material warranty.

C. Material:
   1. Plaque stock of laminated phenolic and melamine plastic (MP) for interior signs and fiberglass (FP) for exterior signs suited for graphic sandblast process.
   2. Sign stock with face and core plies suited for integral raised profile of text and braille, in finishes and color combinations indicated or, when not indicated, as selected from manufacturer's standards.
   3. NEMA rated self-extinguishing.
   4. Thickness: 1/4 inch.
   5. Edges: Square cut.
   6. Corners: As indicated on Drawings.

D. Finish and Contrast:
   1. Matte finish with color of characters and symbols contrasting with background by minimum of 70 percent, and have non-glare finish per CBC Sections 11B-703.5.1, 11B-703.6.2, and 11B-703.7.1
   2. Colors as selected by Architect.

E. Raised (Tactile) and Visual Characters:
   1. Provide raised characters minimum of 5/8 inch and maximum of 2 inches high, based on height of uppercase letter “I”, complying with CBC Sections 11B-703.2 and 11B-703.2.5
      a. Accompanied by California Contracted Grade 2 Braille complying with CBC Section 11B-703.2.

2. Proportions:
    a. Select Characters from fonts where width of uppercase letter "O" is 60 percent minimum and 110 percent maximum of height of uppercase letter "I" per CBC Sections 11 B-703.4 and 11 B-703.6
3. Format:
    a. Horizontal Text Format per CBC Sections 11 B-703.2 and 11 B-703.5
4. Stroke Thickness:
    a. Stroke thickness of uppercase letter "I" – 15 percent maximum of height of character per CBC Section 11 B-703.4 and 11B-703.6
5. Raised Character and Line Spacing:
    a. Measure character spacing between two closest points of adjacent raised characters within message, excluding word spaces.
    b. Where characters have rectangular cross sections, make spacing between individual raised characters 1/8 inch minimum and 4 times raised character stroke width maximum.
    c. Where characters have other cross sections, make spacing between individual raised characters 1/16 inch minimum and 4 times raised character stroke width maximum at base of cross sections, and 1/8 inch minimum and 4 times raised character stroke width maximum at top of cross sections.
    d. Separate Characters from raised borders and decorative elements 3/8 inch minimum.
    e. Make spacing between baselines of separate lines of raised message at 135 percent minimum and 170 percent maximum of raised character height per CBC Section 11 B-703.2
6. Visual Character and Line Spacing:
    a. Measure visual character spacing on between two closest points of adjacent characters, excluding word spaces.
    b. Make spacing between individual characters at 10 percent minimum and 35 percent maximum of character height.
    c. Make spacing between the baselines of separate lines of characters within message at 135 percent minimum and 170 percent maximum of character height per CBC Section 11B-703.5
7. Visual Character Height and Installation Height:
    a. Minimum character height complying with CBC Table 11 B-703.5.5
8. Measure viewing distance as horizontal distance between character and obstruction preventing further approach towards sign.
9. Base character height on uppercase letter "I".
    a. Install visual characters at 40 inches minimum above finish floor or ground except for elevator car controls, floor-level exit signs and emergency procedures information per CBC Section 11 B-703.5.
10. Visual Character Case and Style:
    a. Visual Characters on Sign:
        1) Uppercase or lowercase or combination of both and conventional in form.
    b. Characters:
        1) Not to be italic, oblique, script, highly decorative, or of other unusual forms per CBC Section 11 B-703.5
11. Visual Character Stroke Thickness:
    a. Stroke thickness of uppercase letter "I": 10 percent maximum of height of character per CBC Section 11 B-703.5
12. Provide pictograms, where required, complying with CBC Section 11B-703.6.
13. Symbol of accessibility (ISA): Comply with CBC Section 11B-703.7.

F. Braille:
   1. Use California (Contracted) Grade 2 Braille wherever Braille is required, complying with CBC Sections 11B-703.3 and 11B-703.4
   2. Braille Dots:
      a. Locate 0.100 inch on center in each cell with 0.300 inch space between cells, measured from second column of dots in first cell to first column of dots in second cell.
      b. Raised minimum of 0.025 inch above background.
      c. Domed or rounded per CBC Sections 11B-703.3 and 11B-703.3.1
   3. Position Braille below corresponding text in horizontal format, flush left or centered.
   4. Place Multi-lined text, Braille below entire text.
   5. Separate Braille 3/8 inch minimum and 1/2 inch maximum from other tactile characters, and 3/8 inch minimum from raised borders and decorative elements. per CBC Section 11 B-703. 3

G. Applied copy is not acceptable.

H. Geometric Toilet Room Signs:
   1. Comply with CBC Section 11B-703.7.2.6
   2. Fabricated of 1/4 inch thick, non-glare material contrasting with restroom door (light to dark, or dark to light).
   3. Boys/Mens Rooms:
      a. Triangular with equal sides,12 inches in length.
   4. Girls/Women Rooms:
      a. Circle, 12 inch in diameter.
   5. When restroom or other sanitary facility is accessible, place ISA in center of geometric sign.
   6. Non-tactile text, such as “Staff Only”, may be added to sign.
   7. Install signs on door leading into restroom or other sanitary facility, centered on door, with center of sign 60 inches from finished floor.

I. Provide Plastic Signs as indicated in schedule and details.

2.05 PARKING LOT ENTRANCE AND ACCESSIBLE PARKING SPACE IDENTIFICATION SIGNS

A. Sign Requirements:
   1. Parking Lot Entrance Signs:
      a. Comply with CBC Chapter 11B, warning that cars parked in parking spaces reserved for people with disabilities will be towed.
   2. Identify parking spaces reserved for people with disabilities with reflective sign featuring ISA, complying with CBC, Chapter 11B.
      a. Identify van-accessible spaces by including term "Van Accessible” below pictogram on same sign, or install separate sign with words below ISA sign.per CBC Section 11B-502.6

B. Sign Fabrication:
   1. Fabricate signs of 3M Scotchlite Brand reflective sheeting laminated to 18 gage galvanized heavy-duty steel.
   2. Size:
      a. Minimum 17 inches x 22 inches.
   3. White reflective graphics on dark blue reflective background.

4. Character Styles and Proportions:
    a. Minimum of one inch high.
5. Provide with ISA, minimum 8 inches high.
6. Posts:
    a. Provide 0.050 inch thick aluminum, or 14 gage galvanized steel, square tube, 2-1/4 inches square, punched.
    b. Furnish with corrosion and tamper resistant fasteners.

C. Sign Installation and Mounting:
1. Install Parking Lot Entrance Signs on wall or pole in conspicuous place at each entrance to off-street parking facilities, or immediately adjacent to, and visible from each accessible stall or space.
2. Install Parking Space Signs as follows:
    a. On wall or pole at head of each accessible parking space.
    b. In public way, with bottom edge of sign minimum of 80 inches above pavement or ground.
    c. In planting area, parking strip, or on wall, with bottom edge of sign minimum of 60 inches above pavement or ground.

D. Painting and Sriping:
1. Identify reserved parking spaces with ISA at foot of space in compliance with CBC, Chapter 11B.
    a. Stripe access aisles as required.
2. Perform painting and striping in accordance with requirements in Section 32 1723.

2.06 ACCESSIBLE PATH OF TRAVEL SIGNS

A. Accessible Path of Travel Signs:
1. Circulation paths of travel with stairs or other obstacles leading from public right of ways, public transportation, and parking lots, that are not accessible, or do not lead to accessible entrances to building.
    a. Locate accessible route signage at decision points compliant with CBC Chapter 11B directing people with disabilities to accessible routes or entrances.
    b. Locate and install signs so steps will not have to be retraced.
2. Graphics:
    a. White on dark blue background; non-glare, high contrast signs.
    b. Conform to requirements of CBC Chapter 11B
    c. ISA minimum 4-1/2 inches high.
3. Installation Location and Mounting:
    a. Mount sign on post or wall with lower edge of sign between 48 inches and 60 inches above ground or surface.

2.07 INFORMATIONAL SIGNS

A. Building Entrance Signs:
1. Install sign at building entrances stating: “No Smoking in Building”, in accordance with California statute prohibiting smoking in public buildings.
2. When functional spaces have individual entrances from exterior of building, or from courtyard, and such entrances are accessible, one sign can be placed on each exterior elevation stating “All Rooms Have Accessible Entrances.”
    a. Include ISA on such signs, and include phrase: “No smoking in Building”.

B. Room Identification Signs:
   1. Identify each permanent room and space required to be identified by sign with sign installed adjacent to door it identifies, with raised characters and Braille.
      a. This includes entrances to rooms and spaces, which are entered by exterior entrance or by door off interior corridor or courtyard, per CBC Chapter 11B.
   2. Toilet Room Identification Signs:
      a. Include gender pictogram in 6 inch high field.
      b. Locate pictogram field above raised character and Braille text on tactile sign, which is to be located adjacent to latch side of the door, per CBC Chapter 11B.
      c. Where there is not adequate space for sign immediately adjacent to door, and door opens inward, gender pictogram, ISA, and raised characters and Braille can be included on geometric sign installed on door.

2.08 PREMISES IDENTIFICATION SIGNS

A. Address Identification:
   1. Provide address identification signs on [new] [existing] buildings complying with following:
      a. Cast aluminum letters and numerals same as specified for dimensional metal letters.
      b. Furnish address identification characters in contrasting color from background.
         1) Color: As selected by Architect
      c. Provide text consisting of Arabic numbers and alphabetical letters.
         1) Do not spell out numbers.
         2) Refer to Drawings for specific text.
      d. Size of Characters:
         1) Not less than 4 inches high.
         2) Minimum Stroke Width: 1/2 inch

PART 3 EXECUTION

3.01 INSTALLATION

A. General – Locate sign units and accessories where shown, scheduled, or directed by Architect.
   1. Use mounting methods shown or selected by Architect.
   2. Comply with manufacturer's instructions, and CCR, Title 24, Part 2, CBC Chapter 11 B.

B. Install level, plumb, and at proper height with sign surfaces free from distortion or other defects in appearance.
   1. Cooperate with other trades for installation to finish surfaces.
   2. Repair or replace damaged units as directed by Architect.

C. Cast Metal Plaques:
   1. Mount plaques using standard method recommended by manufacturer for type of wall surface indicated.
   2. Concealed Mounting:
      a. Mount plaques by inserting threaded studs into tapped lugs on back of plaque.

b. Set in predrilled holes filled with quick-setting cement.

3. Face Mounting:
   a. Mount plaques using exposed fasteners with rosettes attached through face of plaque into wall.

D. Dimensional Letters and Numbers:
1. Mount letters and numbers using standard fastening methods recommended by manufacturer for letter form, type of mounting, wall construction, and condition of exposure indicated.
2. Provide heavy paper template to establish letter spacing and to locate holes for fasteners.
3. Flush Mounting:
   a. Mount letters with backs in contact with wall surface.
4. Projected Mounting:
   a. Mount letters at projection distance from wall surface indicated.

E. Tactile Sign Installation Height and Location:
1. Locate tactile characters on signs minimum of 48 inches above finish floor or ground surface, measured from baseline of lowest Braille cells and 60 inches maximum above finish floor or ground surface, measured from baseline of highest line of raised characters.
2. Locate tactile signs on approach side of of door at entry or exit, and allow for reach within 0 inches of required clear floor space oer CBC Section and Figure 11B-703.4.2.
   a. Where tactile sign is provided at door, locate sign on wall alongside door at latch side.
   b. When at double doors with one active leaf, locate sign on inactive leaf.
   c. When at double doors with two active leafs, locate sign to right of right hand door.
   d. Where there is no wall space at latch side of single door or at right side of double doors, locate signs on nearest adjacent wall.
   e. Locate signs containing tactile characters so that clear floor space of 18 inches minimum by 18 inches minimum, centered on tactile characters, is provided beyond arc of door swing between closed position and 45 degree open position per CBC Section 11 B-703.4

F. Plastic Signs:
1. Mount sign with aluminum T-type bracket, finish to match adjacent surface or adhesive mount with adhesive recommended by sign manufacturer for application to substrate.
2. Locate signs so that person may approach within 3 inches of sign without encountering protruding objects or standing within swing of door per CBC Chapter 11B.

G. Premises Identification Signs:
1. Install address identification signs in position visible from street or road facing Property.
   a. Position as approved by fire code official.
   b. Install additional address identification signs in approved locations when required by fire code official to facilitate emergency response.

3.02 CLEANING AND PROTECTION

A. At completion of installation, clean soiled sign surfaces in accordance with manufacturer's instructions.
   1. Protect units from damage until acceptance by Owner.

END OF SECTION 10 1400

SECTION 10 2117

SOLID PHENOLIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Solid Phenolic Core Toilet Compartments and Urinal Screens
   2. Hardware and accessories
      a. Includes coat hooks

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 10 2813: Toilet Accessories

C. Related Requirements:
   1. Refer to respective Division 22 Sections for coordination with plumbing fixtures.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
   1. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.

B. ASTM International (ASTM):
   1. ASTM A 240 – Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
   2. ASTM A 666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.
   3. ASTM A 743 – Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
   4. ASTM B 221 – Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
   5. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials.

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's detailed technical data for materials, fabrication, color selection, and installation instructions, including catalog cuts of anchors, hardware, fastenings, and accessories.

B. Shop Drawings:
   1. Showing fabrication and erection of toilet compartment assemblies which are not fully described in manufacturer's data.
   2. Include following:
      a. Overall product dimensions, floor plans, elevations, sections, details, and attachments to other work.

b. Anchorage and accessory items.
c. Setting drawings, templates, and instructions for installation of anchorage devices built into other work.
d. Locations of reinforcement and cutouts for compartment-mounted toilet accessories.

C. Samples:
1. Minimum of four for each compartment or screen color and finish required.
2. Provide 6 inch square Samples of same thickness and material indicated for Work.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications:
1. Minimum 5 years experience in manufacture of solid phenolic core toilet compartments.

B. Installers Qualifications:
1. Regularly engaged in installation of solid phenolic core toilet compartments with minimum 5 years experience.

C. Field Measurements:
1. Take field measurements prior to preparation of shop drawings and fabrication where possible, to ensure proper fitting of Work.
2. Allow for adjustments within specified tolerances wherever taking of field measurements before fabrication might delay Work.

D. Coordination:
1. Furnish inserts and anchorages which must be built into other work for installation of toilet compartments and related work; coordinate delivery with other work to avoid delay.

E. Mock-Up:
1. Upon request of Architect, submit minimum 1/4 scale mock-up of toilet partition; include door, pilasters, divider panels, shoes, and specified door and mounting hardware.

F. Indoor Environmental Quality Certification:
1. Provide certification indicated that products have been certified under following programs, or comparable certification acceptable to Owner:
a. GREENGUARD Indoor Air Quality Certified.
b. GREENGUARD Certified for Children and Schools mounting hardware.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver toilet compartments to Project Site until building is enclosed and HVAC systems are in operation.
1. Deliver toilet compartments in manufacturer's original packaging.
2. Store in an upright condition.

1.06 REGULATORY REQUIREMENTS

A. CCR, Title 24, Part 2, CBC, Chapter 11B.

1.07 WARRANTY

A. Provide manufacturer's standard warranty against breakage, corrosion, and delamination under normal conditions.
   1. Warranty Period:
      a. 3 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 TYPE/MANUFACTURER

A. Type of Toilet Compartment:
   1. Solid Phenolic Core:
      a. Overhead Braced

B. Basis-of-Design:
      a. Design of Solid Phenolic Core Toilet Compartments is based on performance characteristics of Overhead Braced Phenolic Core Toilet Compartments, Sentinel Series 400, as manufactured by Bradley Corporation Mills Metals Division, Menomonee Falls, WI

C. Alternate Acceptable Manufacturers:
   1. ASI Accurate Partitions, Burr Ridge, IL
   2. Alan Lewis, Inc., Santa Ana, CA
   3. Bobrick Washroom Equipment, Inc., North Hollywood, CA

D. Type of Urinal Screen:
   1. Solid Phenolic Core:
      a. Wall Hung.
   2. Basis-of-Design:
      a. Basis-of-Design: Design for Solid Phenolic Core Urinal Screens is based on Solid Phenolic Urinal Screens as manufactured by Bradley Corporation Mills Metals Division.
         1) Furnish with specified wall brackets

E. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:
   1. Submit items listed in Article 1.03 and as specified in Section 01 3300, for evaluation of proposed system.
   2. Complete project shop drawings for similar project may be submitted for evaluation purposes, however shop drawings specific to this Project will be required from successful bidder.
   3. Approval is subject to availability of acceptable color.

1.08 MATERIALS

A. General:
   1. Provide materials which have been selected for surface flatness and smoothness.
   2. Exposed surfaces which exhibit pitting, seam marks, roller marks, stains, discolorations, telegraphing of core material, or other imperfections on finished units are not acceptable.

B. Material:
   1. Standard Material:
      a. Fully fused plastic laminate with matte-finish melamine surfaces.
      b. Integrally bonded colored face sheets and black phenolic-resin core.
         1) Doors and Pilasters:
            a) Minimum 3/4 inch finished thickness.
         2) Divider Panels:
            a) Minimum 1/2 inch finished thickness.
      c. Color and Pattern: As scheduled.
      d. Edge (Core) Color: Black

C. Stainless Steel Sheet:
   1. Conforming to ASTM A 240 or A 666, Type 304.

D. Stainless Steel Castings:
   1. Conforming to ASTM A 743

E. Aluminum Extrusions:
   1. Conforming to ASTM B 221, 6463-T5 alloy and temper

F. Pilaster Shoes:
   1. Type 304 stainless steel, No. 4 finish.
   2. Minimum 20 gage.
   3. Not less than 4 inches high, secured to pilaster with sex bolts.

G. Hardware – General:
   1. Hardware to be 18-8, Type 304 stainless steel with satin finish.
   2. Screws:
      a. Vandal resistant one-way mounting screws throughout installed into threaded inserts.
   3. Hardware of stainless steel or chrome plated.
      a. Zamac material is unacceptable.
   4. Through bolting of hardware is unacceptable.

H. Door Latch:
   1. Sliding door latch, complying with CBC Chapter 11B, requiring less than 5 lb. force to operate.
      a. Pinching or twisting latch operation is not acceptable.
   2. Center opening hardware between 34 and 44 inches above finish floor, per CBC Section 11B-404.2.7
   3. Door Latch:
      a. 14 gage stainless steel latch with shock resistant nylon track sliding on one-piece 11 gage stainless steel keeper.
      b. Attach latch to door and stile by theft resistant one-way stainless steel machine screws into factory installed threaded metal inserts.
   4. Provide latch handle with rubber bumper to act as door stop.
   5. Design metal to metal connection to withstand direct pull of over 1000 lbs. per screw.

I. Door Pulls:
   1. Stainless steel or chrome plated, 4 inch centers, U-shaped.
   2. Provide pull immediately below latch on both sides of doors to accessible compartments, each attached with 2 stainless steel one-way machine screws.

J. Hinges:
1. Surface mounted stainless steel continuous hinges attached to door and pilaster by theft resistant one-way stainless steel machine screws into factory installed metal inserts.
2. Design metal to metal connection to withstand direct pull over 1,000 lbs. per screw.
3. Fasten hinge to door by factory installed threaded metal inserts.
   a. Fasteners secured directly into core are not acceptable.
4. Equip outswinging doors and doors to accessible compartments with self-closing hinge per CBC Chapter 11B.
5. Mount hinges at inswinging doors on stall side of door.
   a. Mounting on outside of door is only permitted at outswinging door of semi-ambulatory accessible stalls.

K. Mounting Brackets:
1. 18 gage stainless steel channel for attaching panels to walls and pilasters.
2. Attach bracket to pilasters and panels with stainless steel screws, theft resistant where exposed, into factory installed metal inserts.
3. Provide wall mounted urinal screen brackets of 11 gage double thickness.

L. Coat Hook:
1. Combination stainless steel hook and rubber-tipped bumper, sized to prevent door hitting mounted accessories.
2. Install maximum 48 inches above finish floor.

M. Leveling Device:
1. 3/8 inch x 1 inch steel bar, chromate treated and double zinc plated; bolted to base of phenolic stile.

N. Anchorages and Fasteners:
1. Manufacturer's standard exposed fasteners of stainless steel, chromium-plated steel, or brass finished to match hardware, with theft-resistant type heads and nuts.
2. For concealed anchors, use hot-dip galvanized, cadmium plated, or other rust-resistant protective-coated steel.

O. Overhead Bracing:
1. Continuous extruded aluminum tubing in anti-grip profile, with clear anodized finish.

2.02 FABRICATION

A. General:
1. Provide standard doors, panels, screens, and pilasters fabricated for compartment system, unless otherwise indicated.
2. Furnish units with cutouts, drilled holes, and internal reinforcement to receive partition-mounted hardware, accessories, and grab bars, as indicated.

B. Door Swing:
1. Unless otherwise indicated, furnish inswinging doors for standard toilet compartments and accessible compartment.
2. Furnish outswinging doors at semi-ambulatory accessible compartments.

C. Door Dimensions:
   1. Dimensions are for clear, unobstructed opening widths with door at 90 degree angle from closed position per CBC Chapter 11B:
      a. Standard Compartments: 24 inches wide.
      b. End Opening Accessible Compartments: 32 inches wide.
      c. Side Opening Accessible Compartments: 34 inches wide.

D. Overhead Braced Partitions:
   1. Furnish galvanized steel supports and leveling bolts at pilasters, as recommended by manufacturer to suit floor conditions.
   2. Furnish shoe at each pilaster to conceal supports and leveling mechanism.
   3. Furnish extruded aluminum headrails, 0.065 inch thick, with anti-grip profile.
      a. Furnish with manufacturer’s standard clear anodized finish.

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with manufacturer's written installation instructions.
   1. Install units rigid, straight, plumb and level.
   2. Provide clearances of not more than 1/2 inch between pilasters and panels, and not more than 1 inch between panels and walls.
   3. Secure units in position with manufacturer's recommended anchoring devices.

B. Anchor through walls to wood blocking or metal backing plates furnished and installed under other sections.

C. Conceal evidence of drilling, cutting and fitting of wall, floor and ceiling finish.
   1. Maintain uniform clearance at vertical edge of doors from top to bottom, not exceeding 1/4 inch.
   2. Locate wall brackets so holes for wall anchorages occur in masonry or tile

D. Overhead Braced Partitions:
   1. Secure pilaster to floor with specified anchorage device.
   2. Level, plumb, and tighten installation with leveling device.
   3. Secure overhead brace to each pilaster with not less than two fasteners.
   4. Adjust tops of doors parallel with overhead brace when doors are in closed position.

E. Urinal Screens:
   1. Attach with heavy duty concealed anchoring devices, recommended by manufacturer to suit supporting structure.
   2. Set units following manufacturer's instructions to provide support and to resist lateral impact.

3.02 ADJUSTING

A. Hardware Adjustment:
   1. Adjust and lubricate hardware for proper operation.
   2. Set hinges on inswinging doors to hold open approximately 30 degrees from closed position when unlatched.
   3. Set hinges on outswinging doors to semi-ambulatory accessible compartments to return to fully closed position.

B. Perform final adjustments to pilaster leveling devices, door hardware, and other operating parts of compartment assembly just prior to final inspection.

3.03 CLEANING

A. Clean exposed surfaces of compartments, hardware, fittings and accessories, and touch up minor scratches and other finish imperfections using materials and methods recommended by manufacturer.

B. Replace damaged units which cannot be satisfactorily field repaired, as directed by Architect.

END OF SECTION 10 2117

SECTION 10 2813

TOILET ACCESSORIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Toilet Accessories.

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 07 9200: Joint Sealants
   3. Section 09 2900: Gypsum Board
   4. Section 09 3000: Tile
   5. Section 10 2117: Solid Phenolic Toilet Compartments

C. Related Requirements:
   1. Refer to Division 22 Sections for related plumbing fixtures and installation.
   2. Underlavatory guards are specified in Division 22.

D. Schedule of Toilet Accessories:
   1. Each type of toilet accessory required is specified in Schedule of Toilet Accessories at end of this Section.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
   1. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.

B. ASTM International (ASTM):
   1. ASTM A 153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   2. ASTM A167 – Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet and Strip.
   3. ASTM A 653 – Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   4. ASTM A 666 – Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
   5. ASTM A 1008 – Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
   6. ASTM B 16 – Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines
   7. ASTM B 19 – Standard Specification for Cartridge Brass Sheet, Strip, Plate, Bar, and Disks
   8. ASTM B 30 – Standard Specification for Copper Alloys in Ingot Form
   9. ASTM C 1036 – Standard Specification for Flat Glass
   10. ASTM C 1503 – Standard Specification for Silvered Flat Glass Mirror

11. ASTM F 446 – Standard Consumer Safety Specification for Grab Bars and Accessories Installed in the Bathing Area
12. ASTM B 456 – Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium.

1.03 SUBMITTALS

A. Product Data:
   1. Include construction details, material descriptions, thicknesses, dimensions, profiles, fastening, and mounting methods, specified options, and finishes for each type of accessory specified.

B. Samples:
   1. Full-size samples of units, upon request, to Architect for review of design and operation.
   2. Acceptable samples will be returned and may be used in Work.
   3. Compliance with other requirements is exclusive responsibility of Contractor.

C. Matrix:
   1. Provide matrix indicating name of each room to receive accessories and type and quantity of each accessory to be provided in each room.

D. Setting Drawings:
   1. Showing cutouts required in other Work.
   2. Include templates, substrate preparation instructions, and directions for preparing cutouts and installing anchoring devices.

E. Operation and Maintenance Data:
   1. Maintenance data, operating instructions and keys required for each type of equipment and lock or accessories to include in maintenance manuals specified in Division 01.
   2. Provide lists of replacement parts and service recommendations.

1.04 QUALITY ASSURANCE

A. Accessory requirements, including those for materials, finishes, dimensions, capacities, and performance, are established by specified products indicated in Toilet Accessory Schedule.
   1. Do not modify aesthetic effects, as judged solely by Architect, except with Architect's approval.
   2. Where modifications are proposed, submit comprehensive explanatory data to Architect for review.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver items in manufacturer's original unopened protective packaging.

B. Store materials in original protective packaging to prevent soiling, physical damage, or wetting.

C. Handle so as to prevent damage to finished surfaces.

D. Maintain protective covers on units until installation is complete.
   1. Remove covers at final clean up of installation.

1.06 COORDINATION

A. Coordinate accessory locations with other work to prevent interference with clearances required for access by disabled persons, proper installation, adjustment, operation, cleaning, and servicing of accessories.

B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying Work.

1.07 WARRANTY

A. General Warranty:
   1. Special warranty specified in this Article does not deprive Owner of other rights Owner may have under other provisions of Contract Documents and is in addition to, and runs concurrent with, other warranties made by Contractor under requirements of Contract Documents.

B. Manufacturer's Mirror Warranty:
   1. Written warranty, executed by mirror manufacturer agreeing to replace mirrors that develop visible silver spoilage defects within minimum warranty period indicated.
   2. Minimum Warranty Period:
      a. 15 years from date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Basis-of-Design:
   1. Model numbers specified for toilet accessories are based on products as manufactured by Bobrick Washroom Equipment Inc., North Hollywood, CA.

B. Alternate Acceptable Manufacturers:
   1. American Specialties, Inc., Yonkers. NY
   2. Bradley Corporation, Menomonee Falls, WI

2.02 MATERIALS – GENERAL

A. Stainless Steel:
   1. Conforming to ASTM A 666, Type 304, with No.4 finish.
   2. Minimum 22 gage (0.03125 inch), unless otherwise indicated.

B. Brass:
   1. General:
      a. Conforming to ASTM B 19, unleaded.
   2. Flat Products:
      a. Conforming to ASTM B 16
   3. Rods, Shapes, Forgings, and Flat Products with Finished Edges:
      a. Conforming to ASTM B 30 castings.

C. Sheet Steel:
   1. Conforming to ASTM A 1008.

a. Cold-rolled, commercial quality 20 gage (0.0359 inch) minimum, unless otherwise indicated.

2. Surface preparation and metal pretreatment as required for applied finish.

D. Galvanized Steel Sheet:
1. Conforming to ASTM A 653, G60.

E. Chromium Plating:
1. Nickel and chromium electro-deposited on base metal.
2. Conforming to ASTM B 456, Type SC 2.

F. Mirror Glass:
1. Conforming to ASTM C1036, Type I, Class 1, Quality q2.
a. 1/4 inch thick, with silver coating, electroplated-copper protective coating, and nonmetallic paint coating complying with ASTM C 1503.
2. Provide mirror with 15 year silver spoilage warranty.

G. Galvanized Steel Mounting Devices:
1. Conforming to ASTM A 153, hot-dip galvanized after fabrication.

H. Fasteners:
1. Screws, bolts, and other devices of same material as accessory unit tamper and theft resistant when exposed, galvanized steel where concealed.

2.03 FABRICATION

A. General:
1. Stamped names or labels on exposed faces of toilet accessory units are not permitted, except where otherwise indicated
2. Unobtrusive labels on surfaces not exposed to view are acceptable.

B. Surface-Mounted Toilet Accessories – General:
1. Except where otherwise indicated, fabricate units with tight seams and joints, exposed edges rolled.
2. Hang doors or access panels with continuous stainless steel piano hinges.
3. Provide concealed anchorage wherever possible.

C. Recessed Toilet Accessories:
1. Except where otherwise indicated, fabricate units of welded construction, without mitered corners.
2. Hang doors or access panels with full-length stainless steel piano hinge.
3. Provide anchorage which is fully concealed when unit is closed.

D. Mirrors:
1. Provide mirror backing and support system which will permit rigid, tamperproof glass installation and prevent accumulation of moisture, as follows:
a. Fabricate mirror frames with angle shapes of not less than 20 gage, with square corners carefully mitered to hairline joints and mechanically interlocked.

E. Grab Bars:
1. Stainless steel type with wall thickness not less than 18 gage and as follows:
a. Mounting:

1) Concealed, manufacturer's standard flanges and anchorages.
b. Gripping Surfaces:
1) Smooth, satin finish, with manufacturer's standard non-slip texture on gripping surface.
2. Heavy-Duty Size:
a. Outside Diameter: 1-1/4 inches.

F. Keys:
1. Provide universal keys for internal access to accesso ries for servicing and resupplying.
2. Where locks are required for particular type of toilet accessory, provide keyed alike throughout Project.
3. Furnish two keys for each lock and minimum of six keys to Owner's representative.

PART 3 EXECUTION

3.01 INSPECTION

A. Check wall opening for correct dimensions, plumbness of blocking or frames, and other preparation that would affect installation of accessories.

B. Check areas to receive surface mounted units for conditions that would affect quality and execution of Work.

C. Verify spacing of plumbing fixtures and toilet partitions that affect installation of accessories.

D. Do not begin installation of washroom accessories until openings and surfaces are acceptable to Contractor and Architect.

3.02 INSTALLATION

A. Install toilet accessory units following manufacturer's instructions, using fasteners appropriate to substrate and recommended by unit manufacturer.
1. Mount toilet accessories required to be accessible in locations and at heights complying with CBC Sections 11B-602 through 11B-612.

B. Install units plumb, level, and firmly anchored in locations and at heights indicated.
1. Use concealed fastenings wherever possible.
2. Provide anchors, bolts and other necessary anchorages.
3. Install concealed mounting devices and fasteners fabricated of same material as accessories, or of galvanized steel, as recommended by manufacturer.
4. Install exposed mounting devices and fasteners finished to match accessories.
5. Provide theft-resistant fasteners for accessory mountings.
a. Finish of exposed fasteners to match items secured.
6. Fit flanges of accessories snug to wall surfaces.
a. Provide sealant in gaps between 90 degree return flanges and finish wall surface after accessories are installed.
b. Comply with requirements of Section 07 9200 for mildew-resistant silicone sealant
1) Do not use acrylic sealant

C. Secure mirrors to walls in concealed, tamperproof manner with special hangers or screws.
   1. Set unit plumbs, level, and square at locations indicated, following manufacturer's instructions for type of substrate indicated.

D. Grab Bars in Toilet Facilities:
   1. Install grab bars to withstand a downward load of at least 250 lbf, when tested according to method in ASTM F 446.
   2. Comply with CBC Section 11B-609.
   3. Provide grab bars and wall or other surfaces adjacent to grab bars free of sharp or abrasive elements and with rounded edges.
   4. Clearances:
      a. 1-1/2 inch clearance between wall surface and inside face of bar.
      b. 1-1/2 inch minimum between grab bar and projecting objects below and at ends.
      c. 12 inches minimum between grab bar and projecting objects above point of grab bar.
   5. Toilet paper and feminine napkin disposals when located on grab bar side of accessible toilet room or stall are not to project more than 3 inches from finished wall surface nor be located closer than 1-1/2 inches clear of tangent point of grab bar.
      a. Do not install surface mounted accessories above grab bar where they will restrict usability.

E. Conceal evidence of drilling, cutting and fitting on adjacent finishes.

3.03 ADJUSTING AND CLEANING

A. Adjust accessories for proper operation and verify that mechanisms function smoothly.
   1. Replace damaged or defective items.

B. Clean and polish exposed surfaces following manufacturer's recommendations after removing temporary labels and protective coatings.

3.04 CLOSE OUT

A. Deliver accessories schedule, keys, and parts manual as part of Project Closeout Documents.

B. For Owner's permanent records, provide two sets of following items of manufacturer's literature:
   1. Technical data sheets of each item installed on Project.
   2. Service and parts manuals.
   3. Name and local representative to be contacted in event of need for field service or consultation.

3.05 SCHEDULE OF TOILET ACCESSORIES

A. Provide toilet accessories equal to Bobrick Model Numbers listed below unless indicated otherwise:
   1. Combination Towel Dispenser/Waste Receptacle:
      a. Surface Mounted:
         1) No. B-3949.

2. Soap Dispenser:
   a. Vertical Tank:
      1) No. B-2111.
3. Stainless Steel Angle Framed Mirror:
   a. No. B-290 Series.
   b. Size: As indicated on Drawings.
4. Sanitary Napkin Vendor:
   a. Surface Mounted:
      1) 25 cent Coin Operation.
      2) No. B-2706 25.
5. Toilet Tissue Dispenser:
   a. Surface Mounted Multi-Roll:
      1) No. B-2888.
   b. Partition Mounted Multi-Roll:
      1) Serves 2 compartments.
      2) No. B-386.
6. Sanitary Napkin Disposal:
   a. Surface Mounted:
      1) No. B-254.
   b. Partition Mounted:
      1) Serves two compartments.
      2) No. B-354.
7. Seat Cover Dispenser:
   a. Surface Mounted:
      1) No. B-221.
8. Grab Bar:
   a. No. B-5806.99 Series with non-slip texture gripping surface.
9. Utility Shelf with Mop and Broom Holder:
   a. No. B-224.36 inches long.
      1) With 4 mop holders and 3 rag hooks.

END OF SECTION 10 2813

SECTION 10 4400

FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Fire extinguishers.
   2. Fire extinguisher cabinets.

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.

1.02 REFERENCES

A. California Code of Regulations:
   1. Title 19 – Public Safety
   2. Title 24, current edition:
      a. Part 2 - California Building Code (CBC), Volumes 1 and 2.
      b. Part 9 – California Fire Code (CFC).

B. National Fire Protection Association (NFPA):
   1. NFPA 10 – Standard for Portable Fire Extinguishers.

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's technical data and installation instructions for portable fire extinguishers required.
   2. Include roughing-in dimensions, and details for fire extinguisher cabinets:
      a. Show mounting methods, relationships to surrounding construction, door hardware, cabinet type and materials, trim style and door construction, style and materials.
   3. Where color selection by Architect is required, include color charts showing full range of manufacturer's standard colors and designs available.

B. Samples:
   1. Minimum of four, 6 inch square, of each required finish.
   2. Prepare samples on metal of same gage as metal to be used in Work.

1.04 QUALITY ASSURANCE

A. Provide portable fire extinguishers, cabinets and accessories by one manufacturer, unless otherwise acceptable to Architect.

B. UL-Listed Products:
   1. Provide new portable fire extinguishers which are UL Listed and bear UL "Listing Mark" for type, rating, and classification of extinguisher indicated.

C. Provide fire extinguishers as required by CCR, Title 19 and NFPA 10.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design:
   1. Design of fire extinguishers and fire extinguisher cabinets are based on products as manufactured by Larsen's Manufacturing Co., Minneapolis, MN

B. Subject to compliance with specified requirements, provide named product or comparable product by following:
   1. Activar Construction Products Group, Inc. – JL Industries, Bloomington, MN
   2. Nystrom, Nystrom, MN
   3. Potter Roemer Fire Pro, Morris Group International, City of Industry, CA

C. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:
   1. Submit items listed in Article 1.04 and as specified in Section 01 3300, for evaluation of proposed system.
   2. Complete project shop drawings for similar project may be submitted for evaluation purposes, however shop drawings specific to this Project will be required from successful bidder.
   3. Copy of manufacturer's warranty.

2.02 FIRE EXTINGUISHERS (FE)

A. General:
   1. Provide fire extinguishers for each extinguisher cabinet and other locations indicated:
      a. In colors and finishes selected by Architect from manufacturer's standard.
      b. Complying with requirements of governing authorities.

B. Multi-Purpose Dry Chemical Type:
   1. UL-rated 2A-10B:C
      a. 5 lb. nominal capacity, in enameled steel container,
         1) Class A, Class B and Class C fires.
      b. Model MP-5 by Larsen's Mfg. Co.

2.03 FIRE EXTINGUISHER CABINETS (FEC)

A. General:
   1. Provide fire extinguisher cabinets where indicated,
      a. Suitable size for housing fire extinguishers of types and capacities indicated.
   2. Comply with CBC Chapters 11B-205, 11B-305, 11B-307, 11B-308, 11B-309, and 11B-403.5.1

B. Construction:
   1. Manufacturer's standard enameled steel box.
   2. Provide trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.
   3. Weld joints and grind smooth.
   4. Miter and weld perimeter door frames.

C. Cabinet Type:
   1. Suitable for mounting conditions indicated, of following types:
   2. Recessed:
      a. Cabinet box (tub) fully recessed in walls of sufficient depth to suit style of trim indicated.

D. Trim Style:
   1. Fabricate trim in one piece with corners mitered, welded and ground smooth.
   2. Exposed Trim: One-piece combination trim and perimeter door frame overlapping surrounding wall surface with exposed trim face and wall return at outer edge (backbend).
      a. Flat Trim:
         1) Square edges with backbend of 5/16 inch at non-rated cabinets.

E. Door Material and Construction:
   1. Manufacturer's standard door construction, of material indicated, coordinated with cabinet types and trim styles selected.
   2. Stainless Steel:
      a. Manufacturer's standard stainless steel door construction.

F. Door Style:
   1. Manufacturer's standard design as specified.
      a. Solid Door with Vertical Die-Cut Letters.

G. Door Hardware:
   1. Provide manufacturer's standard door operating hardware of proper type for cabinet type, trim style, and door material and style indicated.
   2. Provide surface mounted door pull with Larsen-Loc Door Locking System.
   3. Provide concealed or continuous type hinge permitting door to open 180 degrees.

H. Basis-of-Design:
   1. Architectural Series:
      a. Model as listed, by Larsen's Mfg. Co.:
         1) Model No. SS 2409-R1 for non-rated cabinets.

2.04 FACTORY FINISHING OF FIRE EXTINGUISHER CABINETS

A. General:
   1. Comply with NAAMM "Metal Finishes Manual" for finish designations and application recommendations except as otherwise indicated.
   2. Apply finishes in factory after products are assembled.
   3. Protect cabinets with plastic or paper covering, prior to shipment.

B. Painted Finish for Box:
   1. Preparation:
      a. Clean surfaces of dirt, grease, and loose rust or mill scale.
      b. Apply finish to surfaces of fabricated and assembled units, whether exposed or concealed when installed, except those surfaces specified to receive another finish.
   2. Baked Enamel Finish:
      a. Immediately after cleaning and pretreatment, apply manufacturer's standard baked enamel coating.

b. Provide manufacturer's standard white color.

C. Stainless Steel Finish for Doors and Trim:
1. No.4 finish.
2. Furnish with paper masking to protect finish.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets are to be installed.

B. Examine fire extinguishers for proper charging and tagging.
1. Remove and replace damaged, defective, or undercharged units.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Comply with manufacturer's written instructions for installing fire extinguishers and cabinets.
1. Install each cabinet plumb and level, and secure rigidly in place

B. Locate fire extinguisher cabinets where indicated, and along accessible route complying with CBC Section 11B-403.

C. Locate height of fire extinguisher handle and fire extinguisher cabinet opening hardware to comply with reach ranges in CBC Section 11B-308 and following:
1. Maximum 48 inches above finished floor per CBC Sections 11B-308.2 and 11B-308-3.
2. Opening Hardware:
a. Accessible with U-shaped pull and latch force less than 5 pounds, per CBC Section 11B-309.4

3.03 IDENTIFICATION

A. Identify fire extinguisher in cabinet with vertical [Type A] die-cut lettering spelling "**FIRE EXTINGUISHER**".
1. Provide lettering on door as indicated.
2. Letter Color: Red

END OF SECTION 10 4400

SECTION 11 5223

AUDIO-VISUAL EQUIPMENT SUPPORTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Video projector ceiling mounting system
   2. Flat screen TV mounting system

B. Related Sections:
   1. Section 09 5000: Acoustical Ceilings.

C. Related Requirements:
   1. Refer to Division 26 sections for electrical power and wiring requirements
   2. Refer to Division 27 Sections for communications cabling requirements.

1.02 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications and installation instructions for specified equipment.

B. Electrical power and cabling requirements

PART 2 PRODUCTS

2.01 FLAT SCREEN TV MOUNTING SYSTEM

A. TV Screen Mount:
   1. Model and Manufacturer:.
      a. Model: ST660 Tilt Wall Mount by Peerless-AV, or approved equal
   2. Finish:
      a. Manufacturer’s standard Black.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install equipment in locations shown, complying with manufacturer's recommendations.

B. Anchor units to other construction as indicated, using manufacturer's recommended methods, for type of installation shown.

C. Clean exposed surfaces and touch-up marred finishes or replace item as necessary to eliminate evidence of damage or deterioration.

END OF SECTION 11 5223

SECTION 12 2413

ROLLER SHADES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. **Shade Type 1**:
      a. Manually operated, chain drive, single roller sunscreen shades at exterior window openings where indicated on Drawings.

B. Related Sections:
   1. Section 01 3119: Project Meetings; pre-installation meeting.
   2. Section 01 4100: Regulatory Requirements; current Code edition.
   3. Section 05 0513: Shop-Applied Coatings for Metal
   4. Section 06 1053: Miscellaneous Carpentry; blocking for support of window shade bracket assemblies.
   5. Section 09 2900: Gypsum Board; substrate for window shade systems and installation of accessories supplied under this Section.
   6. Section 09 5100: Acoustical Ceilings; installations of shade pockets, pocket closure and accessories supplied under this Section.
   7. Section 09 9100: Painting; field painting of steel components.

C. Products Supplied But Not Installed Under This Section:
   1. Extruded aluminum shade pockets or housings recessed into ceiling system or assembly.
   2. Extruded aluminum ceiling pocket trim closure assemblies.

1.02 REFERENCES

A. California Code of Regulations (CCR):
   1. Title 19 – Public Safety, Division 1 – State Fire Marshal
   2. Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
      a. Chapter 8 – Interior Finishes
         1) Section 806 – Decorative Materials and Trim.

B. ASTM International (ASTM):
   1. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials
   2. ASTM G 21 – Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi

C. National Fire Protection Association (NFPA):
   1. NFPA 701 – Standard Methods of Fire Tests for Flame Propagation of Textiles and Films.

D. UL, LLC (UL):
1. UL 2818 – GREENGUARD Certification Program For Chemical Emissions For Building Materials, Finishes and Furnishings.
2. UL 2821 – GREENGUARD Certification Program Method for Measuring and Evaluating Chemical Emissions From Building Materials, Finishes and Furnishings

E. California Department of Public Health (CDPH):
1. Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, Version 1.2

1.03 SUBMITTALS

A. Product Data:
1. Manufacturer's product data sheets, performance data, and standard installation instructions for each item required.

B. Shop Drawings:
1. Interior Elevations at minimum 3/8 inch equals 1 foot – 0 inch scale, indicating shade layout, seam/batten locations, and coordination with surrounding conditions.
   a. Include field verified window dimensions and controls.
2. Floor plans or reflected ceiling plans showing overall arrangement of shades and control locations.
3. Head, jamb, and sill details as necessary to coordinate Work with surrounding conditions and construction.

C. Roller Shade Schedule:
1. Furnish for entire roller shade installation.
2. Use same room designations as indicated on Drawings.
3. Coordinate room number, window type, opening size, shade type, quantities, and key to typical mounting details.
4. Include fabric in specified colors.

D. Samples:
1. Roller Shades:
   a. One fully operational roller shade sample of each type required.
   b. Size:
      1) 30 inches by 30 inch complete with selected shade cloth.
   c. Include sample of seam/batten when applicable.
   d. Disassemble sample to demonstrating compliance with requirements of Part 2 of this Section.
2. Shade Components:
   a. Two complete sets of shade components, unassembled, demonstrating compliance with requirements of Part 2 of this Section.
3. Shade Fabric Samples:
   a. Minimum of four, 8 inch by 10 inch samples of each selected fabric representing actual product, color, and patterns.
      1) Mark face of material to indicate interior faces.
4. Aluminum Finish Samples:
   a. Prepare samples on metal of same alloy and gage to be used for Work.
   b. Minimum of four, 3 inch by 6 inch samples of each type and color of exposed aluminum finish required.

E. Design Data, Test Reports, and Certificates:
   1. Furnish current reports from independent testing laboratories demonstrating compliance with Performance Article

F. Maintenance Data:
   1. Furnish following to include in maintenance manuals:
      a. Methods for maintaining roller shades and finishes.
      b. Precautions about cleaning materials and methods that could be detrimental to fabrics, finishes, and performance.
      c. Operating hardware.

1.04 QUALITY ASSURANCE

A. Qualifications:
   1. Manufacturer:
      a. Minimum 20 years experience manufacturing products comparable to those specified in this Section.
   2. Installer:
      a. Minimum 5 years experience installing products comparable to those specified in this Section.

B. Mock-Ups:
   1. Provide mock-up of one of each type roller shade assembly specified, for evaluation of mounting, appearance and accessories.
      a. Use selected fabrics for final verification of color, weave and density
   2. Locate mock-ups in windows designated by Architect.
   3. Do not proceed with remaining work until mock-up is accepted by Architect.

C. Pre-installation Meetings:
   1. Conduct in accordance with requirements of Division 01 and following:
      a. Review access requirements for material delivery.
      b. Review storage and security requirements.
      c. Inspect and discuss condition of substrate and other preparatory work performed by other trades.
      d. Review structural loading limitations.
      e. Review coordination with other installers whose work interfaces with or affects roller shades.
      f. Review and finalize construction schedule and verify availability of, materials, installer's personnel, and facilities needed to make progress avoid delays.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery::
   1. Do not deliver items to Project Site until concrete, masonry, painting, and other wet work has been completed and is dry.
   2. Deliver shades and related materials to Project Site in labeled protective packaging.
      a. Uniquely labeled to identify each shade for each opening.
      b. Schedule delivery to prevent delays to completion of Work but to minimize on-site storage time.

B. Storage and Protection:
   1. Store materials in dry secure place.

2. Protect from weather, surface contaminants, corrosion, construction traffic and other potential damage.

1.06 PROJECT CONDITIONS

A. Environmental Limitations:
1. Do not install roller shades until construction and wet and dirty finish work in spaces, including painting, is complete and ambient temperature and humidity conditions are maintained at levels indicated for Project when occupied for its intended use.

B. Field Measurements:
1. Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings.
2. Allow clearances for operable glazed units operating hardware throughout entire operating range.
3. Notify Architect of discrepancies.
4. Do not fabricate shades without obtaining field dimensions for each opening.

C. Coordination:
1. Coordinate fabrication schedule with construction progress to avoid delaying Work.
2. Coordinate construction of surrounding conditions to allow for timely field dimension verification.

1.07 SEQUENCING

A. Ensure that products specified by this Section, including materials, components, locating templates, and other information required for installation, are furnished to affected trades in sufficient time to prevent interruption of construction progress.

1.08 REGULATORY REQUIREMENTS

A. Comply with CBC requirements for design and installation.
1. Chapter 8, Section 806.

B. Fire-Resistance Ratings:
1. Comply with fire-resistance ratings as shown and as required by governing authorities and codes.
2. Provide materials, accessories and application procedures which have been listed tested complying with following:
a. ASTM E 84
b. NFPA 701.

1.09 WARRANTY

A. Limited Warranty:
1. Provide Manufacturer's limited warranty under provisions of General Requirements in Division 01 and following:
a. Manufacturer warrants to Owner (End User) that its products are free from defects in material and workmanship for each specified warranty period provided below.

b. Warranty periods begin on date of Substantial Completion.
c. Warranty is limited to Project for which product was originally purchased.
d. Warranty extends only to original end user, and is not transferable to third party.
e. Warranty is applicable to products that are repaired or replaced for balance of Warranty Period or for ninety days from date product is repaired or replaced, whichever is longer.

2. Shade Components and Shade Fabric:
   a. Consisting of mounting hardware, headbox, clutch, fascia and shade fabric.
   b. Warranty Period:
      1) 25 years from date of Substantial Completion.
3. In event of warranted product failure, shade contractor will, at no cost to Owner, facilitate acquisition and delivery of necessary components to Owner.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design:
   1. Design of roller shades systems are based on products as manufactured by Draper, Inc. Spiceland, IN.

B. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:
   1. Submit items listed in “Submittals” Article and as specified in Section 01 3300, for evaluation of proposed system.
   2. Complete project shop drawings for similar project may be submitted for evaluation purposes, however shop drawings specific to this Project will be required from successful bidder.
   3. Furnish documentation that tests have been made for identical systems within ranges of specified performance criteria.
   4. Copy of manufacturer's 25 year material warranty on shade components and accessories.

2.02 COMPONENTS

A. Shade Hardware and Shade Brackets:
   1. Provide shade hardware constructed of minimum 1/8 inch thick. cadmium plated steel or thicker as required to support 150 percent of full weight of each shade.
   2. Provide shade hardware system that allows 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. Provide shade hardware system that allows for following:
      a. Field adjustment of motor or replacement of operable hardware components without requiring removal of brackets regardless of mounting position.
      b. Operation of multiple shade bands offset by maximum of 12 degrees from motor axis between shade bands, 6 degrees on each side of radial line, by single motor (Multi-banded shades) subject to manufacturer's design criteria.

4. Shade Roller and Shade Cloth Attachment:
   a. Use extruded aluminum shade roller tube of diameter and wall thickness required to support shade fabric without excessive deflection.
      1) Roller tubes less than 1.5 inches in diameter for manual shades, and less than 2.0 inches in diameter for motorized shades, are not acceptable.
   b. Use industrial 3M double sided adhesive tape to attach fabric to roller tube.
      1) Spline fabric attachment is acceptable.
      2) Shade bands must be replaceable on-site.

B. Manually Operated Window Shades:
   1. Manually operated, vertical roll-up, fabric window shade with independent control.
      a. Include components necessary for complete installation.
   2. Product and Manufacturer:
      a. Manual FlexShade XD as manufactured by Draper, Inc.
   3. Operation:
      a. Bead chain and clutch operating mechanism allowing shade to stop when chain is released.
      b. Design to never need adjustment or lubrication.
      c. Provide limit stops to prevent shade from being raised or lowered too far.
      d. Clutch mechanism:
         1) Fabricated from Polyoxymethylene (POM) thermoplastic with welded 0.354 inch primary steel post with rotational bearing, overrunning design, and positive mechanical engagement of drive mechanism to tube.
         2) Color: Black
      e. Center bead chain placement for right or left hand operation as indicated in Schedule.
         1) Locate operable controls (bead chain) with unobstructed forward and side approach.
            a) Locate operable controls (bottom of bead chain loop) to be within 48 inches from finished floor.
         2) Operable Controls:
            a) Operable with one hand, not requiring tight grasping, pinching, or twisting of wrist.
            b) Maximum Operating Force: 5 pounds.
            c) Comply with CBC Chapter 11B, Sections 11B-308.2 and 11B-302.3 for reach ranges, and Section 11B-309.4.
      f. Bead Chain Loop:
         1) Stainless steel bead chain.
      g. Bead Chain Hold Down:
         1) Spring-Loaded Tensioner.
   4. Rollers:
      a. Extruded aluminum roller tube of appropriate diameter to support shade fabric with minimal deflection.
      b. Minimum Roller Tube Diameter: 1.56 inches.
      c. Fabric Connection to Roller Tube:
         1) Spline fabric/roller or double sided adhesive tape attachmen system to allow shade fabric to be removed from roller without having to remove roller from brackets.

d. Fabric Length:
1) 6 inches greater than window height minimum.
e. Bottom Slat:
1) 13/16 inch aluminum dowel, encased in bottom hem with heat sealed ends.
f. Orientation:
1) Regular from back of roller.

5. Mounting:
a. Recessed mounted in ceiling where indicated.
b. Provide endcaps and fascia for exposed locations where indicated..
1) Endcaps:
a) Stamped steel with universal design suitable for mounting to ceiling, wall, and jamb.
2) Provide size compatible with roller size.
3) Endcap Covers:
a) Match fascia or headbox color.
c. Fascia:
1) L shaped aluminum extrusion to conceal shade roller and hardware.
2) Attachment:
a) Snaps onto endcaps without requiring exposed fasteners.
3) Fascia may be mounted continuously across two or more shade bands.
a) Notching is not required.

2.03 FABRIC

A. Light-Filtering Fabrics
1. E Screen Series by Mermet:
a. PVC coated fiberglass yarn woven in 2 by 2 basketweave.
1) Average 3 percent open.
b. Thickness: 0.016 inch.
2. Fire Rating:
a. NFPA 701 – both small and large scale tests.
b. CCR, Title 19.

B. Colors and Patterns:
1. Classrooms: 3 percent open.
a. Color: As selected by Architect.

2.04 ACCESSORIES

A. Shade Pockets for Recessed Mounting in Acoustical or Gypsum Board Ceilings:
1. Provide extruded aluminum shade pocket with exposed extruded aluminum removable closure panel to provide access to shades and exposed ceiling tile support.
2. Furnish in manufacturer's standard white finish, unless indicated otherwise.
a. Draper C177.080.21 – Type D Pocket for single shade installations.
b. Draper C177.250SA – Access Dual Roller Pocket DHMO for double shade installations.

B. Mounting Brackets:
1. Stamped steel , 1/8 inch thick.
2. Includes idler height adjuster, field adjustable to mounting to face of mullions.

3. Finish:
   a. Manufacturer's standard Black Powder Coat.

C. Endcaps and Fascia Panels:
1. Endcaps:
   a. Stamped steel with universal design suitable for mounting to face of mullions.
   b. Provide size compatible with roller size.
2. Fascia:
   a. L shaped aluminum extrusion to conceal shade roller and hardware.
   b. Attachment:
      1) Snaps onto end caps without requiring exposed fasteners.
      2) Fascia can be mounted continuously across two or more shade bands.
3. Finish:
   a. As specified in Article 2.06

2.05 FABRICATION

A. Fabricate units to completely fill existing openings from head to sill and jamb-to-jamb, unless specifically indicated otherwise.
1. Comply with manufacturer's edge clearance standards and recommendations.

B. Fabricate shade cloth to hang flat without buckling or distortion.
1. Fabricate with heat-sealed trimmed edges to hang straight without curling or raveling.
2. Fabricate unguided shade cloth 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-railroaded shades as required by manufacturer to ensure proper tracking and uniform rolling of shade bands.

D. Railroaded Shade Bands:
1. Provide seams or battens in railroaded multi-width shade bands as required by manufacturer to meet Width/Height ratios and size requirements.
2. Unless specified elsewhere, manufacturer's standard seam/batten placements are acceptable to Architect.
3. When custom placement of seams/battens are required, coordinate these locations with design requirements.

E. Provide batten pockets utilizing self-colored fabric front and back, RF welded into shade cloth.
1. Provide self-colored opaque liner front and back to eliminate see through of batten pocket
   a. Not to exceed 1-1/2 inches high and be totally opaque.
   b. See-through moire effect, which occurs with multiple layers of transparent fabrics, is not acceptable.
2. Reinforce batten pockets using coil coated, roll formed spring steel to ensure flatness of shade bands in accordance with manufacturer's standards.
3. Design formed profile of batten stiffeners to be compatible with diameter of shade roller tube.

2.06 FINISHES

A. Aluminum Components:
   1. Manufacturer's standard finish on concealed aluminum components.
   2. Match finish on exposed aluminum components of aluminum storefront and curtain wall.
      a. Comply with requirements of Section 05 0513.

B. Steel Components:
   1. Cadmium-plated, satin-finished, or bonderized prior to painting with finish as specified finish per Section 09 9100.
   2. Color: As scheduled.

C. Provide finishes on surfaces exposed to view to match finish/color of adjacent surfaces.

2.07 PERFORMANCE REQUIREMENTS

A. Fire Resistance:
   1. Provide shade fabrics tested in accordance with following:
      a. NFPA 701 – Vertical Burn Test, small and large: Rated "Pass".
      b. ASTM E 84:
         1) Flame Spread Index: 17
         2) Smoke Developed Index: 118

B. Toxicity:
   1. Provide shade fabrics tested in accordance with University of PittsburghToxicity Protocol including LC50 analysis and toxicity characteristics.

C. Anti-Microbial:
   1. Comply with requirements of ASTM G 21 indicating minimum 0.197 inch, "No Growth Contact Area".

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine substrate and conditions for installation.
   1. Do not commence installation until conditions are satisfactory.
   2. Notify Architect upon inspection when Project conditions are unacceptable for shade installation.
   3. Commencement of installation indicates acceptance of Site conditions by installer.

3.02 PREPARATION

A. Coordinate requirements for blocking and structural supports to ensure adequate means for installation of roller shades.

3.03 INSTALLATION

A. Install units to comply with manufacturer's instructions for type of mounting and operation required.

1. Provide units plumb, true, and securely anchored in place with recommended hardware and accessories to provide smooth operation without binding.

B. Install units within following tolerances:
   1. Maximum variation of gap at window opening perimeter:
      a. 1/4 inch, per 8 feet (±1/8 inch) of shade height.
   2. Maximum offset from level:
      a. 1/16 inch per 5 feet of shade width.

C. Install fascia to conceal roller and operating mechanism.
   1. Do not use exposed fasteners.

3.04 ADJUSTING

A. Adjust drive/brake mechanism of units for smooth operation.
   1. Adjust shade and shade cloth to hang flat without buckling or distortion.
   2. Replace units or components, which do not hang properly or operate smoothly.

3.05 CLEANING

A. Touch up damaged finishes and repair minor damage in order to eliminate evidence of repair.
   1. Remove and replace Work that cannot be satisfactorily repaired.

B. Clean exposed surfaces, including metal and shade cloth, using non-abrasive materials and methods recommended by shade cloth manufacturer.
   1. Remove and replace Work, which cannot be satisfactorily cleaned.

3.06 DEMONSTRATION

A. Demonstrate operation methods and instruct Owner's personnel in proper operation and maintenance of roller shade systems.

3.07 ROLLER SHADE SCHEDULE

A. Refer to schedule on Drawings for shade types and locations.

END OF SECTION 12 2413

SECTION 14 2423

HYDRAULIC PASSENGER ELEVATORS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Holeless Hydraulic Passenger Elevator.
      a. Elevator car finishes and operating fixtures.
      b. Hall fixtures.
      c. Guide rails and supports.
      d. Hoisting beam.
   2. Elevator equipment vibration isolation.
   3. Initial maintenance service agreement.
   4. Permit and Tests:
      a. Arrange and pay for permits, inspections, and tests required by authorities having jurisdiction.
   5. Deferred Approvals:
      a. Elevator guide rails and guide rail support brackets.

B. Related Sections:
   1. Section 01 3300: Submittal Procedures; deferred approval submittals.
   2. Section 01 4100: Regulatory Requirements; current Code edition.
   3. Section 01 5000: Temporary Facilities and Controls; barricades and protection of openings.
   4. Section 01 7419: Construction Waste Management and Disposal
   5. Section 01 7423: Cleaning
   6. Section 03 3000: Cast-in-Place Concrete; elevator pit.
   7. Section 05 1200: Structural Steel Framing; hoist beams and steel framing at gypsum board walls at hoistway.
   8. Section 05 5000: Metal Fabrications; pit ladder and supports for hoistway openings.
   9. Section 07 1616: Crystalline Waterproofing; elevator pit waterproofing.
   10. Section 09 2900: Gypsum Board; gypsum board shaftwall construction.
   11. Section 09 6500: Resilient Flooring; VCT flooring and rubber base.
   12. Section 10 1400: Signage

C. Related Requirements:
   1. Refer to Division 23, 26, 27, and 28 Sections for hoistway ventilation, electrical, communications and fire detection work related to elevator installation.

D. Related Work to be Performed by Contractor:
   1. General:
      a. Protection of elevator during installation period.
      b. Provide Cal/OSHA approved barricades where required by elevator contractor.
         1) Including removable hoistway guards, barricades, screening, steps, and ladders required during construction.
         2) Comply with requirements of Section 01 5000.

2. Legal Hoistway:
    a. Sized to elevator contractor drawings.
    b. Vertically plumb within 1 inch per 100 feet
    c. Provide finished floor elevations at each elevator opening and each landing to ensure that hall sills are set at correct height.
    d. Properly framed and enclosed, including pit of proper depth, provided with ladder, lights, and waterproofing, as required.
    e. Hoistway ventilation as required by elevator manufacturer.
3. Adequate support and foundation to carry loads of equipment, including supports for guide rail brackets.
4. Suitable connections from power mains to each controller signal equipment feeders as required, including necessary circuit breakers, and fused mainline disconnect switches.
    a. Electric power without charge, for construction, testing and adjusting, of same characteristics as permanent supply.
5. Outlets at center of hoistway for lighting in car.
6. Cutting of walls, floors, and removal of such obstructions as may be necessary for proper installation of elevator.
    a. Conform to requirements of Section 01 7329.
    b. Submit description and drawings indicating proposed Work for Architect and Structural Engineer's review and acceptance prior to performing cutting and patching.
7. Setting of anchors and sleeves.
8. Pockets or block outs for signal fixtures.
9. Sill supports, including steel angles where required, sill recesses and grouting of door sills after installation.
10. Painting, except as otherwise specified.
11. Provide temporary enclosures or other protection from open hoistways during time elevator is being installed.
12. Provided openings, cutting and patching in machine room walls, hoistway walls and other areas as directed by elevator contractor:
    a. For installation of overhead oil line.
    b. Includes firestopping sealant at penetrations in fire rated elevator shaft walls.
13. Providing finish flooring in car.
    a. Refer to Section 09 6500.
14. Installation of supports furnished under Sections 05 1200:
    a. For guide rail brackets furnished by elevator contractor.
    b. Hoist Beam:
        1) 5,000 pound capacity.
        2) Centered over rails at top of hoistway.
        3) May require removal later for legal overhead.
15. Wiring to controller for car lighting and ventilation.
16. Voice communications connection to elevator hoistway
17. Wiring from elevator hoistway to alarm bell as required by ANSI/ASME A17.1.
18. Heat and smoke sensors as required in accordance with NFPA 72E and ANSI/ASME A17.1.
19. Properly sized and legal machine room, adequate for elevator equipment:
20. Including temperature of 50 degrees F minimum, to 90 degrees F maximum.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, current edition:
   1. Part 2, California Building Code (CBC), Volumes 1 and 2.
      a. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.
   2. Part 3, California Electrical Code (CEC).

B. California Department of Industrial Relations:
   1. Chapter 4 – Division of Industrial Safety:
      a. Subchapter 6 – Elevator Safety Orders

C. American National Standards Institute (ANSI)

D. National Fire Protection Association (NFPA):
   1. ANSI/NFPA 80 – Standard for Fire Doors and Other Opening Protectives.

E. American Society of Mechanical Engineers (ASME):
   1. ANSI/ASME A 17.1 – Safety Code for Elevators and Escalators.

F. UL, LLC (UL):
   1. UL 10B – Standard for Fire Tests of Door Assemblies

1.03 SYSTEM DESCRIPTION AND REQUIREMENTS

A. Fire-Resistance of Entrances:
   1. Comply with NFPA No. 80 and provide units bearing UL labels with 30 minute temperature rise on labels.

B. Performance and Capacity Requirements:
   1. Power Supply:
      a. 208 VAC, 60 Hertz, 3 Phase.
         1) Plus or minus 5 percent of normal 3 Phase.
         2) Provide with separate equipment grounding conductor.
      b. Pump Motor: 50 hp
   2. Lighting Supply:
      a. 120 VAC, 60 Hertz, 1 Phase, 15 Amp.
   3. Capacity: 3500 lbs.
   4. Speed: 100 FPM
   5. Openings: Two, in line.
   6. Car Dimensions:
      a. Refer to Drawings for dimensions of following:
         1) Platform
         2) Car:
            a) Clear Inside.
            b) Car Height
            c) Clear Car Height.
   7. Travel Distance:
      a. Floor to Floor: As indicated on Drawings.
      b. Total: As indicated on Drawings.
   8. Stops: Two

9. Hoistway Doors:
    a. Door Type:
        1) Single Speed, Side Opening.
    b. Size:
        1) 3 feet – 6 inches wide by 7 feet - 0 inches high
    c. Provide with UL approved "B" label.
10. Door Operation:
    a. Automatic, direct current powered.

C. Elevator Operation:
1. Simplex Collective Operation:
    a. Automatic operation using microprocessor-based controller, by means of car and hall buttons.
    b. When every call in system has been answered, park car at last landing served.
2. Standard Operating Features:
    a. Full Collective Operation
    b. Fan and Light Protection
    c. Firefighters Service Phase I and Phase II.
    d. Top of Car Inspection
    e. Relative System Response Dispatching

D. Door Control Features:
1. Door control to open doors automatically when car arrives at landing in response to normal hall or car call.
2. Provide elevator doors with reopening device that will stop and reopen car doors and hoistway doors automatically should doors become obstructed by object or person.
3. Provide door protection consisting of two dimensional, multi-beam array projecting across car door opening.
4. Door nudging operation to occur when doors are prevented from closing for adjustable period of time.
5. Provide equipment according to Seismic Zone 4.

E. Vibration Isolation:
1. Isolate elevator equipment from building structure so as not to transmit noise or vibration to building.
2. Provide vibration isolation equipment and materials and install them as specified.

1.04 SUBMITTALS

A. Product Data:
1. Manufacturer's standard brochures, catalog cut sheets, product specifications, and installation instructions for each principal component or product:
    a. Include descriptive literature of specified products to be provided.
2. List and describe features of control system, performances, and operating characteristics.
3. Vibration isolation equipment and materials as follows:
    a. Complete description of vibration isolation products to be supplied:
        1) Including product data, dimensions, and specifications.
    b. Tabulation for each vibration isolator showing following:
        1) Equipment identification mark

2) Isolator durometer and type
3) Actual load applied.
4) Static deflection under actual load meeting specified minimum.

B. Shop Drawings:
1. Plans, elevations, and details of car enclosures and hoistway entrances.
2. Prepare elevatoring diagrams to show service to each level.
3. Show in detail size, arrangement and location of parts and specify requirements for structural supports, block outs, and Work required by other trades.
4. Provide detail drawings for elevator signal equipment:
   a. Including hall lanterns, push buttons, car position indicators and car operating stations.
5. Make submittals promptly to allow for adequate review prior to information being required at Project Site for preparation of elevator pits, hoistway supports and other components.

C. Engineering Details and Calculations:
1. Detail plans, specifications, and engineering calculations for elevator guide rails and guide rail support brackets:
   a. For review and approval of Architect, Structural Engineer, and Division of the State Architect
2. Provide engineering plans, specifications, and calculations prepared and signed by registered structural engineer licensed in State of California and employed by Contractor.
3. Provide following on engineering plans:
   a. Identify project and provide DSA Application Number.
   b. Eliminate non-structural information from Drawings since this deferred approval is for structural information only, such as guide rail and brackets, equipment, anchorages, and machine beams.
   c. List elevator capacity and weight of car.
   d. Seismic Design Loads for Elevator:
      1) Design Load:
         a) Equal to (weight of car plus 0.4 rated capacity) by 0.5
      2) Lateral Force Distribution:
         a) 1/3 to top guide rollers and 2/3 to bottom guide rollers
   e. Locate guide rail brackets, minimum of 2 per rail, and show connection detail to structural steel framing.
   f. Locate guide rail splices and splice details.
   g. Specify grade of steel for guide rails and brackets.
   h. Provide retainer plate detail where required.
   i. Slotted holes are not permitted in final position for supporting details.
   j. Design and provide anchorage detail for each individual equipment and hydraulic elevator power unit.
   k. Specify tests for expansion type anchor bolts where used.
   l. Provide index of submitted drawings.

D. Samples:
1. Exposed finishes of car enclosures, hoistway entrances, and signal equipment:
   a. Minimum of four, 8 inch squares of each material and 12 inch lengths of running trim members.

E. Maintenance Manuals:
   1. Bound manual for each elevator with operating and maintenance instructions, parts listing, recommended parts inventory listing, purchase source listing, emergency instructions, and similar information.
   2. Comply with requirements of Sections 01 7700 and 01 7839.

F. Certificates and Permits:
   1. Provide Owner with copies of inspection/acceptance certificates and operating permits as required by authorities having jurisdiction to allow normal, unrestricted use of elevators.

G. Submit electrostatic copies of wiring diagrams with "as built" changes included.
   1. Provide three sets, each bound and identified with reference to elevator numbers and apparatus to which they are applicable.

H. Diagrams:
   1. Provide electrostatic reduction print of wiring diagrams of entire system of power distribution, lighting control, signals and communication.
      a. Mount in plastic, hermetically sealed.
      b. Install charts in Elevator Machine Room.

I. Make electronic submittals as specified in “Submittal Procedures and Requirements” Article in Section 01 3300.

1.05 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Either elevator manufacturer or licensee of manufacturer, who has not less than 5 years successful experience with installation of similar elevators.

1.06 DEFERRED APPROVAL

A. Portion of Work of this Section is Deferred Approval item.
   1. Comply with Section 01 3300 for Deferred Approval submittal requirements.
   2. Deferred Approval:
      a. Elevator guide rails and guide rail support brackets.

B. Do not proceed with fabrication and installation of elevator guide rails and guide rail support brackets until detail plans, specifications, and engineering calculations have been accepted and signed by Architect or Structural Engineer in general charge of design and signed by Architect or Structural Engineer who has been delegated responsibility covering Work shown on particular plan or specification, and approved by Division of the State Architect.
   1. Provide details in accordance with Structural Drawings.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Delivery:
   1. Provide adequate access for:
      a. Off-loading equipment using dollies and forklifts upon equipment delivery at Project Site.
      b. Access to work areas, including stairs, to install elevator.

B. Storage:
   1. Protect elevator equipment and parts from damage in transit, from weather. and water to keep equipment dry
   2. Locate materials stored at Project Site to prevent damage from moisture, dirt, and other damaging conditions.

1.08 PROJECT CONDITIONS

A. Verify dimensions with Project Site measurements prior to installation of equipment.
   1. Installation to proceed only when conditions are satisfactory for proper performance of Work.

B. Verify electrical service characteristics and adequacy before beginning manufacture and installation.

1.09 WARRANTY

A. General Warranty:
   1. Special warranties, specified in this Article are in addition to, and run concurrent with, other warranties made by Contractor under requirements of Contract Documents, and are not to deprive Owner of other rights Owner may have under other provisions of Contract Documents.

B. Special Warranty:
   1. Elevator contractor’s acceptance is conditional on understanding that their warranty covers defective material and workmanship.
   2. Warranty Period:
      a. Not more than one year from date of Substantial Completion, or acceptance by beneficial use, whichever is earlier.
   3. Exclusions:
      a. Warranty excludes ordinary wear and tear, improper use, vandalism, abuse, misuse, or neglect or other causes beyond control of elevator contractor.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis-of-Design:

B. Basis-of-Design:
   1. Design of hydraulic elevators is based on engineered 3500 lb. capacity, general purpose, front opening, holeless hydraulic passenger elevator as manufactured by Otis Elevator Company, Farmington, CT
      a. Provide Holeless Hydraulic automatic passenger elevator complying with CBC Section 11B-407 and ASME A17.1

C. Alternate Acceptable Manufacturer:
   1. Mitsubishi Electric US Inc., Cypress, CA

D. Subject to compliance with specified requirements, comparable products may be submitted by alternate manufacturers in accordance with requirements for product substitutions specified in Section 01 6000 and following:

1. Submit items listed in “Submittals” Article and as specified in Section 01 3300, for evaluation of proposed system.
2. Complete project shop drawings for similar project may be submitted for evaluation purposes, however shop drawings specific to this Project will be required from successful bidder, along with compliance with required deferred approval submittals.
3. Furnish documentation that tests have been made for identical systems within ranges of specified performance criteria.
4. Copy of manufacturer's 1 year material and workmanship warranty

E. Elevator Control System and Car Design:
1. Provide industry-recognized automatic operation of following type as defined in ANSI/ASME A17.1, which responds to momentary pressing of signal buttons, key control and to other signals and devices.
   a. Based on materials and systems by Otis Elevator Company.
2. Two stop collective automatic push button operation.
3. Provide system consisting of following components:
   a. Locate entire hydraulic system and controller inside separate machine room.
4. Sleep mode operation for LED ceiling lights and car fan.
5. LED lighting standard in ceiling lights and elevator fixtures.

F. Provide auxiliary operations as indicated:
1. Including car inspection and automatic 2-way leveling.

G. Inserts:
1. Furnish required concrete inserts and similar anchorage devices for installation of guide rails, machinery, and other components of elevator Work, where installation of devices is indicated as Work of another specification section.

H. Elevator Manufacturer/Installer Responsibilities:
1. Designing, coordinating, furnishing, and installing supplemental materials and devices:
   a. Including installation of hoist beams, necessary for installation or maintenance of elevators rests with Contractor.
2. Work includes furnishing of documentation, including, but not necessarily limited to, drawings and calculations as may be required by DSA for their approval.

2.02 MACHINE ROOM COMPONENTS

A. Provide hydraulic system of compact design suitable for operation under required pressure.
1. Mount power component in hydraulic-fluid storage tank.
2. Provide control valve to control flow for up and down directions hydraulically.
   a. Include integral check valve.
3. Provide control section, including control solenoids to direct main valve and control:
   a. Up and down starting, acceleration, transition from full speed to leveling speed, up and down stops, pressure relief and manual lowering.
   b. Provide functions to be fully adjustable for maximum smoothness and to meet contract conditions.
4. Provide system with low-pressure switch and shut-off valve.

5. Locate entire hydraulic system with hydraulic-fluid storage tank, power component and valves in elevator machine room.

B. Provide microprocessor-based controller:
   1. Including necessary starting switches together with relays, switches, solid-state components, and hardware required for operation and including door operation, as described.
   2. Provide 3 Phase overload device to protect motor against overloading.
   3. Locate controller together with hydraulic system in elevator machine room, easily accessible for maintenance through same access door used for hydraulic system.

C. Provide manual lowering feature to permit lowering elevator at slow speed in event of power failure or for adjusting purposes.

D. Provide following additional components:
   1. Pressure Switch
   2. Tank Heater.
   3. Low-oil control

E. Provide electrical disconnect switch inside machine room:
   1. Comply with California Elevator Safety Orders and ASME A 17.1.

2.03 HOISTWAY COMPONENTS

A. Plunger and Cylinder:
   1. Construct each cylinder of steel pipe of sufficient thickness and suitable for operating pressure.
   2. Equip top of each cylinder with cylinder head with drip ring to collect oil seepage along with internal guide ring and self-adjusting packing.
   3. Construct each plunger of selected steel tubing or pipe of proper diameter, machined true and smooth with fine polished finish.
   4. Provide each plunger with stop ring electrically welded to it to prevent plunger from leaving cylinder.
   5. Install each plunger and cylinder plumb.
      a. Plunger to operate freely with minimum friction.

B. Car Guide Rails:
   1. Tee-section steel rails with brackets and fasteners.

C. Buffers:
   1. Provide polyurethane type.

D. Wiring:
   1. Wiring for hoistway electrical devices included in scope of elevator system, hall panels, pit emergency stop switch, and traveling cable for elevator car.

E. Hoistway Entrances:
   1. Entrance Frames:
      a. 16 gage frames of bolted construction for complete one-piece unit assembly.
         1) Sound deaden frames.
      b. Securely fasten frames to fixing angles mounted in hoistway.

c. Fire Rating: UL “B” label.

2. Sills:
   a. Extruded aluminum, 1/4 inch thick, with grooved surface and mill finish.
3. Entrance Doors:
   a. Provide manufacturer's standard, pre-engineered, hollow metal type, sliding door and frame hoistway entrances.
      1) Complete with track systems, hardware, safeties, non-vision screens, sills and accessories.
   b. Match car enclosure doors for size, number of door panels, and door panel movement.
   c. Provide frame section size and profile to coordinate with hoistway wall construction as indicated.
   d. 18 gage flush stainless steel construction with vertical channel reinforcements.
      1) Sound deaden doors.
   e. Fire Rating: UL 1-1/2 hour label.
4. Finish for Entrance Doors and Frames:
   a. No. 4 stainless steel.
5. Hoistway Entrance Marking Plates:
   a. Complying with CBC Section 11B-407.2.3
   b. Floor Designations:
      1) Provide floor designations complying with CBC Section 11B-407.2.3 and 11B-703.4.1 on both jambs of hoistway entrance in both raised characters 2 inches high and Braille.
      2) Provide raised star to left of floor designation on both jambs at main entry level.
         a) Outside diameter of star to be 2 inches, with equal points.
      3) Raised characters, including star to be white on black background.
      4) Provide Braille complying with CBC Section 11B-703.3 placed below raise character and star.
      5) Braille translation for star: MAIN
   c. Mounting Height: 60 inches above finished floor.

F. Hoistway Signs:
   1. Complying with CBC Section 11B-407.2.3
   2. Floor Designations:
      c. Provide floor designations complying with CBC Section 11B-407.2.3 and 11B-703.4.1 on both jambs of hoistway entrance in both raised characters 2 inches high and Braille.
      d. Provide raised star to left of floor designation on both jambs at main entry level.
         1) Outside diameter of star to be 2 inches, with equal points.
      e. Raised characters, including star to be white on black background.
      f. Provide Braille complying with CBC Section 11B-703.3 placed below raise character and star.
      g. Braille translation for star: MAIN

   3. Sight Guards:
      a. Furnish sight guards with doors.
      b. Painted flat black for stainless steel doors.

2.04 VIBRATION ISOLATORS

A. Constrained Neoprene Isolators:
   1. Oil resistant neoprene-in-shear type with steel housing to contain neoprene element so that neoprene and top fastener cannot be removed from housing.
   2. Provide isolator capable of compression, tension, and shear loading.
   3. Provide bolt holes in housing base and female threaded fastener for top.
   4. Include leveling bolts for mounts that may be rigidly connected to equipment.
   5. Provide mounts capable of resisting seismic acceleration in any direction in accordance with prevailing codes and complying with pertinent sections regarding earthquake regulations of CBC, current edition.
   6. Provide neoprene grommets for bolt holes to prevent metal-to-metal contact.
   7. Product and Manufacturer:
      a. Type BR by Mason Industries, Anaheim CA, or approved equal.

B. Neoprene Isolated Clamps:
   1. Provide clamps consisting of two-piece polypropylene or polymide clamp body with 5/16 inch to 5/8 inch thick annular neoprene insert of 30 to 40 durometer.
   2. Product and Manufacturer:
   3. Type R1 by STAUFF Corporation, Waldwick, NJ, or approved equal.

C. Foam Neoprene Pipe Insulation:
   1. Closed-cell type, 6 pet density, tubular in form with 1/2 inch thick wall and inside diameter equal to pipe outside diameter.
   2. Product and Manufacturer:
      a. Type R-180-FS Tubing Insulation by Rubate x Corp., div. of GCP Industrial Products, or approved equal.

D. Oil Line Muffler:
   1. Provide elevator manufacturer's standard oil line muffler.

E. Isolation Coupling: Provide sound isolation couplings for oil line.
   1. Elevator manufacturer's standard, unless indicated otherwise.

2.05 DEVICES AND EQUIPMENT

A. Automatic Leveling Device:
   1. Provide with leveling tolerance of 1/4 inch under rated loading to zero loading conditions for travel either direction.

B. Power Door Operator:
   1. Provide car door operator with interconnection to hoistway doors for:
      a. Checking action.
      b. Hand operation of car door for power failure.

C. Door Edge Protective Device:
   1. Provide full-height device for reopening door which makes contact with object before being fully closed complying with CBC Section 11B-407.3.3 and following:
      a. Height: Device is activated by sensing obstruction passing through opening at 5 inches nominal and 29 inches nominal above finish floor. ~
      b. Contact:

c. Device does not require physical contact to be activated.
   1) Contact is permitted to occur before door reverses.
d. Duration: Door reopening devices is to remain effective for 20 seconds minimum.
e. Door and Signal Timing: Calculate minimum acceptable time from notification that car is answering call until doors of car start to close per following equation:

   $T = 0/(1.5 \text{ ft/s}) = 5$ seconds minimum where T equals total time in seconds and D equals distance in feet.
f. Delay: Elevator doors to remain fully open in response to car call for 5 seconds minimum.

D. Elevator Doors:
   1. Horizontal sliding type complying with CBC Section 11B-407.3
   2. Doors to open and close automatically per CBC Section 11B-404.3.3
   3. Door Width:

E. Battery Operated Lowering Device:
   1. Provide and install built-in battery lowering device compatible with elevator controller for safe lowering of car to lowest level in case of power unit failure.
   2. Provide and install necessary connectivity for operation of device so that in event of loss of power, device will lower car to next available landing and open doors.
   3. Conduct testing of device and provide demonstration to Owner's designated personnel.

2.06 CAR COMPONENTS

A. Provide manufacturer's standard car components prepared to receive signal equipment, elevator devices, and equipment as follows:
   1. Cab:
      a. Steel Shell Cab with stainless steel vertical panels:
         1) Rear and Side Wall Panels: Stainless Steel
         2) Doors, Front Panel, and Car Operating Panel: Stainless steel.
         3) Finish: No. 4
      b. Floor:
         1) Provide smooth steel surface, prime painted:
            a) Recessed to receive specified flooring:
               i Including installation materials.
   2. Ceiling Type:
      a. Flat metal ceiling with 4 LED lights (FC-4).
         1) Level of Illumination: 5 foot candles minimum.
      b. Emergency Exit:
         1) Provide concealed access door with electrical contact.
      c. No. 4 stainless steel finish.
   3. Emergency Car Lighting:
      a. Provide emergency power unit employing 6 volt sealed rechargeable battery and totally static circuits to illuminate elevator car in event of building power failure.
   4. Fan:
      a. Provide single speed 120 VAC fan mounted to structural ceiling to facilitate in-car air circulation, meeting A17.1 code requirements.

b. Rubber mounted to prevent transmission of structural vibration.
1) Include baffle to diffuse audible noise.
c. Provide switch in car operating panel to control fan.

5. Handrail:
a. 1-1/2 inch diameter stainless steel tubular handrail.
b. Allowable Stresses: Not exceed for materials used when vertical or horizontal force of 250 pounds is applied at any point on handrail, fastener, mounting device, or supporting structure.
c. Smooth surface with No. 4 stainless steel finish.
d. Locate on rear wall of cab only.
1) Mounting height as indicated on Drawings.

1. Threshold:
a. Extruded aluminum, 1/4 inch thick with grooved surface and mill finish to match hoistway sill.

2. Guides:
a. Provide car slide type guides at top and bottom.

3. Platform:
a. Construct car platform of metal.

4. Certificate Frame:
a. Provide certificate frame with No. 4 stainless steel finish.

5. Provide for LED ceiling lights and fan to automatically shut off when system is not in use and to power back up after passenger calls elevator and pushes hall button.

2.07 SIGNAL DEVICES AND FIXTURES

A. Car Operating Panel:
1. Provide car operating panel containing push buttons, key switches, and message indicators for elevator operation.
a. Complying with CBC Sections 11B-309.4 and 11B-407.4.6
b. Mounting location complying with CBC Section 11B-308 as indicated on Drawings.

2. Push Buttons:
a. Complying with CBC Sections 11B-407.4.6.2 and 11B-407.4.7
b. Square shoulders, 3/4 inch minimum in smallest dimension, internally illuminated with white light over entire surface of button.
c. Mounted to panel with 1/8 inch projection (plus or minus 1/32 inch) above surrounding surface to left of control button.
d. Arrange buttons in ascending order.

3. Provide car operating panel with satin stainless steel finish.
a. Equip car operating panel with following features:
1) Raised markings and Braille to left hand side of each push-button.
2) Car Position Indicator at top of, integral with car operating panel.
3) Door open and door close buttons.
4) Inspection key-switch.
5) Elevator Data Plate:
a) Marked with elevator capacity and car number.
b. Help Button:
1) Initiates two-way communication between car and location inside building.
2) Switches over to another location, when call is unanswered, where personnel are available to take appropriate action.

3) Provide visual indicators for call initiation and call acknowledgement.

c. Landing Passing Signal:
   1) Provide chime bell sound in car to signal that car is either stopping at or passing floor served by elevator.

d. Emergency Controls:
   1) Complying with CBC Section 11B-407.4.6.4
   2) In car stop switch (toggle or key) per local elevator code.
   3) Firefighter's hat.
   4) Firefighter's Phase II Key-switch.
   5) Call Cancel Button.
   6) Group at bottom of panel.
   7) Refer to Drawings for mounting locations.

B. Car Position Indicator:
   1. Digital, LED car position indicator integral to car operating panel.
   2. Provide visible indicators complying with CBC Section 11B-407.4.8.1.
      a. Character Size: Minimum 1/2 inch high.
      b. Floor Arrival: As car passes floor, and when car stops at floor served by elevator, corresponding character is to illuminate.
   3. Provide audible indicators complying with CBC Section 11B-407.4.8.2.
      a. Signal Type: Automatic verbal annunciator which announces floor at which car is about to stop.
      b. Signal Level for Verbal Annunciator: 10 dB minimum above ambient, and not to exceed 80 dB, measured at annunciator.
      c. Frequency for Verbal Annunciator: 300 HZ minimum to 3000 HZ maximum.

C. Car Lantern and Chime:
   1. Provide directional lantern visible from corridor in car entrance.
   2. When car stops and doors are opening, lantern indicates direction in which car is to travel and chime will sound.
      a. Chime to sound once for up direction and twice for down direction.
      b. Frequency of Audible Signals: 1500 Hz, at 10 dB minimum above ambient and not to exceed 80dB measured at hall call buttons.

D. Hall Button Fixtures:
   1. Provide hall button fixtures with necessary push buttons and key switches for elevator operation.
      a. Complying with CBC Sections 1009,11B-309.4, 11b-407.2, and 11B-407.2.1
   2. Locate hall fixtures in entrance frame face.
      a. First Floor:
         1) Provide Lobby fixture with 1 call button and Firefighter's Phase II Key-switch.
      b. Second (or Top) Floor:
         1) Provide Terminal button fixture.
      c. Mount buttons vertically in fixture.
      d. Provide access key-switch at each station.
   3. Button Options:
      a. Square shoulders, 3/4 inch in smallest dimension
      b. Mounted in panel with 1/8 inch projection (plus or minus 1/32 inch) above surface.

c. Button activation by mechanical motion that is detectable.
d. Provide call buttons with visible signals, activated when each call is registered and extinguishes when call is answered.
e. Call button to be internally illuminated with white light over entire surface of button.

E. Hall Lantern and Chime:
1. Provide directional lantern visible from corridor at each hall entrance.
a. Complying with CBC Section 11B-407.2.2
2. When car stops and doors are opening, lantern indicates direction in which car is to travel and chime will sound.
a. Chime to sound once for up direction and twice for down direction.
3. LCD Screen.
4. No. 4 finish stainless steel.

F. Emergency Elevator Communications System:
2. Provide emergency two way communication system complying with CBC, 1009.8 and 3001.2
3. System to provide visible text and audible modes meeting following requirements:
a. Signals to occur at elevator landing and each accessible floor that is one or more stories above story of exit discharge.
b. When operating in each mode, include live interactive system that allows back and forth conversation between elevator occupants and emergency personnel.
c. Is operational when elevator is operational.
d. Allows elevator occupants to select text based or audible mode depending on their communication needs to interact with emergency personnel.
1) Provide directions for use of two-way communication system, including:
2) Instructions for summoning assistance via such system.
a) Post written identification of location adjacent to two way communication system per CBC Section 1009.8.2

G. Directional Signage:
4. Provide directional signage complying with CBC Sections 1009.10 and 11B-703.5 at elevator landings indicating locations of other means of egress and which of those are accessible means of egress.
5. Provide signage complying with requirements of Section 10 1400.

2.08 REGULATORY REQUIREMENTS

A. Elevator Code:
1. Comply with applicable requirements of CCR, Title 24, current edition:
a. Part 2 – CBC Chapter 30, Section 3003 and Chapter 11B-407.
b. Part 7 – Elevator Safety Regulations and ANSI/ASME A 17.1
2. Comply with more stringent requirements where indicated or imposed by governing regulations and authorities having jurisdiction.

B. NFPA Code:
1. Comply with applicable NFPA codes:
a. Specifically those Codes relating to electrical work and elevators.

C. Accessibility:
   1. Comply with CCR, Title 24, Part 2, CBC, Chapter 11B.

PART 3 EXECUTION

3.01 PREPARATION

A. Take field dimensions and examine conditions of substrates, supports, and other conditions under which Work is to be performed.
   1. Do not proceed with Work until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Comply with manufacturer's instructions and recommendations for Work required during installation of elevator components, except related work to be performed by Contractor.

B. Install plunger units plumb and coordinated in alignment with shafts and hoistway entrances.
   1. Anchor securely in place at pit floor level

C. Coordination:
   1. Install hoistway entrances for elevator plumb with each other and aligned properly with hoistway.
   2. Install guide rails for uniform, close tolerance of car door with hoistway entrances.

D. Install sills after car installation and align with car sill.

E. Sound Isolation:
   1. Mount rotating and vibrating elevator equipment and components on vibration-absorption mounts, designed to effectively prevent transmission of vibrations to structure, and to eliminate sources of structure-borne noise from elevator system.
   2. Provide isolators to deflect uniformly under operating gravity and equipment thrust loadings to within plus or minus 10 percent of specified deflection values.
   3. Mount power unit on constrained neoprene isolators, of Durometer 50 or less, that will achieve minimum of 0.12 inch static deflection.
      a. Mount motor starting relay on power unit.
   4. When belt driven pump is used, provide not less than two sound isolating couplings in each machine room oil line, between pump and jack.
   5. Provide oil-hydraulic silencer (oil line muffler device) at power unit (pump), containing pulsation absorbing material inserted in blowout-proof housing arranged for inspecting interior parts without removing unit from oil line.
      a. Rubber hose without blowout-proof features is not acceptable.
   6. Hydraulic Piping Isolation:
      a. Isolate piping from building structure from tank to piston base as follows:
         1) Support and attach piping as necessary using neoprene isolated clamps.
         2) Isolate from wall or floors at penetrations with foam neoprene pipe insulation.
         3) Make pipe penetrations airtight as necessary in accordance with other requirements.

7. Make electrical power and control connections to isolated elevator equipment using either minimum three foot long flexible conduit installed in grossly slack condition or with flexible electrical coupling similar to Crouse-Hinds Type XD or Spring City Electrical Mfg. Co. Type OF, or approved equal.

F. Install piping without routing underground, where possible
1. Where not possible, cover underground piping and joint with permanent protective wrapping before backfilling.

G.

Welded Construction:
1. Provide welded connections for installation of elevator work where bolted connections are not required for subsequent removal or for normal operations, adjustment, inspection, maintenance and replacement of worn parts.
2. Comply with AWS standards for workmanship and for qualifications of welding operators.

J. Lubricate operating parts of systems as recommended by manufacturers.

H. Alignment:
1. Coordinate installation of hoistway entrances with installation of elevator guide rails, for accurate alignment of entrances with cars.
2. Where possible, delay final adjustment of sills and doors until car is operable in shaft.
3. Reduce clearances to minimum, safe, workable dimension at each landing.

I. Leveling Tolerance:
1. 1/2 inch, up or down, regardless of load and direction of travel.

J. Coordinate grouting of sills with non-staining, non-shrink grout and setting of units accurately aligned with and slightly above finish floor at landings.

3.03 FIELD QUALITY CONTROL

A. Acceptance Testing:
1. Upon nominal completion of each elevator installation, and before permitting use of elevator, perform acceptance tests as required and as recommended by ANSI/ASME A 17.1, governing regulations, or authorities having jurisdiction.

B. Advise Contractor, Owner, Architect and Inspection Department of governing agencies, in advance of dates and times tests are to be performed on elevators.

C. Elevator Contractor/Installer Requirements:
1. Make final check of elevator operation with Owner or Owner’s representative present prior to turning elevator over for use.
2. Determine that control systems and operating devices are functioning properly

3.04 INSTRUCTION AND DEMONSTRATION

A. Instruct Owner's personnel in proper use, operations and daily maintenance of elevators.
1. Review emergency provisions, including emergency access and procedures to be followed at time of failure in operation and other building emergencies.

2. Train Owner's personnel in normal procedures to be followed in checking for sources of operational failures or malfunctions.
3. Confer with Owner on requirements for complete elevator maintenance program.

3.05 MAINTENANCE AND SERVICE

A. Provide complete maintenance service consisting of regular examinations and adjustments of elevator equipment by elevator contractor for period of 12 months after elevator has been turned over for Owner’s use.
   1. Do not subcontract maintenance service.
   2. Elevator contractor is to perform by maintenance service.
      a. Work to be performed by competent employees during regular working hours of regular working days.
   3. Maintenance service does not cover adjustments, repairs or replacement of parts due to negligence, misuse, abuse or accidents caused by persons other than elevator contractor.
   4. Provide only genuine parts and supplies as used in manufacture and installation of the original equipment.

B. Elevator Control System Requirements:
   1. Provide in controller necessary devices to run elevator on inspection operation.
   2. Provide on top of car necessary devices to run elevator in inspection operation.
   3. Provide emergency stop switch in controller.
      a. Emergency stop switch when opened disconnects power from brake and prevents motor from running.
   4. Provide means from controller to reset elevator earthquake operation.

C. Continuing Maintenance:
   1. Provide continuing maintenance proposal to Owner, in form of standard yearly (or other period) maintenance agreement, starting on date construction contract maintenance requirements are concluded.
   2. State services, obligations, conditions and terms for agreement period, and for renewal options.

END OF SECTION 14 2423

SECTION 21 1300

AUTOMATIC FIRE SPRINKLERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies automatic sprinkler systems for buildings and structures. Materials and equipment specified in this Section include:
   1. Pipe fittings, valves, and specialties.
   2. Sprinklers.

B. Products furnished but not installed include sprinkler head cabinet with spare sprinkler heads. Furnish to the Owner's maintenance personnel. Coordinate with the school representative for the location of head cabinet.

1.02 RELATED SECTIONS

A. The following Sections contain requirements that relate to this Section:
   1. Division 10 Section "Fire Extinguishers, Cabinets, and Accessories" for fire extinguishers and extinguisher cabinets.
   2. Division 22 Section "Plumbing Identification" for labeling and identification of fire protection piping systems and components.

1.03 DEFINITIONS

A. Pipe sizes used in this Specification are Nominal Pipe Size (NPS).

B. Other definitions for fire protection systems are listed in NFPA Standard 13, 2022 Edition.

C. Working Plans as used in this Section means those documents including drawings and calculations prepared pursuant to the requirements contained in NFPA 13 for obtaining approval of the authority having jurisdiction.

1.04 SYSTEM DESCRIPTION

A. FIRE PROTECTION SYSTEM is a "Wet-Pipe" system employing automatic sprinklers attached to a piping system containing water and connected to a water supply so that water discharges immediately from sprinklers opened by fire.

1.05 SUBMITTALS

A. Product Data for each type of sprinkler head, valve, piping and fire protection specialties.

B. Shop Drawings prepared in accordance with NFPA 13 identified as "Working Plans," including hydraulic calculations where applicable, and which have been approved by the authority having jurisdiction.

C. Maintenance Data for each type of sprinkler head, valve, piping, and fire protection specialties, for inclusion in operating and maintenance manual specified in Division 01 and Division 22 Section "Common Work Results for Plumbing."

D. Welder's qualification certificates.

E. Test Reports and Certificates including "Contractor's Material and Test Certificate for Aboveground Piping" and "Contractor's Material and Test Certificate for Underground Piping" as described in NFPA 13.

1.06 QUALITY ASSURANCE

A. Installer Qualifications: Installation and alterations of fire protection piping, equipment, specialties, and accessories, and repair and servicing of equipment shall be performed only by a qualified installer. The term qualified means experienced in such work experienced shall mean having a minimum of 5 previous projects similar in size and scope to this project, familiar with all precautions required, and has complied with all the requirements of the authority having jurisdiction. Upon request, submit evidence of such qualifications to the Architect. Refer to Division 01 Section "Definitions and Standards" for definitions for "Installers". Installer shall have valid State of California Contractor's License.

B. Qualifications for Welding Processes and Operators: Comply with the requirements of AWS D10.9, Specifications for Qualifications of Welding Procedures and Welders for Piping and Tubing, Level AR-3."

C. Regulatory Requirements: Comply with the requirements of the following standards:
   1. NFPA 13 - Standard for the Installation of Sprinkler Systems.
   2. UL and FM Compliance: Fire Protection system materials and components shall be Underwriter's Laboratories Listed and labeled, and Factory Mutual approved for the application anticipated.

1.07 SEQUENCING AND SCHEDULING

A. Schedule rough-in installations with installations of other building components.

1.08 EXTRA MATERIALS

A. Valve Wrenches: Furnish to Owner 2 valve wrenches for each type of sprinkler head installed.

B. Sprinkler Heads and Cabinets: Furnish six extra sprinkler heads of each style included in the project. Furnish each style with its own sprinkler head cabinet and special wrenches as specified in this Section.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide fire protection system products from one of the following:
   1. Butterfly Valves:
      a. Tyco BFV-1.
      b. Or approved equal.

2. Swing Check Valves:
   a. Tyco CV-1F.
   b. Or approved equal.

3. Grooved Mechanical Couplings:
   a. Victaulic Company of America.
   b. Or approved equal.
4. Water Flow Indicators:
   a. Tyco.
   b. Or approved equal.
5. Sprinkler Heads:
   a. Tyco TY3131 Upright.
   b. Tyco TY3231 Pendant.
   c. Or approved equal.
6. Riser Manifold:
   a. Tyco RM-1.
   b. Or approved equal.

   Inspector's Test Drain
   a. AGF 1011a.
   b. Or approved equal.

2.02 PIPE AND TUBING MATERIALS

A. General: Refer to Part 3 Article "Pipe Applications" for identification of systems where the below-specified pipe and fitting materials are used. Piping shall be of domestic manufacture.

B. Steel Pipe: ASTM A135, Schedule 10 and Schedule 40, black steel pipe, plain ends as manufactured by Wheatland or equal (of domestic manufacture). Manufacturer's thin-wall pipe is not acceptable.

2.03 FITTINGS

A. Cast-Iron Threaded Fittings: ANSI B16.4, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1. Material shall be of domestic manufacture.

B. Malleable-Threaded Fittings: ANSI B16.3, standard pattern, for threaded joints. Threads shall conform to ANSI B1.20.1. Material shall be of domestic manufacture.

C. Steel Fittings: ASTM A234, seamless or welded, for welded joints. Material shall be of domestic manufacture.

D. Grooved Mechanical Fittings: ASTM A536, Grade 65-45-12 ductile iron; ASTM A47 Grade 32510 Malleable iron; or ASTM A53, Type F or Types E or S, Grade B fabricated steel fittings with grooves or shoulders designed to accept grooved end couplings. Material shall be of domestic manufacture.

E. Grooved Mechanical Couplings: Consist of ductile or malleable iron housing, a synthetic rubber gasket of a central cavity pressure-responsive design; with nuts, bolts, locking pin, locking toggle, or lugs to secure roll-grooved pipe and fittings. Grooved mechanical couplings including gaskets used on dry-pipe systems shall be listed for dry-pipe service. Material shall be of domestic manufacture.

F. Cast-Iron Threaded Flanges: ANSI B16.1, Class 250; raised ground face, bolt holes spot faced. Material shall be of domestic manufacture.

2.04 JOINING MATERIALS

A. Welding Materials: Comply, with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.

B. Gasket Materials: Thickness, material, and type suitable for fluid or gas to be handled, and design temperature and pressures.

2.05 GENERAL DUTY VALVES

A. Butterfly Valve - 3 Inch: Iron body; bronze mounted, 175-pound cold water working pressure - non-shock. Valves shall be solid taper wedge; OS&Y, rising stem; flanged bonnet, conforming to ASTM A126 Class B; replaceable bronze wedge facing rings; flanged ends; and packing assembly consisting of a cast iron gland flange, brass gland, packing, bonnet, and bronze bonnet bushing. Valves shall be capable of being repacked under pressure, with valve wide open. Domestic manufacture.

2.06 SPECIALTY VALVES

A. Alarm Check Valve – 3 Inch: 175 PSIG working pressure, designed for horizontal or vertical installations, and have cast iron, flanged inlet and outlet, bronze grooved seat with "O" ring seals, single hinge pin and latch design. Provide trim sets for bypass, drain, electric sprinkler alarm switch, pressure gages, drip cup assembly piped with check valve to main drain line, and fill line attachment with strainer. Domestic manufacture.

2.07 AUTOMATIC SPRINKLERS

A. Sprinkler Heads: Fusible link type and style as indicated or required by the application. Unless otherwise indicated, provide heads with nominal 1/2-inch discharge orifice, for "ordinary" temperature range. Products of domestic manufacture.

B. Sprinkler Head Finishes: Provide heads with the following finishes:
   2. Upright and Pendant Styles: Chrome plated in finish spaces, exposed to view; rough bronze finish for heads in unfinished spaces and not exposed to view. Heads shall be wax coated, where installed exposed to acids, chemicals, or other corrosive fumes. On all exposed heads in Gymnasium, install approved wire mesh head guard.
   3. In all areas of the building with finished ceilings, install concealed type fire sprinkler heads.
      a. Concealed Style: Rough brass with painted white cover plate.
      b. Flush Style: Bright chrome with painted white escutcheon plate.

C. Sprinkler Head Cabinet and Wrench: Finish steel cabinet, suitable for wall mounting, with hinged cover and space for 6 spare sprinkler heads plus sprinkler head wrench. Provide a separate cabinet for each style sprinkler head on the project.

2.08 ALARM DEVICES

A. General: Types and sizes shall mate and match piping and equipment connections.

B. Water Flow Indicators: Vane type water-flow detector, rated to 250 PSIG, designed for horizontal or vertical installation; have 2-SPDT circuit switches to provide isolated alarm and auxiliary contacts, 7 ampere 125 volts AC and 0.25 ampere 24 Volts DC; complete with factory-set, field-adjustable retard element to prevent false signals, and tamper-proof cover which sends a signal when cover is removed. Products of domestic manufacture.

C. Supervisory Switches: SPST, normally closed contacts, designed to signal valve in other than full-open position. Products of domestic manufacture.

PART 3 - EXECUTION

3.01 PIPE APPLICATIONS

A. Install Schedule 40 black steel seamless or welded pipe joined by threaded fittings referenced in table 6.4.1 NFPA 13 or by fitting used with pipe having cut grooves.

B. Install Schedule 10 black steel pipe with welded or roll-grooved ends and grooved pipe and fitting for sizes up to 5”.

C. Black steel pipe shall be listed in table 6.3.1.1 NFPA 13.

3.02 PIPING INSTALLATION

A. Location and Arrangement: Drawings indicate the general location and arrangement of piping systems. So far as practical, install piping as indicated.

B. Deviations from approved "Working Plans" for sprinkler piping require written approval of the authority having jurisdiction and the Mechanical Engineer. Written approval shall be on file with the Architect prior to deviating from the approved "Working Plans."

C. Install sprinkler piping to provide for system drainage in accordance with NFPA 13.

D. Use approved fittings to make all changes in direction, branch takeoffs from mains, and reductions in pipe sizes.

E. Install unions in pipes 2 inch and smaller, adjacent to each valve. Unions are not required on flanged devices or in piping installations using grooved mechanical couplings.

F. Install flanges or flange adapters on valves, apparatus, and equipment having 2-1/2 inch and larger connections.

G. Hangers and Supports (Products of Domestic Manufacture): Comply with the requirements of NFPA 13. Hanger and support spacing and locations for piping joined with grooved mechanical couplings shall be in accordance with the grooved mechanical coupling manufacturer's written instructions, for rigid systems. Provide coupling manufacturer's written instructions, for rigid systems. Provide protection from damage where subject to earthquake in accordance with NFPA 13.

H. Make connections between underground and above-ground piping using an approved transition piece strapped or fastened to prevent separation.

I. Install mechanical sleeve seal at pipe penetrations in foundation walls.

J. Install test connections sized and located in accordance with NFPA 13 complete with shutoff valve. Test connections may also serve, as drainpipes.

K. Install pressure gage on the riser or feed main at or near each test connection. Provide gage with a connection not less than 1/4 inch and having a soft metal seated globe valve, arranged for draining pipe between gage and valve. Install gages to permit removal, and where they will not be subject to freezing.

3.03 PIPE JOINT CONSTRUCTION

A. Welded Joints: AWS D10.9, Level AR-3.

B. Threaded Joints: Conform to ANSI B1.20.1, tapered pipe threads for field cut threads. Joint pipe, fittings, and valves as follows:
   1. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   2. Align threads at point of assembly.
   3. Apply appropriate tape or thread compound to the external pipe threads.
   4. Assemble joint to appropriate thread depth. When using a wrench on valves place the wrench on the valve end into which the pipe is being threaded.
   5. Damaged Threads: Do not use pipe with threads that are corroded or damaged. If a weld opens during cutting or threading operations, that portion of a pipe shall not be used.

C. Flanged Joints: Align flange surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly to appropriate torque specified by the bolt manufacturer.

D. Mechanical Grooved Joints: Grooves on pipe ends dimensionally compatible with the couplings.

E. End Treatment: After cutting pipe lengths, remove burrs and fins from pipe ends.

3.04 VALVE INSTALLATION

A. General: Install fire protection specialty valves, fittings, and specialties in accordance with the manufacturer's written instructions, NFPA 13 and authority having jurisdiction.

B. Gate Valves (Products of Domestic Manufacture): Install supervised-open gate valves so located to control all sources of water supply except fire department connections. Where there is more than one control valve, provide permanently marked identification signs indicating the portion of the system controlled by each valve. Refer to Division 22 Section "Plumbing Identification" for valve tags and signs.

C. Install check valves in each water supply connection.

D. Alarm Check Valves (Products of Domestic Manufacture): Install valves in the vertical position, in proper direction of flow including the bypass check valve. Install valve trim in accordance with the valve manufacturer's appropriate trim diagrams. Test valve for proper operation.

3.05 SPRINKLER HEAD INSTALLATION

A. Use proper tools to prevent damage during installations.

B. Where heads are subject to damage, such as in storage rooms, mechanical rooms, custodian rooms, gymnasiums, shower, and locker rooms, etc., install approved type protective metal basket head guards.

C. In all removable or modular patterned ceilings, install all sprinkler heads centered on the modular ceiling panels.

3.06 FIELD QUALITY CONTROL

A. Flush, test, and inspect sprinkler piping systems in accordance with NFPA 13.

B. Replace piping system components that do not pass the test procedures specified, and retest repaired portion of the system.

3.07 CORROSION PROTECTION

A. All below ground metallic fittings, valves, flanges, bolts, etc., installed under this Section of the Specifications, shall be protected against corrosion.

3.08 COORDINATION WITH OTHER TRADES

A. The Contractor shall review the fire sprinkler design and coordinate the shop drawings, identified as "Working Plans", with the Mechanical Engineer and other parts of the work, prior to submission to Architect for review.

B. Architect will review for concept only. Contractor/Installer and mechanical shall review for possible conflict with other portions of the work.

3.09 HYDROSTATIC TESTS

A. All new systems including yard piping shall be hydrostatically tested at not less than 200 PSI pressure for 2 hours, or at 50 PSI in excess, of the maximum pressure, when the maximum pressure to be maintained in the system is in excess, of 150 PSI.

END OF SECTION 21 1300

SECTION 22 0500

COMMON WORK RESULTS FOR PLUMBING

PART 1 -GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Project Specification, apply to this and the other sections of Division 22.

B. This Division is an integrated whole comprising interrelated and interdependent Section and shall be considered in its entirety in determining requirements of the Work.

C. Refer to other sections of this Division for additional requirements or information regarding the subjects of this Section.

1.02 SECTION INCLUDES

A. This Section includes general administrative and procedural requirements for plumbing installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01:
   1. Submittals.
   2. Coordination drawings.
   3. Record documents.
   4. Maintenance manuals.
   5. Rough-ins.
   6. Mechanical installations.
   7. Cutting and patching.

1.03 SUBMITTALS

A. General: Follow the procedures specified in Division 01.

B. Plumbing submittals shall include shop drawings, product data, and samples per requirements of each section of specification

C. Plumbing Submittals and Product Data: Assemble “submittals” and “product data” into tabbed brochures according to main areas of work.
   1. Assemble each brochure with tabbed separators for each Specification Section where products are noted to be submitted, with separate tabs for each product listed.
   2. Temperature "control shop drawings" may be submitted separately after preparations for review.
   3. For items such as valves, hangers and accessories, indicate specific items and where they are to be used.
   4. Contractor need only to submit for review those items specified to be submitted, unless requested by the Architect for special review.

D. All submittals shall be submitted in hard copy, electronic submittals are not acceptable.

E. Increase the number of plumbing related submittals including; shop drawings, product data, and samples submitted to allow for required distribution by one additional copy, which will be retained by the Mechanical Consulting Engineer.

F. Submit for review, only the specific items required in this Section or other Sections of Division 22.

G. Additional submittals shall include, but not limited:
1. Equipment data record drawings.
2. Certification of completion of testing.
3. Certification of completion of operation instructions.
4. Operating instruction brochure.
5. Maintenance instruction brochures.
6. Equipment guarantees.
7. 1/4" = 1'-0" or larger scale layouts of "Equivalent" equipment or "Or Approved Equal" equipment.
8. Coordination Drawings, where requested or required.

H. Submittal materials will be reviewed for substantial conformity with the intent of the contract plans and specifications only. Such review does not indicate approval of dimensions, quantities, coordination with other trades, or work methods of the contractor, which are indicated thereon.

I. Additional copies may be required by individual sections of these specifications.

1.04 COORDINATION

A. The Contractor shall be totally responsible for coordinating the layout of all building elements to avoid conflict of the work of the structural, mechanical, electrical systems, and architectural features of the building.

B. The cost of any extra work of any kind caused by a conflict due to this lack of coordination shall be borne by the Contractor.

1.05 COORDINATION OF DRAWINGS

A. Prepare coordination drawings in accordance with requirements of Project Specification to a scale of 1/4" = 1'-0" or larger; detailing major elements, components, required clearances, and systems of plumbing equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of the installations are of importance to the efficient flow of the Work, including but not necessarily limited to the following:
1. Indicate the proposed locations of piping, fixtures, equipment, and materials. Include the following:
   a. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
   b. Equipment for connections and support details.

2. Prepare reflected ceiling plans to coordinate and integrate installations with other systems and components, such as, ductwork, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

B. Submittal of "Or Equal" substitutions of equipment will not be reviewed unless accompanied by coordination drawings.

1.06 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements of project specification. In addition to the requirements of project specification, indicate the following installed conditions:
1. Record drawings of all installed systems as specified in project specification including the locations and invert elevations of underground installations.

1.07 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with project specification and Division 22 Section "Supplementary Plumbing Requirements".

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, mill certification, and other information needed for identification.

1.09 EQUIVALENT EQUIPMENT

A. In these specification and drawings, whenever more than one (1) manufacturer’s product is specified, the manufacturer specified on the drawings and the first named product in these specifications is the basis of design and the use of alternate-named manufacturer’s product or substitutes may require modification in the design work and agency approvals. If such alternatives or substitutions are proposed by the contractor, contractor shall adhere to the following requirements;
1. Contractor shall clearly identify all proposed alternatives or substitutions in the submittal package.
2. The Contractor shall assume all costs required to make all necessary revisions and modifications of the contract documents resulting from the substitution or selection of an alternate manufacturer’s product, including all professional fees and the cost of DSA approval.
3. The Contractor shall assume all costs required for any additional modification to building structure, electrical and all other related construction costs resulting from the substitution or selection of an alternate manufacturer’s product

B. These specifications and/or drawings, names and specifies certain equipment in detail which are the basis of design and are explained in paragraph 1.09-A above. It also names alternate equipment by manufacturer, which is not considered to be a "substitution".

C. Submit equivalent equipment to the Architect for review per the requirements of Division 01, and Section "Supplementary Plumbing Requirements."

D. Equipment of Manufacturers named in Division 22 will be considered equivalent to that specified in detail and/or named on the drawings if:
   1. The proposed equipment is of equivalent quality, capacity.
   2. Equipment is as fully equipped, fits the space allotted, and has physical configuration and weight similar to the equipment specified in detail.

E. A complete lay out of an equipment room or area must be submitted for equivalent equipment. Notice space limitations. Layouts to include plans and section views at a scale of not less than 1/4" = 1 ft.

F. The Architect shall determine the acceptability of "Equivalent Equipment."

PART 2 - PRODUCTS (Not Applicable)

PART 3 -EXECUTION

3.01 ROUGH-IN

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

3.02 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of plumbing systems, materials, and equipment. Comply with the following requirements:
   1. Coordinate plumbing systems, equipment, and materials installation with other building components.
   2. Verify all dimensions by field measurements.
   3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for plumbing installations.
   4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
   5. Sequence, coordinate, and integrate installations of plumbing materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
   6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible as required by California Building Code.
   7. Coordinate connection of plumbing system with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
   8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect prior to commencement of installation.
   9. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and components.

10. Install all plumbing equipment to facilitate servicing, maintenance, and repair or replacement of equipment components in full compliance with California Building Code and the equipment manufacturer's recommendations. If the drawings or the manufacturer does not provide a specific space requirement for servicing equipment, provide as a minimum, horizontal distance of 36" from face of equipment to opposite vertical surface.
11. Install access panels or doors for all equipment and components which require access for adjustment and maintenance, where units are concealed behind finished surfaces.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Any equipment located above a ceiling that has any component, which is serviceable shall be installed within 12" of the top of the ceiling.

3.03 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with project specification. In addition to the requirements specified in project specification, the following requirements apply:
   1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of plumbing equipment and materials required to:
   1. Uncover Work to provide for installation of ill-timed Work.
   2. Remove and replace defective work.
   3. Remove and replace Work not conforming to requirements of the Contract Documents.
   4. Remove samples of installed Work as specified for testing.
   5. Install equipment and materials in existing structures.
   6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

C. Cut, remove and legally dispose of selected plumbing equipment, components, and materials as indicated, including but not limited to removal of plumbing piping, gas lines, heating units, plumbing fixtures and trim, and other plumbing items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
   1. Patch existing finished surfaces and building components using experienced installers and new materials matching existing materials. For installer’s qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION 22 0500

SECTION 22 0503

EARTHWORK FOR PLUMBING SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes limited scope instructions for methods and materials applicable, to excavation for underground utilities and services, including underground piping, under the building and from building to utility connection, tanks, basins, and equipment.

1.02 SUBMITTALS

A. Submit schedules in accordance with Conditions of Contract and Divisions 01 and 22 specification sections.
   1. Indicate proposed methods and schedule of operations prior to commencement of work.
   2. Include coordination for shut-off of utility services where required.
   3. Maintain services to areas outside construction limits, where such service exists.
   4. Coordinate sequencing with construction phasing and Owner occupancy specified in Division 01.

1.03 DEFINITIONS

A. Excavation consists of removal of material encountered to sub-grade elevations, indicated and subsequent disposal of materials removed.

B. Unauthorized excavation consists of removal of materials beyond indicated sub-grade, elevations or dimensions without specific direction of Architect. Unauthorized excavation, as well as remedial work directed by Architect, shall be at Contractor's, expense.

C. Sub-grade: The undisturbed earth or the compacted soil layer immediately below granular sub-base drainage fill, or topsoil materials.

D. Structure: Buildings, foundations, slabs, tanks, curbs, or other man made stationary features occurring above or below ground surface.

1.04 CODES AND ORDINANCES

A. Perform excavation work in compliance with applicable requirements of authorities, having jurisdiction.

1.05 PROJECT CONDITIONS

A. Conditions Affecting Excavations: The following project conditions apply:
   1. Maintain and protect existing building services which transit the area affected by selective demolition.

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

B. Site Information: Subsurface conditions were investigated during the design of the Project. Reports of these investigations are available for information only data in the reports are not intended as representations or warranties of accuracy or continuity of conditions. The Owner will not be responsible for interpretations or conclusions, drawn from this information.

C. Existing Utilities: Locate existing underground utilities in excavation areas. If utilities are indicated to remain, support and protect services during excavation operations. Remove existing underground utilities indicated to be removed.

D. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.

E. Use of Explosives: Use of explosives is not permitted.

1.06 SEQUENCE AND SCHEDULING

A. Coordinate the shut off and disconnection of utility services with Owner and Utility Company.

B. Provide minimum of 48-hour notice to Architect prior to utility interruption.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Select Bedding Sand: Dry riverbed sand free of any debris or organic matter.

B. Mastic Coatings: "Henry's" oil base roof mastic or approved equal.

C. Polyethylene sheeting not less than 8 mils thick.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas where earthwork is to occur. Determine extent of work and effect on existing conditions to remain. Advise Architect of any conditions that might create, extensive alteration beyond indicated scope.

B. Clearances: Take special notice and maintain the required horizontal and vertical depth clearances from structural footings for utility trenches running parallel to footings. Do not violate the area of the footing bearing prism. In the event of conflict (i.e., the utility cannot be relocated, or its depth changed), proceed as directed by the Architect. Lower structural footings to maintain proper clearances for underground utilities trenching without additional cost to Owner.

3.02 EXCAVATION

A. Slope sides of excavations to comply with local codes and ordinances. Shore and brace as required for stability of excavation.

B. Shoring and Bracing: Establish requirements for trench shoring and bracing to comply, with local codes and authorities. Maintain shoring and bracing in excavations, regardless of time-period excavations will be open.
   1. Remove shoring/bracing when no longer required. Where sheeting is allowed to remain, cut top of sheeting at a height of 30 inches below finished grade elevation.

C. Install sediment and erosion control measures in accordance with local codes and ordinances.

3.03 DEWATERING

A. Dewatering: Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
   1. Do not allow water to accumulate in excavations. Remove water to prevent softening of bearing materials. Provide and maintain dewatering system components necessary to convey water away from excavations.
   2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey surface water to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.

3.04 MATERIAL STORAGE

A. Material Storage: Stockpile satisfactory excavated materials where directed, until required for backfill or fill. Place, grade, and shape stockpiles for proper drainage.
   1. Locate and retain soil materials away from edge of excavations. Do not store within dripline of trees indicated to remain.
   2. Remove and legally dispose of excess excavated materials and materials not acceptable for use as backfill or fill.

3.05 TRENCHING

A. Do all necessary trenching, excavation, shoring, and backfilling required for the proper laying of the pipelines.

B. Pipe Trench Dimensions: The following requirements are considered minimal unless otherwise indicated in order, to provide adequate pipe clearances and bedding. Provide trenches wider than the specified minimum where required to properly install, the specific type of piping. In the event utility company regulations, code requirements, or the pipe manufacturer's recommendations differ from these, provisions, the most restrictive requirements shall take precedence.
   1. Pipe Burial Depths:

Sewer & Drainage:	24"(a) + pipe O.D.(b) + 3" bed of sand
Gas:	30" + pipe O.D. + 4" bed of sand
Water (Domestic)	
PVC:	30" + pipe O.D. + 4" bed of sand
All other:	24" (30" at planters) + pipe O.D. + 4" bed of sand
Pre-insulated Piping	24" + jacket O.D. + 4" bed

Condenser Water (PVC)	30" + pipe O.D. + 4" bed

Notes:
a. Finish grade to top of pipe, typical.
b. O.D.: Outside dimension.

2. Trench Widths:

Sewer & Drainage:	12" + pipe O.D. for 4" to 18" diameter pipe
Gas:	8" + pipe O.D.
Water (Domestic)	8" + pipe O.D.
Water (Fire)	
Pre-insulated Pipe	8" + jacket O.D.
Condenser Water	8" + pipe O.D.

C. Where rock is encountered, carry excavation below required elevation and backfill with a layer of select bedding sand prior to installation of pipe. Provide a minimum of 6-inches of stone or gravel cushion between rock bearing surface and pipe.

D. Excavate trenches for piping and equipment with bottoms of trench to accurate, elevations for support of pipe and equipment on undisturbed soil.

E. Do not install copper piping or metal gas piping in a common trench with other, dissimilar metal piping or conduit; separate a minimum of 4 feet when running parallel, to such piping or conduit.

F. Separate multiple parallel lines of piping in a common trench a minimum of 12 inches, both horizontally and vertically, between individual pipes.

G. Install domestic water piping, running parallel in a common trench with sewer or drainage lines, on a solid shelf 12 inches above the sewer or drainage piping.

H. Do not run electrical power and communications conduit in a common trench with sewer, drainage, water, or gas piping.

I. Provide and install a bare 14-gauge copper "tracer" wire, continuous for entire length, for all underground non-metallic piping. Secure to piping at alternate joints, at each, fitting and at each valve. Locate "Tracer" wire along side pipe, but not under pipe.

J. Install thrust blocks in all pressurized lines. Install thrust blocks in accordance with pipe manufacturer’s recommendations.

3.06 EXCAVATION FOR UNDERGROUND CLARIFIERS AND STRUCTURES

A. Excavation for Underground Tanks, Basins, and Mechanical Structures: conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 foot plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection.
   1. Excavate, by hand, areas within dripline of large trees. Protect the root system from damage and dry-out. Maintain moist conditions for root system and cover exposed roots with burlap. Paint root cuts of 1 inch in diameter larger with emulsified asphalt tree paint.
   2. Take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed.

3.07 BACKFILLING AND FILLING

A. Backfilling and Filling: Place soil materials in layers to required sub-grade elevations, for each area classification listed below, using materials specified in Part 2 of this, Section.

B. Bedding: Lay and bed pipe in compacted select dry river-bed bedding sand, thickness as specified herein and backfill with the same sand material to a height of one foot, above the top of pipe.
   1. Sewer drainlines except as hereinafter specified may be bedded in the native soil provided it is rock free and sandy. Dig out under bell portions of the piping for uniform bearing.
   2. Under walks and pavements, use a combination of sub-base materials and excavated or borrowed materials.
   3. Under building slabs, set piping on a 6-inch bed of dry river-bed sand and backfilled to 12" of finish grade with dry river-bed sand. Remainder of backfill to be approved backfill material.
   4. Under piping and equipment, use sub-base materials where required over rock bearing surface and for correction of unauthorized excavation.
   5. For piping less than 30 inches below surface of roadways, provide 4-inch-thick concrete base slab support. After installation and testing of piping, provide a
   6. 4-inch, thick concrete encasement (sides and top) prior to backfilling and placement of roadway sub-base.
   7. Other areas use excavated or borrowed materials.

C. Backfill excavations as promptly as work permits, but not until completion of the following:
   1. Do not backfill until installation has been approved and as-built drawings are up to date.
   2. Inspection, testing, approval, and locations of underground utilities have been recorded.
   3. Removal of concrete formwork.
   4. Removal of shoring and bracing, and backfilling of voids.
   5. Removal of trash and debris.

D. Placement and Compaction: Place backfill and fill materials in layers of not more than 8 inches in loose depth for material compacted by heavy equipment, and not more, than 4 inches in loose depth for material compacted by hand-operated tampers.

E. Before compaction, moisten or aerate each layer as necessary to provide optimum, moisture content. Compact each layer to required percentage as specified in Division, 02. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain, frost or ice.

F. Place, backfill and fill materials evenly adjacent to structures, piping, and equipment to required elevations. Prevent displacement of piping and equipment by carrying material uniformly around them to approximately same elevation in each lift.

G. Cold Weather Protection: Protect excavation bottoms against freezing when, atmospheric temperature is less than 35 deg. F.

H. Unauthorized excavation:
   1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Architect.
   2. In locations other than those above, backfill and compact unauthorized excavations as specified for authorized excavations of same classification, unless otherwise directed by Architect.

3.08 SUBSIDENCE

A. Subsidence: Where subsidence occurs at mechanical installation excavations during the period 12 months after Substantial Completion, remove surface treatment (i.e., pavement, lawn, or other finish), add backfill material, compact to specified conditions, and replace surface treatment. Restore appearance, quality, and condition of surface, or finish to match adjacent areas.

3.09 CORROSION PROTECTION

A. All below ground metallic fittings, valves, flanges, bolts, pipes (which are not factory coated with a bituminous material) shall be protected against corrosion as follows:
   1. All metallic components as described above shall receive a heavy coating of "Henry's" oil base roof mastic.
   2. After mastic coating is completed and inspected, wrap entire metallic component with a minimum of 8 mil polyethylene wrap overlapped 50% of the circumference and extended beyond ends of component as required for polyethylene to be secured to piping. The overlap seam shall be located to avoid backfill material from entering the encapsulated area. The ends and seam of the polyethylene material shall be secured to the piping and sealed with 3M Scotch/Wrap N. 50, 10 mil., 2" wide, printed, pipe wrap sealing tape.
   3. The mastic coating shall be inspected and approved prior to the finish application of the polyethylene material, which shall also be inspected.

END OF SECTION 22 0503

SECTION 22 0511

SUPPLEMENTARY PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies supplementary requirements for plumbinginstallations and includes requirements common to more than one section of Division 22. It expands and supplements the requirements specified in Section 22 0500 "Common Work Results for Plumbing."

1.02 DESCRIPTION

A. Provide a complete and operable installation, including all labor, supervision, materials, equipment, tools, apparatus, transportation, warehousing, rigging, scaffolding and other equipment and services necessary to accomplish the work in accordance with the intent and meaning of these drawings and specifications.

1.03 COORDINATION

A. Coordination of the work is the responsibility of the Contractor.

B. Contractor shall designate an individual competent and versed in the plumbing trades to coordinate the plumbing work with the work of other trades.

1.04 DEFINITIONS (AS USED ON DIVISION 22 DRAWINGS AND HEREIN)

A. "Provide" means furnish, install and connect unless otherwise described in specific instances.

B. "Piping" means pipes, fittings, valves and all like pipe accessories connected thereto.

C. "Extend", "Submit", "Repair" and similar words mean that the Contractor (or his designated subcontractor) shall accomplish the action described.

D. "Codes" or "Code" means all codes, laws, statutes, rules, regulations, ordinances, orders, decrees, and other requirements of all legally constituted authorities and public utility franchise holders having jurisdiction.

E. "Products", "Materials" and "Equipment" are used interchangeably and mean materials, fixtures, equipment, accessories, etc.

F. "Utility Areas" are defined as mechanical, electrical, janitorial, and similar rooms or spaces which are normally used or occupied only by custodial or maintenance personnel. "Public Areas" are defined as the rooms or spaces, which are not included in the utility areas definition.

G. "Building Boundary" includes concrete walkways immediately adjacent to the building structure.

H. "Below Grade" means buried in the ground.

I. "Substantial Completion" means all components of all systems are functioning but lacking in final adjustment.

J. Pressure rating specified (such as for valves and the like) means design working pressure for and with references to the fluid, which the device will serve.

1.05 RELATED WORK

A. Coordination: Refer to Architectural, HVAC, Plumbing, Civil, Structural, and Electrical Drawings for the construction details and coordinate the work of this Division with that of other Divisions. Order the work of this Division so that progress will harmonize with that of other Divisions and all work will proceed expeditiously. The work of this Division shall include direct responsibility for the correct placing and connection of Plumbingwork in relation to the work of other Divisions.

B. Examine other Divisions for work related to the Work of this Division, especially Divisions 23 & 26.

1.06 EXISTING CONDITIONS

A. Visit the site prior to bidding and investigate the existing conditions, which affect or will be affected by the work of this Division. Become thoroughly familiar with the working conditions and take into account any special or unusual features peculiar to this job. By the act of submitting a Bid, the Contractor will be deemed to have complied with the foregoing, to have accepted such conditions, and to have made allowance therefore in preparing his Bid.

B. The locations of existing concealed utility lines are shown in accordance with reference data received by the Architect. The Architect does not guarantee the accuracy of such data. The points of connection are therefore approximate and the Bidder shall include adequate funds in his Bid to cover costs of connection regardless of their exact location.

C. Exercise extreme caution during trenching operations. Repair the damage caused by such operations to existing utility lines at no cost to the Owner, whether the lines are shown on drawings or not.

1.07 DRAWINGS AND SPECIFICATIONS

A. These drawings and specification do not include necessary components for construction safety.

B. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option".

C. Except where dimensioned, the drawings relating to this division are a diagrammatic presentation of the design concept, which indicates the general area where piping is to be run. The drawings do not necessarily indicate any and all offsets and configurations required for coordination with other trades. The contractor is responsible for the correct placing of his work, and the proper location and connection of his work in relation to the work or other trades.

1.08 WATER (DOMESTIC AND FIRE), SANITARY SEWERS AND NATURAL GAS SERVICES

A. Within 5 days after award of Contract, notify the serving utilities that the project is under construction and apply for permanent service in the name of the Owner. Furnish pertinent load and location information to them including the required dates for permanent service. Verify service locations and conform to utility company requirements.

B. Contractor shall pay charges for permanent service connections levied by the utilities for which he will be reimbursed by the Owner. The reimbursement shall be limited to the actual amount of the utility service charges and a copy of the billing from the utility company shall accompany the Contractor's invoice.

1.09 PERMITS AND INSPECTIONS

A. Obtain, schedule and pay for permits, licenses, approvals, tests, and inspections required by legally constituted authorities and public utility franchise holders having jurisdiction over the work.

B. Afford the Architect's representative every facility for evaluating the skill and competence of the mechanics and to examine the materials. Concealed work shall be reopened when so directed during his periodic visits.

1.10 CODES AND REGULATIONS

A. By submitting a Bid, Contractor is deemed to represent himself as competent to accomplish the work of this Division in conformance with applicable Codes. In case of conflict between the Contract Documents and Code requirements, the Codes shall take precedence. Should such conflicts appear, cease work on the parts of the contract affected and immediately notify the Architect in writing. It shall be the Contractor's responsibility to correct, at no cost to the Owner, any work he executes in violation of Code requirements. Specific references to codes elsewhere in this Division are either to aid the Contractor in locating applicable information or to deny him permission to use options, which are permitted by Codes.

B. Applicable Codes: (Current editions unless otherwise noted)
   1. All local codes; City and/or County as applicable.
   2. OSHA requirements.
   3. California Building Code.
   4. California Code of Regulations (CCR) Titles (as applicable).
   5. Fire Marshal Regulations.
   6. State, County, City Health Department Ordinances and Regulations.
   7. Regulations of all other authorities having jurisdiction.
   8. California Mechanical Code.
   9. California Plumbing Code.

C. Where conflict or variation exists amongst Codes, the most stringent shall govern.

1.11 RECORD AND DOCUMENTATION

A. Accumulate the following and deliver to the Owner's representative prior to final acceptance of the work.

1. Record (As-Built) Drawings:
   a. Maintain in good order in the field office a complete set of prints for all work being done under Division 22. Update the drawings daily with neat and legible annotations in red ink showing the work as actually installed.
   b. The actual size, location and elevation of all buried lines, valve boxes, manholes, monuments, and stubouts shall be accurately located and dimensioned from building walls or other permanent landmarks.
   c. Furnish the original marked up AS-Built drawings and an electronic copy in AutoCAD-14 format.
2. Operation and Maintenance Manual: Furnish an operation and maintenance manual covering the stipulated Plumbing systems and equipment. Seven copies of the manual, bond in hardback binders or an approved equivalent shall be provided to the Architect.
3. Furnish one complete manual prior to the time that system or equipment tests are performed.
4. Furnish the remaining manuals before the contract is completed.
5. The following identification shall be inscribed on the cover:

   OPERATION AND MAINTENANCE MANUAL

   PROJECT TITLE . . . . . .

   CONTRACTOR NAME & CONTACT INFORMATION

6. Provide a Table of Contents.
   a. Insert tab sheets to identify discrete subjects.
   b. Instruction sheets shall be legible and easily understood, with large sheets of drawings folded in.
   c. The manual shall be complete in all respects for all materials, piping, valves, devices and equipment, controls, accessories and appurtenances stipulated. Include as a minimum the following:
      1) Updated approved materials lists, shop drawings and catalog information of all items of HVAC system equipment.
      2) System layout showing piping, valves and controls.
      3) Wiring and control diagrams with data to explain detailed operation and control of each component.
      4) A control sequence describing start-up, operation and shutdown.
      5) Detailed description of the function of each principal component of the system.
      6) Procedure for starting.
      7) Procedure for operating.
      8) Shut-down instructions.
      9) Installation instructions.
      10) Adjustments, maintenance and overhaul instructions.
      11) Lubrication schedule including type, grade, temperature range and frequency.
      12) Safety precautions, diagrams and illustrations.
      13) Test procedures.
      14) Performance data.
      15) Parts list, with manufacturer's names and catalog numbers.
      16) Preventive maintenance schedule.
      17) Service organization with name, address and telephone number.
      18) Valve identification chart and schedule.

19) ASME certificates.
20) Hydronic balance report.

B. Standards Compliance: Where equipment or materials are specified to conform to requirements of standards of recognized technical or industrial organizations such as American National Standards Institute (ANSI) American Society for Mechanical Engineers (ASME) American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), American Society for Testing Materials (ASTM), Underwriters Laboratories (UL), American Gas Association (AGA), American Society of Plumbing Engineers (ASPE),, American Refrigeration Institute (ARI), or National Electrical Manufacturer's Association (NEMA), that use a label or published listing as a method of indicating compliance, proof of such conformance shall be submitted and approved. The label or listing of the specified organization will be acceptable evidence.

C. Certificates of Conformance or Compliance: Submit original and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply that the product does not meet all requirements.

D. Certified Test Reports: Certified Test Reports are reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. Before delivery of materials and equipment, submit certified copies of test reports specified in the individual sections.

E. Factory Tests: Factory tests are tests, which are required to be performed on the actual materials or equipment, proposed for use. Submit results of the tests in accordance with the requirements for laboratory test results of this Contract.

F. Permits and Certificates of Inspection: Furnish the originals.

G. Testing procedures and test results required in this and other sections. Furnish 2 copies.

H. Other data required by other sections of this Division. Furnish 2 copies.

1.12 CONSTRUCTION COST BREAKDOWN

A. Prepare and submit for review a construction cost breakdown for the major subdivisions of the PLUMBING scope of work in accordance with General and Supplemental Conditions and Project Specification.

B. Subdivide each item on the breakdown into two headings: labor and materials. Include overhead and profit in each entry.

C. Submit one copy of the breakdown directly to the Engineer and the remaining copies sent through regular channels.

1.13 TOOLS

A. Provide all special tools needed for proper operation and routine adjustment and maintenance of systems and equipment. Deliver tools to Owner's representative and request a receipt for same.

1.14 WARRANTIES

A. Refer to Project Specification for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Where periods more than one year are specified in the specifications, such longer periods shall govern. However, when any component fails at any time during this period, the warranty period for such component and all other components, which are inactive because of, said failure shall be suspended. The warranty period for such components shall resume to-run for the remaining portion of the warranty period when failed component is completely repaired and in operation; however, in no case shall the resumed portion of the warranty period be less than 3 months in duration.

C. Neither payment for work, nor total or partial occupancy of work by the Owner, within or prior to the warranty period specified, shall be construed as acceptance of faulty work or shall condone any negligence or omission of Contractor in doing the work.

D. Compile and assemble the warranties specified in Division 22, into a separated set of vinyl covered, three ring binders, tabulated and indexed for easy reference.

E. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names and addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.15 SEISMIC RESTRAINT

A. Provide seismic restraint for plumbing equipment, piping, and accessories.

B. Contractor shall submit certification of suitability of seismic restraint methods signed by Licensed Structural Engineer registered in the State of California.

1.16 SYSTEM OPERATIONAL TESTS

A. The Contractor shall inform the Owner one week prior to start of testing in order that the Owner's representative may be present.

B. After balancing and prior to final inspection, the contractor shall operate all plumbing systems trouble free and stable. Contractor shall submit a written report certified by the Owner's representative indicating the successful completion of a stable and trouble free testing.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Standard Products: Materials and equipment shall be essentially the standard cataloged products of manufacturers regularly engaged in production of such materials or equipment and shall be their latest standard designs that comply with the specification requirements.

B. Materials and equipment shall duplicate items that have been in satisfactory commercial or industrial use at least two years prior to bid opening, unless more stringent requirements are specified. Where two or more units of the same type of equipment are required, these units shall be products of a single manufacturer. The components thereof, however, are not required to be exclusively of the same manufacturer.

C. Each major component of equipment shall have manufacturer's name, address, model, and serial number on a nameplate securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.

D. In these specification and drawings, whenever more than one (1) manufacturer's product is specified, the manufacturer specified on the drawings and the first named product in these specifications is the basis of design and the use of alternate-named manufacturer's product or substitutes shall comply with the requirements of Section 22 0500.

2.02 PRODUCT LISTING

A. When two or more items of same material or equipment are required (pipe and fittings, plumbing fixtures, pumps, valves, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, sheet metal, wire, steel bar stock, welding rods, solder, fasteners, and similar items used in Work, except as otherwise indicated.

2.03 NAMEPLATE DATA

A. Provide permanent operational data nameplate on each item of power operated plumbing equipment, indicating manufacturer, product name, model name, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

2.04 SUBSTITUTIONS

A. General: Submittals of "Substitutions" shall be in accordance with requirements of Division 01.

B. By proposing a substitution, it is deemed that the Contractor shall bear the cost of any and all design and construction changes (whether architectural, structural, electrical, and Plumbing) necessary to accommodate the substitution, if said substitution is accepted.

C. Specific: Refer to Specification Sections 22 0500 & 22 0512 for additional requirements.

2.05 SUBMITTALS

A. General: Make submittals in accordance with requirements of Division 01.

B. Specific: Refer to Specification Sections 22 0500 for additional requirements.

PART 3 - EXECUTION

3.01 WORKMANSHIP AND INSTALLATION METHODS

A. Workmanship shall be in the best standard practice of the trade.

B. Install equipment in accordance with the manufacturer's instructions and recommendations unless otherwise noted or specified.

3.02 TESTS

A. General:
   1. Demonstrate that all components of the work of this Division have been provided and that they operate in accordance with the Contract Documents.
   2. Provide instruments and personnel for tests and demonstrations. Submit signed test results.

B. Specific: Refer to the other sections of this Division for test requirements.

3.03 DELIVERY, HANDLING, STORAGE OF MATERIALS AND PROTECTION OF WORK

A. Protect materials against dirt, water, chemical and mechanical damages both while in storage and during construction.

B. Cover materials in such a manner that no finished surfaces will be damaged, marred or splattered with plaster or paint, and all moving parts will be kept clean and dry.

C. Replace or refinish any damaged materials including fronts of control panels, piping, insulation, and equipment.

D. All plumbing fixtures, vents, and waste linesshall be aggressively protected during construction process to ensure that no contamination of the system occurs.

E. The use of permanently installed plumbing fixtures during construction is prohibited.

F. Keep cabinets and other openings closed to prevent entry of foreign matter.

G. Specific: Refer to other sections of this Division for additional requirements.

3.04 PROJECT CONDITIONS

A. Check and coordinate for clearance, accessibility and placement of equipment either by going through openings provided or by placing equipment during construction. Ordering of equipment to be shipped disassembled, or disassembly of equipment at Project Site and reassembly of equipment to accomplish this requirement shall be executed without additional cost. Where provided openings are inadequate to accommodate equipment, provide new openings and restoration of same, all at no additional cost. Obtain written approval for new openings before proceeding.

B. Verify location of all plumbing fixtures and equipment within finished spaces with the Architectural Drawings. In the event that Plumbing Drawings do not indicate exact locations, or are in conflict with the Architectural Drawings, obtain information regarding proper locations. Installation of work without proper instruction under such circumstances will result in relocation of work, when directed, without additional cost.

3.05 INSTRUCTION TO OWNER PERSONNEL

A. Contractor shall furnish, without additional expense to the Owner, the services of competent instructors who will give full instruction to the designated personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the equipment or system specified. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance of work. Instruction shall be given at the Owner's convenience. The number of man-days (eight-hours) of instruction furnished shall be as specified in other sections. When more than four man-days of instruction are specified, approximately half of the time shall be used for classroom instruction. All other time shall be used for instruction with the equipment or system. When significant changes or modifications are made under the terms of the contract, provide additional instructions to acquaint the operating personnel with the changes or modifications.

B. Contractor shall videotape, both visual and audio, instruction to Owner's personnel on the maintenance and operation of the plumbing equipment and systems.

C. Submit certification, signed by Owner's agent that instructions have been completed and the videotape has been reviewed and delivered to the Owner.

D. Printed operating instructions and a copy of wiring diagrams are to be mounted in all equipment areas, framed and behind glass or encased in plastic. Printed operating instructions shall include steps for starting up and securing equipment. As a precedent to final acceptance four (4) copies of instructions are to be submitted to the Architect for review. Contractor shall turn over to Owner in a neat brochure form, equipment guarantee and maintenance instructions.

3.06 CLEANING

A. Cleaning shall be done as the work proceeds. Periodically remove waste and debris to keep the site as clean as is practical.

B. Refer the Division 01 for general requirements for cleaning.

C. Leave exposed parts of the plumbing work in a neat and clean condition, with painted surfaces unblemished and plated metal surfaces polished.

D. Thoroughly clean all materials, equipment and appliances. Clean and prepare all surfaces to be painted. Clean the entire premises of unused materials, debris, spots and marks to the satisfaction of the Architect.

E. Remove, thoroughly clean and replace all strainers and valves after the system has been put in operation until system is clear of all foreign matter and repeat this operation after ten (10) days and again after the system has been in operation thirty (30) days. Submit certification that this operation has been completed.

3.07 SAFETY REQUIREMENTS

A. Enclose and guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts in accordance with OSHA requirements. Insulate, guard, and cover any high-temperature equipment and piping so located as to endanger personnel or create a fire hazard.

END OF SECTION 22 0511

SECTION 22 0512

PLUMBING PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies administrative and procedural requirements for handling requests made after award of the Contract for substitutions of products specified in Division 22.

1.02 RELATED SECTIONS

A. Procedure for Contractor's construction Schedule and the Schedule of Submittals are included under Division 01.

B. Standards: Refer to Division 01 for applicability of industry standards to products specified.

C. Procedural requirements governing the Contractor's selection of products and product options are included under Division 01.

D. Refer to Division 01 for Products and Substitutions.

E. Refer to Sections 22 0500 & 22 0511 for additional requirements.

1.03 DEFINITIONS

A. "Products" is defined to include purchased items for incorporation into the work, regardless of whether specifically purchased for project or taken from Contractor's stock of previously purchased products. "Materials" is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, installed or applied to form units of work.

B. "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service connections (wiring, piping, etc.). Definitions in this paragraph are not intended to negate the meaning of other terms used in contract documents, including "specialties", "systems", "structure", "finishes", "accessories", "furnishings", "special construction", and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

1.04 SUBSTITUTIONS

A. The requirements for substitutions do not apply to specified Contractor options on products and construction methods. Revisions to contract documents, where requested by Owner, Architect or Engineer, are "changes" not "substitutions". Substitutions requested during bidding period, which have been accepted prior to Contract Date, are included in contract document and are not subject to requirements for substitutions as specified herein.

Contractor's determination of and compliance with governing regulations and orders issued by governing authorities do not constitute "substitutions"; and do not constitute a basis for change orders, except as provided for in contract documents. Otherwise, contractor's requests of changes in products, materials and methods of construction required by contract documents are considered requests for "substitutions", and are subject to requirements hereof.

B. Conditions: The Contractor's substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect; otherwise requests will be returned without action except to record noncompliance with these requirements.
   1. Extensive revisions to Contract Documents are not required.
   2. Proposed changes are in keeping with the general intent of Contract Documents.
   3. The request is directly related to an "or approved equal" clause or similar language in the Contract Documents.
   4. All costs required to make all necessary revisions and modifications to the contract documents resulting from the substitution, including but not limited to, all professional fees and the cost of DSA approval will be the Contractor’s responsibility.
   5. All costs required to make all necessary revisions and modifications to the building structure, electrical and all other related construction costs resulting from the substitution, including but not limited to, material, products, equipment, testing, and inspection will bethe Contractor’s responsibility.
   6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
   7. Contractor will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.
   8. Contractor certifies that the substitution is not heavier than the specified item and does not necessitate any structural and electrical redesign; will fit within the room or area designed for the specified item; and will not exceed any maximum dimensions specified or shown on the original contract Documents. All roof mounted equipment must be less than or equal to the maximum height dimension from the finished roof as shown on the drawings.
   9. Contractor represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified.
   10. Contractor represents that he will provide the same warranty for the substitution that he would for that specified.

1.05 SUBMITTALS

A. Requests for Substitutions: Any request for substitution shall follow the guidelines of Substitution Requirements in Division 01, Section 22 0500 & 22 0511.

B. Substitution Warranty: All submittals of Request for Substitutions under the General and Supplementary Conditions of this Section shall be accompanied by a completely executed (filled out) and signed Substitution Warranty in the form entitled "Substitution Warranty", bound herein. Substitutions will not be accepted without the Substitution Warranty.

In addition to other requirements, Contractor shall warrant in writing on his own letterhead that substituted materials shall perform as specified, and assume complete responsibility for same, including responsibility and costs required for modifications to building or other materials or equipment, and any additional coordination with work of other trades. Testing, if required, shall be paid by Contractor.

C. Responsibility of Contractor: The contractor shall be solely and directly responsible for fitting accepted substitute material and equipment into the available space in a manner acceptable to the Architect, and for the proper operation of the substituted equipment with all other equipment with which it may be associated. The Contractor shall bear all costs of meeting the above requirements for presenting a proposed substitution, and if the substitution is accepted, he must bear all costs involved.

D. Submit the following as part of the Request for Substitutions:
   1. Data showing proposed equipment is "equal" to that specified and is fully equipped, fits the space allotted and has physical configuration and weight similar to the equipment specified in detail.
   2. A complete layout, where applicable, of equipment room or area must be submitted for equipment proposed in "Request for Substitution". Submittal shall conform to requirements of Division 01 and Section 22 0500 "Common Work Results for Plumbing" as it applies to "Coordination Drawings."
   3. Seismic Restraint: Where seismic restraint is required for products or equipment as specified, methods of seismic restraint signed by licensed Structural Engineer registered in the State of California, shall be submitted for review to the Division of the State Architect.

1.06 ARCHITECT'S ACTION

A. The Architect may request additional information or documentation necessary for evaluation of the request. Requests, by the Architect, for additional information or documentation will be in accordance with Division 01 requirements. The Architect will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, Contractor shall use the “Basis of Design” product specified by name in the contract documents. Acceptance will be in the form of a Change Order.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Substitutions shall conform to the product requirements for the specified products or equipment.

PART 3 - EXECUTION (Not Applicable.)

END OF SECTION 22 0512

SAMPLE

S U B S T I T U T I O N S W A R R A N T Y

In addition to other requirements, Contractor shall warrant in writing that substituted materials shall perform as specified, and assume complete responsibility for same, including responsibility and costs required for modifications to building or other materials or equipment, and any additional coordination with work of other trades. Testing, if required, shall be paid by contractor. The following is an example of the type Substitution Warranty which shall be executed by the Contractor, on his own letterhead:

SUBSTITUTION WARRANTY

We propose to provide

_____
(Describe items being proposed for substitution)

for_____ in lieu of
(List project name)

as indicated on the drawings and described in Section _____ of the Specifications.

We agree to assume the cost of any and all modifications to the Contract Documents and to other portions of the work as indicated in the Specification Sections 220500, 220511, & 220512, and as necessary to accommodate for substituted material(s) and system(s) as indicated in this letter of “Substitution Warranty.”

We hereby warrant that _____
(Provide Description)

is the equivalent of _____
(Specified Product)

in every respect and will perform satisfactorily under the conditions and use indicated on the Drawings and described in the Specifications.

Signed: _____ Date: _____
(Manufacturer/Supplier)

Signed: _____ Date: _____
(Subcontractor)

Signed: _____ Date: _____
(Contractor)

NOTE: Affix Corporate Seal over Signatures.

SECTION 22 0515

ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes limited scope of general construction materials and methods for access doors and panels in walls and ceilings for access to plumbing materials.

B. Requirements of access doors are outlined in Division 08.

C. Access doors and panels are required for all plumbing equipment requiring maintenance, inspection, adjustment, monitoring, etc… which are installed in inaccessible areas such as behind walls, above ceiling, under floor, etc…

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of access door or panel.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer Qualifications: Engage an experienced Installer for the installation of access panels and doors.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with specified requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:
   1. Elmdor / Stoneman.
   2. Jay R. Smith Mfg. Co.
   3. Milcor Inc.

2.02 ACCESS DOORS

A. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.

B. Frames: 16-gage steel, with a 1-inch-wide exposed perimeter flange.
   1. For installation in masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling: 1 inch-wide-exposed perimeter flange and adjustable metal masonry anchors.
   2. For gypsum wallboard or plaster: perforated flanges with wallboard bead.

3. For full-bed plaster applications: galvanized expanded metal lath and exposed casing bead, welded to perimeter frame.

C. Flush Panel Doors: 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.
1. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.

D. Locking Devices: Flush, screwdriver-operated cam locks.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which access door and panel products are to be installed. Do not proceed with work until unsatisfactory conditions have been in manner acceptable to Installer.

3.02 APPLICATION

A. Nonrated Walls and Ceilings: Prime coat finish door and frame, Allen key latch face of wall type; Smith 4760, Elmdor / Stoneman DW Series.

B. Fire Rated Walls and Ceilings: "B" Labeled U.L. 1-1/2 hours, prime coat finish door and frame, flush keyed cylinder lock; Milcor.

C. Tile Walls: Cover and frame 18-8 satin stainless steel, face-of-wall type, vandal resistant screws; J. R. Smith 4762, Elmdor / Stoneman DW Series

3.03 INSTALLATION OF ACCESS DOORS

A. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.

B. Adjust hardware and panels after installation for proper operation.

3.04 COORDINATION

A. General: Coordinate locations of ceilings access doors with lights, air outlets, speakers, etc. Submit drawings showing relative locations of doors to other ceiling items for acceptance by the Architect prior to installation. Transparencies of floor plans and/or reflected ceiling plans will be available from the Architect for this purpose.

B. Location: Doors may be located to serve more than one item where feasible, providing they are approved as specified. Sizes suitable for purpose intended, with 12" x 12" minimum.

C. Access doors and panels not required in accessible ceiling systems where direct access to plumbing items is possible.

END OF SECTION 22 0515

SECTION 22 0519

METERS AND GAGES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes the following types of meters and gages:
   1. Temperature gages and fittings.
   2. Pressure gages and fittings.
   3. Flow meters.

B. Meters and gages furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 22 sections.

1.02 SUBMITTALS

A. General: Submit the following in accordance with conditions of Contract and Division 01 Specification Sections and Section 22 0500 "Common Work Results for Plumbing."
   1. Product data for each type of meter and gage. Include scale range, ratings. Submit meter and gage schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gage.
   2. Maintenance data for each type of meter and gage for inclusion in Operating and Maintenance Manuals specified in Division 01 and Division 22 Section "Common Work Results for Plumbing."

1.03 QUALITY ASSURANCE

A. ASME and ISA Compliance: Comply with applicable portions of ASME and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gages.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Liquid-In-Glass Thermometers:
      a. Marshalltown Instruments, Inc.
      b. Trerice (H.O.) Co.
      c. Weiss Instruments, Inc.
      d. Weksler Instruments Corp.
   2. Thermometer Wells: Same as for thermometers.
   3. Pressure Gages:
      a. Ametek, U.S. Gauge Div.
      b. Ashcroft Dresser Industries Instrument Div.
      c. Marsh Instruments Co., Unit of General Signal.
      d. Marshalltown Instruments, Inc.
      e. Trerice (H.O.) Co.
      f. Weiss Instruments, Inc.

g. Weksler Instruments Corp.
h. WIKA Instruments Corp.

4. Pressure Gage Accessories: Same as for pressure gages.
5. Water Orifice-Type Measurement System:
   a. Armstrong Pumps, Inc.
   b. Bell & Gossett, ITT. Fluid Handling Div.
6. Calibrated Balance Valves
   a. Armstrong Pumps, Inc.
   b. Bell and Gossett, ITT, Fluid Handling Div.
7. Venturi-Type Flow Measurement System
   a. Armstrong Pumps, Inc.
   b. Barco Div., Marison Industries
   c. Gerand Engineering Co.
8. Test Plugs
   a. MG Piping Products Co.
   b. Peterson Equipment Co., Inc.
   c. Sisco, ASpedco, Inc. Co.
   d. Trerice (H.O.) Co.
   e. Watts Regulator Co.

2.02 THERMOMETERS, GENERAL

A. Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.

B. Scale range: Temperature ranges for services listed as follows:
   1. Domestic Hot Water: 30 to 240 deg. with 2-degree scale divisions.
   2. Domestic Cold Water: 0 to 100 deg. F. with 2-degree scale divisions
   3. Heating Water: 30 to 300 deg. with 2-degree scale divisions
   4. Condenser Water: 0 to 160 deg. F. with 2-degree scale divisions
   5. Chilled Water: 0 to 100 deg. F. with 2-degree scale divisions
   6. Steam and Condensate: 50 to 400 deg. F. with 2-degree scale divisions

2.03 LIQUID-IN-GLASS THERMOMETERS

A. Case: Die cast, aluminum finished, in baked epoxy enamel, glass front, spring secured, and 9 inches long.

B. Adjustable Joint: Finished to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.

C. Tube: Red reading, liquid filled, magnifying lens.

D. Scale: Satin-faced, non-reflective aluminum, with permanently etched markings.

E. Stem: Copper-plated steel, aluminum or brass, for separable socket, length to suit installation.

2.04 THERMOMETER WELLS

A. Thermometer Wells: Brass or stainless steel, pressure rated to match piping system design pressure; with 2-inch extension for insulated piping and threaded cap nut with chain permanently fastened to well and cap.

2.05 PRESSURE GAGES

A. Type: General use, ASME B40.1, Grade A, phosphor bronze bourdon-tube type, bottom connection.

B. Case: Drawn steel or brass, glass lens, 4-1/2-inches diameter.

C. Connector: Brass, 1/4-inch NPS.

D. Scale: White coated aluminum, with permanently etched markings.

E. Accuracy: Plus or minus 1 percent of range span.

F. Range: Conform to the following:
1. Vacuum: 30" & 0-15 PSI compound range; 1" and 1/2 PSI gradations.
2. Chilled and heating water systems, except as otherwise indicated: 0-60 PSI range, 1 PSI gradation.
3. Condenser water system, except as otherwise indicated: (0-15); (0-30) PSI range, (1/4 PSI); (1/2 PSI) gradation.
4. Except as otherwise indicated: 0-100 PSI range, 1 PSI gradation.
5. High temperature water system: 0-300 PSI range, 2 PSI gradations.

2.06 PRESSURE GAGE ACCESSORIES

A. Syphon: 1/4-inch NPS straight coil constructed of brass tubing with threads on each end.

B. Snubber: 1/4-inch NPS brass bushing with corrosion-resistant porous metal disc. Disc material shall be suitable for fluid served and rated pressure.

2.07 FLOW METERS, GENERAL

A. Flow rate of elements and meters shall be same as connected equipment or system.

2.08 WAFER ORIFICE TYPE FLOW ELEMENTS

A. Type: Differential-pressure wafer type orifice insert flow elements designed for installation between pipe flanges.

B. Construction: Cast-iron body, brass valves with integral check readout valves and caps, and calibrated nameplate. Elements pressure rated for 300 PSIG and 250 degree F.

2.09 CALIBRATED BALANCE VALVE

A. Type: Differential-pressure, ball type, adjustable orifice designed for installation in piping.

B. Construction: Bronze body/brass ball construction with glass and carbon filled TFE seal rings, screwed connections with integral check readout valves and caps and calibrated nameplate and memory stop and drain connection. Elements pressure rated for 300 PSIG and 250 degree F.

2.10 VENTURI TYPE FLOW ELEMENTS

A. Type: Differential-pressure venturi type, designed for installation in piping.

B. Construction: Bronze or cadmium-plated steel with brass fittings and attached tag with flow conversion data. Ends shall be threaded for 2 inches and smaller elements and flanged or welded for 2-1/2 inches and larger elements.

2.11 PITOT-TUBE TYPE FLOW ELEMENTS

A. Type: Differential-pressure Pitot-tube type design with probe for insertion into piping.

B. Construction: Stainless steel probe of length to span inside of pipe, with brass fittings and attached tag with flow conversion data. Elements shall be pressure rated for 150 PSIG and 250 deg. F. (120 deg. C.).

2.12 METERS

A. Portable Meters: Differential-pressure gage and two 12-foot hoses in carrying case with handle.

B. Scale: In inches of water unless otherwise indicated.

C. Accuracy: Plus or minus 2 percent between 20 to 80 percent of range.

D. Each meter shall be complete with operating instructions.

2.13 TEST PLUGS

A. Test Plugs shall be nickel-plated brass body, with 1/2-inch NPS fitting and 2 self-sealing valve-type core inserts, suitable for inserting a 1/8-inch O.D. probe assembly from a dial-type thermometer or pressure gage. Test plug shall have gasketed and threaded cap with retention chain and body of length to extend beyond insulation. Pressure rating shall be 500 PSIG.

B. Core Material: conform to the following for fluids and temperature range:
   1. Air, Water, Oil, and Gas, 20 to 200 deg. F.: Neoprene.

C. Test Kit: Provide test kit consisting of 1 pressure gage, gage adapter with probe, 2 bimetal dial thermometers, and carrying case.

D. Ranges of pressure gage and thermometers shall be approximately 2 times systems operating conditions.

PART 3 - EXECUTION

3.01 THERMOMETERS INSTALLATION

A. Install thermometers in vertical and tilted positions to allow reading by observer standing on floor.

B. Install in the following locations and elsewhere as indicated:
   1. At inlet and outlet of each hydronic zone.
   2. At inlet and outlet of each hydronic boiler and chiller.

3. At inlet and outlet of each hydronic coil in air-handling units and built-up central systems.
4. At inlet and outlet of each hydronic heat exchanger.
5. At inlet and outlet of each hydronic heat recovery unit.
6. At inlet and outlet of each thermal storage tank.

C. Thermometer Wells: Install in piping tee where thermometers are indicated, in vertical position. Fill well with oil or graphite and secure cap.

3.02 INSTALLATION OF PRESSURE GAGES

A. Install pressure gages in piping tee with pressure gage valve, located on pipe at most readable position.

B. Install in the following locations, and elsewhere as indicated:
1. At suction and discharge of each pump.
2. At discharge of each pressure-reducing valve.
3. At building water service entrance.
4. At chilled water and condenser water inlets and outlets of chillers.

C. Pressure Gage Needle Valves: Install in piping tee with snubber. Install syphon in lieu of snubber for steam pressure gages.

3.03 INSTALLATION OF TEST PLUGS

A. Test Plugs: Install in piping tee where indicated, located on pipe at most readable position. Secure cap.

3.04 INSTALLATION OF FLOW MEASURING ELEMENTS AND METERS

A. Locations: Install flow measuring elements in the following locations and elsewhere as indicated.
1. At discharge of each pump.
2. At inlet of each hydronic coil in built-up central systems.

B. Differential-Pressure-Type Flow Elements: Install minimum straight lengths of pipe upstream and downstream from element as described by the manufacturer's installation instructions.

C. Install wafer orifice-type element between 2 Class 125 pipe flanges, ANSI B16.1 (cast iron) or ANSI B16.24 (bronze).

D. Install connections for attachments to portable flow meters in a readily accessible location.

3.05 INSTALLATION OF CALIBRATED BALANCE VALVES

A. Install calibrated balance valves in the following locations and elsewhere as indicated.
1. At each fan coil unit.
2. At each unitary water source heat pump.
3. At each 3-Way valve.

3.06 ADJUSTING AND CLEANING

A. Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.

B. Cleaning: Clean windows of meters and gages and factory-finished surfaces. Replace cracked and broken windows, and repair scratched and marred surfaces with manufacturer's touch-up paint.

3.07 CONNECTIONS

A. Piping installation requirements are specified in other sections of Division 22. The drawings indicate the general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

B. Install meters and gages piping adjacent to machine to allow servicing and maintaining of machine.

END OF SECTION 22 0519

SECTION 22 0523

GENERAL DUTY VALVES FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes general duty valves common to most mechanical piping systems.
   1. Special purpose valves are specified in individual piping system specifications.

1.02 RELATED SECTIONS

A. Division 22 Section "Plumbing Identification" for valve tags and charts.

1.03 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract, Division 01 Specification Sections, and Section 22 0500 "Common Work Results for Plumbing."
   1. Product data, including body material, valve design, pressure and temperature classification, end connection details, seating materials, trim material and arrangement, dimensions and required clearances, and installation instructions.
   2. Provide valve schedule showing manufacturer's figure number and sizes.

1.04 QUALITY ASSURANCE

A. Single Source Responsibility: Comply with the requirements specified in Division 01 Section "Materials and Equipment," under "Source Limitations."

B. American Society of Mechanical Engineers (ASME) Compliance: Comply with ASME B31.9 for building services piping and ASME B31.1 for power piping.

C. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS) Compliance): Comply with the various MSS Standard Practices referenced.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Preparation For Transport: Prepare valves for shipping as follows:
   1. Ensure valves are dry and internally protected against rust and corrosion.
   2. Protect valve ends against damage to threads, flange faces, and weld-end preps.
   3. Set valves in best position for handling. Set globe and gate valves closed to prevent ratting; set ball and plug valves open to minimize exposure of functional surfaces; and block swing check valves in either closed or open position.

B. Storage: Use the following precautions during storage:
   1. Do not remove valve end protectors unless necessary for inspection; then reinstall for storage.
   2. Protect valves from weather. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products from one of the manufacturers listed in valve schedule.

2.02 VALVE FEATURES, GENERAL

A. Valve Design: Rising stem or rising outside screw and yoke stems.
   1. Non-rising stem valves may be used where headroom prevents full extension of rising stems.

B. Pressure and Temperature Ratings: As scheduled and required to suit system pressures and temperatures.

C. Sizes: Same size as upstream pipe, unless otherwise indicated.

D. Operators: Provide the following special operator features:
   1. Hand wheels, fastened to valve stem, for valves other than quarter turn.
   2. Lever handles, on quarter-turn valves 6-inch and smaller, except for plug valves. Provide plug valves with square heads; provide one wrench for every 10 plug valves.
   3. Chain-wheel operators, for valves 2-1/2 inch and larger, install 72 inches or higher above finished floor elevation. Extend chains to an elevation of 5'-0" above finished floor elevation.
   4. Gear drive operators, on quarter-turn valves 8-inch and larger.

E. Extended Stems: Where insulation is indicated or specified, provide extended stems arranged to receive insulation.

F. End Connections: As indicated in the valve specifications.
   1. Threads: Comply with ANSI B1.20.1.
   2. Flanges: Comply with ANSI B16.1 for cast iron, ANSI B16.5 for steel, and ANSI B16.24 for bronze valves.
   3. Solder-Joint: Comply with ANSI B16.18.
      a. Caution: Where soldered end connections are used, use solder having a melting point below 840 deg. F. for gate, globe, and check valves; below 421 deg. F. for ball valves.

2.03 GATE VALVES

A. Gate Valves, 2-Inch and Smaller: MSS SP-80; Class 150, body and union bonnet of ASTM B62 cast bronze; with threaded or solder ends, solid disc, copper-silicon alloy stem, brass packing gland, "Teflon" impregnated packing, and malleable iron hand wheel. Do not use solder end valves for hot water heating or steam piping applications.

MANUFACTURER	THREADED NRS	THREADED RS	SOLDER NRS	SOLDER RS
Crane	X	431UB	X	X
Grinnell	3050	3060	X	X
Milwaukee	1141	1151	X	1169
Nibco	T-136	T-135	S-136	X
KITZ	X	42	X	43

"X" means not available. Provide lead-free products.

B. Gate Valves, 2-1/2 Inch and Larger: MSS SP-70; Class 125 iron body, bronze mounted, with body and bonnet conforming to ASTM A126 class B; with flanged ends, "Teflon" impregnated packing, and two-piece backing gland assembly.

MANUFACTURER	OS & Y RS	NRS
Crane	465-1/2	461
Grinnell	6020A	6060A
Nibco	617-O	F-619
Milwaukee	F-2885	F-2882
KITZ	72	75

"X" means not available. Provide lead-free products.

2.04 BALL VALVES

A. Ball Valves, 2 Inches and Smaller: Rated for 150 PSI saturated stem pressure, 400 psi WOG pressure; two- or three-piece construction; with bronze body conforming to ASTM B 62, full port only, chrome-plated brass ball, replaceable "Teflon" or "TFE" seats and seals, blowout-proof stem, and vinyl covered steel handle. Provide solder ends for condenser water, chilled water, and domestic hot and cold water service; threaded ends for heating hot water and low-pressure steam.

1. Ball Valves - 1 Inch and Smaller:

MANUFACTURER	THREADED ENDS	SOLDER ENDS
Crane	9302	9322
Nibco	T-580-70	S-580-70
Watts	B-6000	B-6001
Milwaukee	BA-100	BA-150
KITZ	58	59

"X" means not available. Provide lead-free products.

2. Ball Valves - 1-1/4 Inch to 2 Inch:

MANUFACTURER	THREADED ENDS	SOLDER ENDS
Nibco	T-590-Y	S-590-Y
Stockham	S-216 BR-R-T	S-216-BR-R-S
Watts	B-6800	B-6801
KITZ	62	63

"X" means not available. Provide lead-free products. Grooved Ends: Victaulic Style 721.

2.05 PLUG VALVES

A. Plug Valves, 2-Inch and Smaller: Rated at 150 PSI WOG; bronze body, with straightaway pattern, square head, and threaded ends.
   1. Lunkenheimer: 454 or equal.
   2. Homestead: 611 (Semi Steel Body) or equal.

B. Plug Valves, 2-1/2 Inch and Larger: MSS SP-78; rated at 175 PSI WOG; lubricated plug type, with semi steel body, single gland, wrench operated and flanged ends.
   1. Powell: 2201 or equal.
   2. Homestead: 605 or equal.

2.06 CHECK VALVES

A. Swing Check Valves, 2-Inch and Smaller: MSS SP-80; Class 125, cast-bronze body and cap conforming to ASTM B 62; with horizontal swing, Y-pattern, and bronze disc; and having threaded or solder ends. Provide valves capable of being reground while the valve remains in the line. Provide Class 150 valves meeting the above specifications, with threaded end connections, where system pressure requires or where Class 125 valves are not available.

MANUFACTURER	CLASS 125THREADED ENDS	CLASS 125SOLDER ENDS	CLASS 125THREADED ENDS
Crane	37	1342	137
Milwaukee	509	1509	510
Nibco	T-413	S-413	T-433
KITZ	22	23	29

Grooved Ends: Victaulic Series 712. Provide lead-free products.

B. Swing Check Valves, 2-1/2 Inch and Larger: MSS SP-71; Class 125 (Class 175 FM approved for fire protection piping systems), cast iron body and bolted cap conforming to ASTM A 126, Class B; horizontal wing, and bronze disc or cast-iron disc with bronze disc ring; and flanged ends. Provide valves capable of being refitted while the valve remains in the line.

MANUFACTURER	CLASS 125	CLASS 175
Crane	373	X
Milwaukee	F2974	X
Nibco	F-918	X
KITZ	78	X

“X” means not available. Provide lead-free products.

C. Lift Check Valves, 2-Inch and Smaller: Class 125; cast-bronze body and cap conforming to ASTM B 62; horizontal or angle pattern, lift-type valve, with stainless steel spring, bronze disc holder with renewable "Teflon" disc, and threaded ends. Provide valves capable of being refitted and ground while the valve remains in the line.

MANUFACTURER	HORIZONTAL	ANGLE
Jenkins	655-A	X
Lunkenheimer	233	X

“X” means not available. Provide lead-free products.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine valve interior through the end ports for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks used to prevent disc movement during shipping and handling.

B. Actuate valve through an open-close and close-open cycle. Examine functionally significant features, such as guides and seats made accessible by such actuation. Following examination, return the valve closure member to the shipping position.

C. Examine threads on both the valve and the mating pipe for form (i.e., out-of-round or local indentation) and cleanliness.

D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Check gasket material for proper size, material composition suitable for service, and freedom from defects and damage.

E. Prior to valve installation, examine the piping for cleanliness, freedom from foreign materials, and proper alignment.

F. Replace defective valves with new valves.

3.02 VALVE ENDS SELECTION

A. Select valves with the following ends or types of pipe/tube connections:
   1. Copper Tube Size, 2-Inch and Smaller: Solder ends, except provide threaded ends for heating hot water and low-pressure steam service.
   2. Steel Pipe Sizes, 2-Inch and Smaller: threaded or grooved end.
   3. Steel Pipe Sizes 2-1/2 Inch and Larger: grooved end or flanged.

3.03 VALVE INSTALLATIONS

A. General Application: Refer to piping system specification sections for specific valve applications and arrangements. Use gate, ball, and butterfly valves for shut-off duty. Use globe, plug, and ball valves for throttling duty.

B. Locate valves for easy access and provide separate support where necessary. Where concealed, install behind access panel with valve located for complete accessibility for servicing.

C. Install valves and unions for each fixture and item of equipment. Arrange valves to allow equipment removal without system shutdown. Unions are not required on flanged devices.

D. Install three-valve bypass around each pressure reducing valve using throttling-type valves.

E. Install valves in horizontal piping with stem at or above the center of the pipe.

F. Install valves in a position to allow full stem movement.

G. Installation of Check Valves: Install for proper direction of flow as follows:
   1. Swing Check Valves: Horizontal position with hinge pin level.
   2. Lift Check Valve: With stem upright and plumb.

H. Where shut-off valves are installed in a confined space such as in a wall or furring, install ball valves with operating handle parallel with face of wall.

I. Where valves are located in walls, do not install more than 6'-0" from finished floor. Where valves are located above ceilings, install centered on access point and not greater than 24" above access point.

3.04 SOLDER CONNECTIONS

A. Cut tube square and to exact lengths.

B. Clean end of tube to depth of valve socket with steel wool, sand cloth, or a steel wire brush to a bright finish. Clean valve socket in same manner.

C. Apply proper soldering flux in an even coat to inside of valve socket and outside of tube.

D. Open gate and glove valves to full open position.

E. Remove the cap and disc holder of swing check valves having composition discs.

F. Insert tube into valve socket, making sure the end rests against the shoulder inside valve. Rotate tube or valve slightly to ensure even distribution of the flux.

G. Apply heat evenly to outside of valve around joint until solder will melt upon contact. Feed solder until it completely fills the joint around tube. Avoid hot spots or overheating valve. Once the solder starts cooling, remove excess amounts around the joint with a cloth or brush.

H. Use 95-5 tin/antimony lead-free solder for all solder joints unless indicated otherwise.

3.05 THREADED CONNECTIONS

A. Note the internal length of threads in valve ends, and proximity of valve internal seat or wall, to determine how far pipe should be threaded into valve.

B. Align threads at point of assembly.

C. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).

D. Assemble joint, wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

3.06 FLANGED CONNECTIONS

A. Align flange surfaces parallel.

B. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

3.07 FIELD QUALITY CONTROL

A. Tests: After piping systems have been tested and put into service, but before final adjusting and balancing, inspect valves for leaks. Adjust or replace packing to stop leaks; replace valves if leak persists.

3.08 ADJUSTING AND CLEANING

A. Cleaning: Clean mill scale, grease, and protective coatings from exterior of valves and prepare valves to receive finish painting or insulation.

3.09 VALVE PRESSURE/TEMPERATURE CLASSIFICATION SCHEDULES

A. Below schedules are for standard installation conditions. Variations or special valves and/or conditions set forth in other Division 15 Sections shall take precedence.

1. VALVES, 2-INCH AND SMALLER

SERVICE	GATE	GLOBE	BALL	CHECK
Condenser Water	125	125	150	125
Chilled Water	125	125	150	125
Domestic Hot and Cold Water	125	125	150	125
Heating Hot Water	150	150	150	150
Low-Pressure Steam	150	150	150	150

2. VALVES, 2-1/2 INCH AND LARGER

SERVICE	GATE	GLOBE	BUTTERFLY	CHECK
Condenser	125	125	200	125
Chilled Water	125	125	200	125
Domestic Hot and Cold Water	125	125	200	125
Heating Hot Water	125	125	200	125
Low-Pressure Steam	125	125	200	125

END OF SECTION 22 0523

SECTION 22 0529

SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Extent of supports and anchors required by this section is indicated on drawings or in other Division 22 sections and include the following:
   1. Horizontal Piping Hangers and Supports.
   2. Vertical Piping Clamps.
   3. Hanger-Rod Attachments.
   4. Building Attachments.
   5. Saddles and Shields.
   6. Miscellaneous Materials.
   7. Anchors.
   8. Equipment Supports.

1.02 RELATED SECTIONS

A. This section is part of each Division 22 section making reference to or requiring supports and anchors specified herein.

B. Supports and anchors furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 22 sections.

1.03 QUALITY ASSURANCE

A. Codes and Standards:
   1. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.
   2. UL and FM Compliance: Provide products which are UL-listed and FM approved.
   3. MSS Standard Compliance:
      a. Provide pipe hangers and supports of which materials, design, and manufacturer comply with MSS SP-58.
      b. Select and apply pipe hangers and supports, complying with MSS SP-69.
      c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
      d. Terminology used in this section is defined in MSS SP-90.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

A. Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with MSS SP-58.
   1. Components shall have galvanized coatings where installed for piping and equipment that will not have field-applied finish.
   2. Pipe attachments shall have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.

B. Thermal Hanger Shield Inserts: 100-PSI average compressive strength, waterproofed calcium silicate, encased with a sheet metal shield. Insert and shield shall cover entire circumference of the pipe and shall be of length indicated by manufacturer for pipe size and thickness of insulation.

2.02 HORIZONTAL PIPING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
   1. Adjustable Steel Clevis Hangers: MSS Type 1.
   2. Adjustable Swivel Pipe Rings: MSS Type 6.

2.03 VERTICAL PIPING CLAMPS

A. General: Except as otherwise indicated, provide factory fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.

B. Two-Bolt Riser Clamps: MSS Type 8.

2.04 HANGER ROD AND BUILDING ATTACHMENTS

A. General Hanger Rod Attachment: Refer to structural drawings for requirements of hanger rod and building attachments. If a specific attachment that is required is not detailed on the structural drawings, one of the following attachments may be submitted for review by the structural engineer prior to installation. Except as otherwise indicated, provide factory fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachment to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.

B. General Building Attachment: Except as otherwise indicated, provide factory fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.
1. Concrete Inserts: MSS Type 18.
2. Center Beam Clamps: MSS Type 21.
3. Steel Beam Clamps W/Eye Nut: MS Type 28.
4. Linked Steel Clamps W/Eye Nut: MSS Type 29.
5. Malleable Beam Clamps: MSS Type 30.
6. Steel Brackets: One of the following for indicated loading:
7. Light Duty: MSS Type 31.

2.05 SADDLES AND SHIELDS

A. General: Except as otherwise indicated, provide saddles or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Protection Shields: MSS Type 40; provide high density insert of same thickness of insulation.

2.06 MANUFACTURERS OF HANGERS AND SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide hangers and supports of one of the following:
1. B-Line Systems, Inc.
2. Tolco, Inc.
3. Elcen Metal Products Co.
4. Fee & Mason Mfg. Co.; Div. Figgie International.
5. ITT Grinnel Corp.

2.07 MISCELLANEOUS MATERIALS

A. Steel Plates, Shapes and Bars: ASTM A36.

B. Cement Grout: Portland cement (ASTM C150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0 part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

C. Pipe Alignment Guides: Factory fabricated, of cast semi-steel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

D. Pipe Roll Stand: Factory fabricated cast iron stand, size as required, with insulation installed on piping.

2.08 ISOLATORS

A. Isolators: Provide factory-fabricated isolators of size required.

B. Manufacturers: Semco "Trisolator" or Potter-Roemer PR-ISO.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine substrates and conditions under which supports and anchors are to be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachment.

B. Prior to installation of hangers, supports, anchors and associated work, installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.03 INSTALLATION OF BUILDING ATTACHMENTS

A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top of inserts.

3.04 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacing complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers and supports of same type and type as installed for adjacent similar piping.

C. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

D. Provisions of Movement: Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors.

E. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

F. Pipe Slopes: Install hangers and supports to provide required pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.

G. Bare Piping: Install isolators for all bare domestic water and bare hydronic piping.

H. Insulated Piping: Comply with the following installation requirements.
   1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
   2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields. Provide rigid insulation reinforcement at shields.

I. Hangers and supports to be capable to resist the minimum seismic forces indicated in drawings.

3.05 EQUIPMENT SUPPORTS

A. Concrete housekeeping bases will be provided as work of Division 03.

B. Furnish to Contractor, scaled layouts of all required bases, with dimensions of bases, and location to column center lines. Furnish templates, anchor bolts, and accessories, necessary for base construction.

3.06 ADJUSTING AND CLEANING

A. Hanger Adjustment: Adjust hangers so as to distribute loads equally on attachments.

B. Support Adjustment: Provide grout under supports so as to bring piping and equipment to proper level and elevations.

C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

D. Touch-Up Painting: Immediately after erection of anchors and supports, clean field welds and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA-1 requirements for touch-up of field-painted surfaces.
   1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

E. For galvanized surfaces clean welds bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A 780.

END OF SECTION 22 0529

SECTION 22 0553

PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Extent of Plumbing identification work required by this section is indicated on drawings or specified in other Division 22 sections, and includes the following:
   1. Painted Identification Materials.
   2. Plastic Pipe Markers.
   3. Plastic Tape.
   4. Underground-Type Plastic Line Marker.
   5. Plastic Duct Markers.
   6. Valve Tags.
   7. Diagram and Schedule Frames.
   8. Engraved Plastic-Laminate Signs.
   9. Plastic Equipment Markers.
   10. Plasticized Tags.

1.02 RELATED SECTIONS

A. This section is part of each Division 22 section making reference to identification devices specified herein.

B. Plumbing identification furnished as part of factory-fabricated equipment is specified as part of equipment assembly in other Division 22 sections.

C. Refer to Division 26 Sections for identification requirements of electrical work; not work of this section.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.

C. Schedules and Diagrams:
   1. Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule.
   2. Submit temperature control diagrams and Sequence of Operation on bond paper suitable for framing.

D. Maintenance Data: Include product data and schedules in maintenance manuals; in accordance with requirements of Division 01 and Division 22 Section 220511 "Supplementary Plumbing Requirements".

1.04 QUALITY ASSURANCE

A. Codes and Standards:
   1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
   2. No adhesive type identification markers will be accepted. All markers and tags shall be permanently attached to pipe, etc.
   3. All identification markers installed exterior of buildings shall be ultra-violet resistant.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide Plumbingidentification materials of one of the following:
   1. Seton Name Plate Corp.
   2. Allen Systems, Inc.
   3. Brady (W.H.) Co.; Signmark Div.
   4. Industrial Safety Supply Co., Inc.

2.02 PLUMBING IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 22 sections. Where more than single type is specified for application, selections is Installer’s option, but provide single selection for each product category.

2.03 PLASTIC PIPE MARKERS

A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.

B. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subject to fluid temperatures of 125°F (52°C) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.

C. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
   1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
   2. Laminated or bonded application of pipe marker to pipe (or insulation).
   3. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".

D. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
   1. Laminated or bonded application of pipe marker to pipe (or insulation).
   2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2" wide; full circle at both ends of pipe marker, taped lapped 3".
   3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless steel bands.

E. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.
   1. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as a separate unit of plastic.

2.04 PLASTIC TAPE

A. General: Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

B. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2-1/2" wide tape for larger pipes.

C. Color: Comply with ANSI A13.1, except where another color selection is indicated.

2.05 UNDERGROUND TYPE PLASTIC LINE MARKER

A. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates the type of service of buried pipe.
   1. Provide multi-ply tape consisting of solid aluminum foil core between 2-layers of plastic tape.

2.06 VALVE TAGS

A. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamped-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high, and with 5/32" hole for fastener.
   1. Provide 1-1/2" diameter tags, except as otherwise indicated.
   2. Fill tag engraving with black enamel.

B. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

C. Access panel markers: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves, and manufactured specifically for that purpose.

D. Access Panel Markers: Provide manufacturer's standard 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8" center hole to allow attachment.

2.07 DIAGRAM AND SCHEDULE FRAMES

A. General: For each page of schedule and/or diagrams, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

2.08 ENGRAVED PLASTIC LAMINATE SIGNS

A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, white with black core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.

C. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.09 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in Plumbing identification work, with corresponding designations shown, specified, or scheduled. Provide numbers, lettering and wording as indicated, as recommended by manufacturers or as required for proper identification and operation/maintenance of Plumbing systems and equipment.
   1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

2.10 EQUIPMENT MARKERS

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
   1. Data:
      a. Manufacturer, product name, model number, and serial number.
      b. Capacity, operating and power characteristics, and essential data.
      c. Labels of tested compliances.
   2. Location: Accessible and visible.
   3. Fasteners: As required to mount on equipment.

B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
   1. Terminology: Match schedules as closely as possible.
   2. Data.
   3. Name and plan number.
      a. Equipment service.
      b. Design capacity.
      c. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
   4. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine sub-core, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
   1. Data: Instructions for operation of equipment and for safety procedures.

2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
3. Retain and edit subparagraph above or first subparagraph below.
4. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
5. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

D. Access Panel and Door Markers: 1/16-inch thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.
1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finishes, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.02 PIPING SYSTEM IDENTIFICATION

A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
1. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot-non-insulated pipes.

B. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
1. Near each valve and control device.
2. Near each branch, excluding short take-offs for fixtures and terminal units; mark each pipe at branch, where there could be question of flow pattern.
3. Near locations where pipes pass through walls, floors ceilings, or enter non-accessible enclosures.
4. At access doors, manholes similar access points which permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment.
7. On piping above removable acoustical ceilings, except omit intermediately spaced markers.

3.03 UNDERGROUND PIPING IDENTIFICATION

A. General: During back-filling/top-soiling of each exterior underground piping systems, except sanitary sewer and storm drainage install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker.

3.04 VALVE IDENTIFICATION

A. General: Provide valve tag on every valve, cock and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units, plumbing fixture faucets, convenience and lawn-watering hose bibs, and shut-off valves at plumbing fixtures, and similar rough-in connections of end-use fixtures and units. List each tagged valve on valve schedule for each piping system.

B. Mount valve schedule frames and schedules in machine rooms where indicated or, if not otherwise indicated, where directed by Architect/Engineer.

3.05 PLUMBING EQUIPMENT IDENTIFICATION

A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of plumbing equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
   1. Fuel-burning units including water heaters, boilers, furnaces, heaters.
   2. Pumps, compressors, chillers, condensers and similar motor-driven units.
   3. Fans and blowers.

B. Lettering Size: Minimum 1/4" high lettering for name of unit where viewing distance is less than 2'-0", 1/2" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 of size of the principal lettering.

C. Test of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.06 ADJUSTING AND CLEANING

A. Adjusting: Relocate any Plumbing identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

END OF SECTION 22 0553

SECTION 22 0700

PLUMBING INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Extent of plumbing insulation required by this section is indicated on drawings and schedules, and by requirements of this section, and includes the following:
   1. Piping Systems Insulation:
      a. Fiberglass.
      b. Calcium Silicate.
      c. Flexible Unicellular.
   2. Equipment Insulation:
      a. Fiberglass.
      b. Calcium Silicate.
      c. Flexible Unicellular.

1.02 RELATED SECTIONS

A. Refer to Division 22 Section "Supports and Anchors" for protection saddles, protection shields, and thermal hanger shields; not work of this section.

B. Refer to Division 22 Section "Plumbing Identification" for installation of identification devices for piping and equipment; not work of this section.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of mechanical insulation. Submit schedule showing manufacturer's product number, K-value, thickness, and furnished accessories for each mechanical system requiring insulation.

B. Maintenance Data: Submit maintenance data and replacement material lists for each type of mechanical insulation. Include this data and product data in maintenance manual.

1.04 QUALITY ASSURANCE

A. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

B. As a minimum, insulation shall meet installed conductance as set forth in Title 24 California Code of Regulations (CCR) 2016 Building Energy Efficiency Standards or as indicated in contract documents, whichever is greater.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
   1. Owens-Corning Fiberglas Corp.
   2. Manville Products Corp.
   3. Armstrong World Industries, Inc.
   4. CertainTeed Corp.
   5. Knauf Fiber Glass GmbH.

2.02 PIPING INSULATION MATERIALS

A. Fiberglass (Mineral Fiber) Piping Insulation: ASTM C547, Class 1 unless otherwise indicated. Manville Products Corp. Micro-Lok, Owens-Corning Fiberglas Corp., ASJ/SL-II or equivalent.

B. Calcium Silicate Piping Insulation: ASTM C533, Type I. Owens-Corning Fiberglass Corp. "Kaylo Asbestos Free" or equivalent.

C. Flexible Unicellular Piping Insulation: ASTM C534, Type I. Armstrong World Industries, Inc. or equal meeting ASTM E-84 25/50 index.

D. Jackets for Piping Insulation: ASTM C921, Type I (Vapor Barrier) for piping with temperatures below ambient. (Type II (Water Vapor Permeable) for piping with temperatures above ambient. Type I may be used for all piping at Installer's option.
   1. Encase pipe fittings insulation with one-piece pre-molded PVC fitting covers, fastened as per manufacturer's recommendations. Zeston PVC Insulated fitting covers or equivalent.
   2. Encase exterior piping insulation with aluminum jacket with weather-proof construction.

E. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.

F. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

G. All Insulation shall be U.L. listed showing flame spread not greater than 25, nor smoke greater than 50, per NFPA 90A.

2.03 EQUIPMENT INSULATION MATERIALS

A. Flexible Fiberglass Equipment Insulation: ASTM C553, Type II, Class F-1, Owens-Corning Fiberglass, Inc., Type 701 1.5 lbs/Ft3.

B. Calcium Silicate Equipment Insulation: ASTM C533, Type I, Block; Owens/Corning Fiberglass, Inc., Kaylo Asbestos Free, U-Grooved block insulation.

C. Jacketing Material for Equipment Insulation: Provide canvas jacketing material, not less than 7.8 ounces per square yard, or metal jacket at Installer's option, except as otherwise indicated.

D. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

E. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape corner angles, anchors and stud piping as recommended by insulation manufacturer for applications indicated.

F. All Insulation shall be U.L. listed showing flame spread not greater than 25, nor smoke greater than 50, per NFPA 90A.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which plumbing insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 PLUMBING PIPING SYSTEM INSULATION

A. Insulation Omitted: Omit insulation on chrome-plated exposed piping (except for handicapped fixtures), air chambers, unions, strainers, check valves, balance cocks, flow regulators, drain lines from water coolers, drainage piping located in crawl spaces or tunnels, buried piping, fire protection piping, and pre- insulated equipment.

B. Cold Piping:
   1. Application requirements: Insulate the following cold plumbing piping systems:
      a. Potable chilled water piping.
      b. Plumbing drains carrying cold condensate.
   2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
      a. Fiberglass: 1" thickness.
      b. Flexible Unicellular: 1/2" thickness.

C. Hot Piping:
   1. Application Requirements: Insulate the following hot plumbing piping systems.
      a. Potable hot water piping.
      b. Potable hot water re-circulating piping.
      c. Hot drain piping (where indicated).
   2. Insulate each piping system specified above with one of the following types and thicknesses of insulation.
      a. Fiberglass: 1" thick for pipe sizes up to and including 6", 1-1/2" thick for pipe sizes over 6".

3.03 EQUIPMENT INSULATION

A. Cold Equipment (Below Ambient Temperature):
   1. Application requirements: Insulate the following cold equipment:

a. Refrigeration equipment, including chillers, tanks and pumps.
b. Drip pans under chilled equipment.
c. Cold and chilled water pumps.
d. Pneumatic water tanks.

2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation:
   a. Fiberglass: 2" thick for cold surfaces above 35ºF and 3" thick for surfaces 35ºF and lower.

B. Hot Equipment (Above Ambient Temperature):
1. Application Requirements: Insulate the following hot equipment:
   a. Boilers (not pre-insulated at factory).
   b. Water heaters.
   c. Hot water expansion tanks.
   d. Hot water pumps.
2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation.
   a. Fiberglass: 2" thick, except 3" thick for low-pressure boilers and steam-jacketed heat exchangers.

C. Breeching and Stacks:
1. Application Requirements: Insulate the following breechings and stacks:
   a. Breechings between heating equipment outlet and stack or chimney connection, except for double wall or factory insulated breechings.

3.04 INSTALLATION OF PIPING INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulated each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor barrier jackets on pipe insulation, and protect to prevent puncture or other damage.

F. Cover valves, fittings and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.

G. Extend piping insulation without interruption through walls, floors and similar piping penetrations, except where otherwise indicated.

H. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.

3.05 INSTALLATION OF EQUIPMENT INSULATION

A. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.

B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship.

C. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.

D. Do not apply insulation to equipment, breechings, or stacks while hot.

E. Apply insulation using the staggered joint method for both single and double layer construction, where feasible. Apply each layer of insulation separately.

F. Coat insulated surfaces with layer of insulating cement, trowel in workmanlike manner, leaving a smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.

G. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2". Apply over vapor barrier where applicable.

H. Do not insulate boiler manholes, hand-holes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.

I. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

J. Equipment exposed to Weather: Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, or jacketing, as recommended by the manufacturer.

3.06 PROTECTION AND REPLACEMENT

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 22 0700

SECTION 22 1100

PLUMBING PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies piping materials and installation methods common to more than one section of Division 22 and includes joining materials, fire stop sealants, and basic piping installation instructions.

1.02 RELATED SECTIONS

A. The following sections contain requirements that relate to this section:
   1. Division 22 Section "Common Work Results for Plumbing" applies to the work of this Section.
   2. Piping materials and installation methods peculiar to individual systems are specified withintheir respective system specification sections of Division 02 and 22.
   3. Valves are specified in a separate section and in individual piping system sections of Division 22.
   4. Division 22 Section "Supports and Anchors."
   5. Division 22 Section "Plumbing Identification."

1.03 SUBMITTALS

A. Refer to Division 01 and Division 22 Section "Common Work Results for Plumbing" for administrative and procedural requirements for submittals.

B. Product Data: Submit product data on fire stop sealants.

1.04 QUALITY ASSURANCE

A. Welding procedures and testing shall comply with ANSI Standard B31.1.0 - Standard Code for Pressure Piping, Power Piping, and The American Welding Society, Welding Handbook.

B. Soldering and brazing procedures shall conform to ANSI B9.1 Standard Safety Code for Mechanical Refrigeration.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Provide factory-applied plastic end-caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, and clay pipe. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

A. Refer to the individual piping system specification Sections in Division 22 for specifications on piping and fittings relative to that particular system.

B. Weld-O-Lets: Welding Weld-O-Lets of domestic manufacture may be used in lieu of tees where branch connection pipe size is two or more pipe sizes smaller than main header size.

2.02 JOINING MATERIALS

A. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.

B. Brazing Materials: Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials appropriate for the materials being joined.

C. Soldering Materials: Refer to individual piping system specifications for solder appropriate for each respective system.
   1. Soldering materials shall not contain lead.

D. Gaskets for Flanged Joints: Gasket material shall be full-faced for cast-iron flanges and raised-face for steel flanges. Select materials to suit the service of the piping system in which installed and which conform to their respective ANSI Standard (A21.11, B16.20, or B16.21). Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

2.03 SLEEVES AND SEALS

A. Sleeves:
   1. Sheet-Metal Sleeves: 5" and Smaller, 20 gage galvanized sheet metal; 6" and Larger, 10 gage, galvanized sheet metal, round tube closed with welded longitudinal joint.
   2. Steel Sleeves: Schedule 40 galvanized, welded steel pipe, ASTM A53, Grade A.
   3. Galvanized steel telescoping type: Galvanized sheet metal per manufacturer’s standards.
   4. Polyethylene Sleeves: Manufacturer's standard product.

B. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

2.04 FIRESTOP SEALANT

A. Fire stopping material shall be asbestos-free and capable of maintaining an effective barrier against flame and gases in compliance with the following requirements:
   1. Flame Spread: 25 or less, ASTM E 84.
   2. Smoke Development: 50 or less, ASTM E 84.
   3. Combustibility: Noncombustible, ASTM E 136.

B. Material when installed shall have the same fire rating as the assembly in which it is being installed.

2.05 PIPING ISOLATION

A. Manufacturer's standard product for providing sound and electrolysis isolation.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ream ends of pipes and tubes, and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris for both inside and outside of piping and fittings before assembly.

3.02 INSTALLATIONS

A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated. Refer to individual system specifications for requirements for coordination drawing submittals.

B. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated otherwise.

C. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

D. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated on the Drawings.

E. Install piping tight to slabs, beams, joists, columns, walls and other permanent elements of the building. Provide space to permit insulation applications, with 1" clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

F. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

G. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4" ball valve, and short 3/4" threaded nipple and cap.

H. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals.

I. Coordinate to provide curb, minimum 4" above finish floor, for all pipe shafts or floor openings for multiple pipes.

J. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings, or floors, the fire rated integrity shall be maintained.

3.03 PIPE SUPPORTS AND HANGERS

A. All pipe Supports and Hangers shall be per requirements of Specification Section 220529 “Supports and Anchors.”

3.04 FITTINGS AND SPECIALTIES

A. Use fittings for all changes in direction and all branch connections.

B. Remake leaking joints using new materials.

C. Install Y-type strainers with blow-down valves on the supply side of each control valve, pressure reducing or regulating valve, solenoid valve, and elsewhere as indicated.

D. Install unions adjacent to each valve and at the final connection to each piece of equipment and plumbing fixture having 2" and smaller connections, and elsewhere as indicated.

E. Install Flanges in piping 2-1/2" and larger, where indicated, adjacent to each valve, and at the final connection to each piece of equipment.

F. Install dielectric unions to connect piping materials of dissimilar metals in dry piping systems (gas, compressed air, vacuum).

G. Install dielectric fittings to connect piping materials of dissimilar metals in wet piping systems (water, steam).

3.05 JOINTS

A. Steel Pipe Joints:
   1. Pipe 2" and Smaller: Thread pipe with tapered pipe threads in accordance with ANSI B2.1. Cut threads full and clean using sharp dies. Ream threaded ends to remove burrs and restore full inside diameter. Apply pipe joint lubricant or sealant suitable for the service for which the pipe is intended on the male threads at each joint and tighten to leave not more then 3 threads exposed.
   2. Pipe Larger than 2":
      a. Weld pipe joints (except for exterior water service pipe) in accordance with ASME Code for Pressure Piping, B31.
      b. Weld pipe joints of exterior water service pipe in accordance with AWWA C206.

c. Install flanges on all valves, apparatus, and equipment. Weld pipe flanges to pipe ends in accordance with ASME B31.1.0 Code for Pressure Piping. Clean flange faces and install gaskets. Tighten bolts to torque specified by manufacturer of flange and flange bolts, to provide uniform compression of gaskets.

B. Non-ferrous Pipe Joints:
1. Brazed and Soldered Joints: For copper tube and fitting joints, braze joints in accordance withANSI B31.1.0 -Standard Code for Pressure Piping, Power Piping and ANSI B9.1 - Standard Safety Code for Mechanical Refrigeration.
2. Thoroughly clean tube surface and inside surface of the cup of the fittings, using every fine emery cloth, prior to making soldered or brazed joints. Wipe tube and fittings clean and apply flux. Flux shall not be used as the sole means for cleaning tube and fitting surfaces.
3. Mechanical Joints: Flared compression fittings may be used for refrigerant lines 3/4" and smaller.

C. Joints for other piping materials are specified within the respective piping systems sections.

3.06 INSTALLATION OF SLEEVES

A. Provide pipe sleeves for pipes to pass through walls, floor and roofs. Diameter of sleeve to be 1-inch larger than the outside diameter of pipe or pipe and covering of insulated pipe. Galvanized steel telescoping type sleeves or polyethylene may be used. Where seepage may occur, use steel pipe sleeves.

B. All pipe sleeves through floors other than floors on grade shall extend 2-inches above finished floor and shall be caulked with mineral wool. Provide collar where polyethylene sleeve is used.

C. Where required in existing construction, or where sleeves have been omitted, openings for pipe may be core drilled in floors and/or walls or partitions, providing prior acceptance of such core drilling is obtained from the Architect. Holes core drilled through floors above grade shall be provided with sleeves extending 2-inches above finish floor as hereinbefore specified.

D. Seal with resilient sealant: Dow Corning "Fire Stop" or approved equal.

3.07 INSTALLATION OF FIRE STOP SEALANT

A. Fire-stopping shall be provided at, but not limited to, duct, and piping penetrations through floor slabs and through time rated partitions or firewalls.

B. Install fire-stopping materials in accordance with the manufacturer's instructions and the following requirements.
1. Filling: Fire-stopping materials shall completely fill the void spaces.

C. Coordination: Coordinate the work with other trades. Firestopping materials at penetrations of insulated pipes and ducts shall be applied prior to insulation, unless the insulation meets the requirements specified for fire-stopping.

D. Surface Preparation: Surfaces to be in contact with firestopping materials shall be free of dirt, grease, oil, loose material, rust, or other substances that may affect proper fitting or the required fire resistance.

3.08 INSTALLATION OF PIPE ISOLATION

A. Provide sound and electrolysis isolation on all un-insulated, pipes, Semco "Trisolators" or Potter-Roemer "Prisolators".

3.09 INSTALLATION OF PIPE FLASHING

A. Pipe flashing assemblies, "Semco" Fig. 1100-4, as required, seal the joint between flashing and pipe with waterproofing compound. Install counter-flashing sleeve to cover a minimum of 3/4-inch to top of lead flashing, making the top joint permanently watertight.

3.10 TESTING OF PIPING

A. Provide notification of test at least three working days prior to tests on all or part of any piping system. Do not allow or cause any piping system to be insulated, covered, concealed or enclosed until such systems have been tested and reviewed. Provide all necessary materials (including temporary isolation valves or caps), pumps, testing media and labor for testing. Temporarily remove any device in piping system, which will not withstand test pressure specified, and reinstall same after successful testing. Test time begins to accrue after full test pressure is achieved.

B. Testing and inspection of all piping systems and associated equipment for leaks shall be accomplished after installation and cleaning and prior to placing into service. Flanges, threaded joints and all welds shall be left unpainted and uninsulated until the piping systems have been approved.

C. A rigid visual inspection of each specific piping system shall be made prior to conducting tightness tests, to ascertain that all appurtenances and equipment are provided, properly connected and supported, and in all respects ready for testing.

D. Equipment such as pumps, chillers, tanks, heat exchangers, flexible hose, safety valves and similar equipment shall not be subjected to the piping system test pressure. Equipment shall either be disconnected from the piping or be isolated by valves or blanks during testing and reinstalled after acceptance by the Owner.

E. Indicating pressure gauges mounted locally may be tested with the lines provided the test pressure does not exceed the scale range.

F. Orifice plates, rotometers, displacement meters and other line inserts shall either not be installed until completion of all testing, or shall be removed prior to any tests and reinstalled after test has been accepted by the Owner.

G. The application of pressure to a system shall be under control at all times, so that in no case shall the test pressure be exceeded by more than 6 percent.

H. Gauges used for testing shall be tested for accuracy as directed or approved by the Owner, and then installed as close as possible to the low point of the piping system.

I. Do not apply test pressure until the piping system and its contents approach the same temperature.

J. While piping is under test, exercise care that excessive pressure does not occur due to increase in ambient temperature.

K. Control Valves:
1. Control valves which are installed with block and by-pass valve shall have the block valve closed, the by-pass valve opened, and a temporary pipe piece inserted in place of the control valve (or a test blank may be installed on each side of the control valve) until all flushing and testing of all lines of that system is completed and accepted by the Owner, after which they shall be reinstalled.
2. Control valves installed without block or by-pass valves shall be replaced by a pipe piece during flushing and testing of the system. After acceptance of the flushing they shall be reinstalled.

L. Minimum piping test pressures shall be as noted in tabulation; or they shall be 150 percent of design pressure for the specific system being tested, whichever is higher.

SYSTEM	TEST MEDIUM	TESTING PRESSURE (PSIG)	DURATION (HOURS	ACCEPTABLE TOLERANCE
Soil, Water, Vent, & Storm Water	Water	Top of highest vent	4	No joint sweat
Water	Water	150	4	None. Except temperature change.
Fuel Gas	Air	60	4	None. Except temperature change.
Fire Sprinkler	Water	200	4	None. Except temperature change.

M. Conduct hydrostatic tests with water at a temperature below 100 degrees F.
1. Fill the system slowly with water and vent at highest points to expel the air before pressurizing.
2. Carefully examine all joints for leaks or defects.
3. Provide connections as required to accomplish the above.

N. Keep accurate test records of each line or system tested and provide copies of same to Owner after acceptance. Each test shall include:
1. Identification of piping system and test number.
2. Testing medium.
3. Test pressure.
4. Date of test acceptance.

3.11 ADJUSTMENTS

A. At the completion of the Work, completely adjust all valves and equipment for their proper use and rating.

END OF SECTION 22 1100

SECTION 22 1116

WATER DISTRIBUTION PIPING (INSIDE BUILDING)

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section includes potable cold water, hot water, and circulation hot water piping, fittings, and specialties within the building to a point of 5 feet outside the building.

1.02 RELATED SECTIONS

A. The following sections contain requirements that relate to this section.
   1. Division 22
      a. Section 220500 “Common Work Results for Plumbing.”
      b. Section 220503 “Earthwork for Plumbing Systems.”
      c. Section 220511 "Supplementary Plumbing Requirements.”
      d. Section 220519 "Meters And Gages.”
      e. Section 220523 “General Duty Valves for Plumbing Piping and Equipment.”
      f. Section 220553 “Plumbing Identification.”
   2. Division 07 Section "Joint Sealers" for materials and methods for sealing pipe penetrations through rated walls and fire and smoke barriers.

B. Separate sections of Division 22 specify Plumbing Piping, Supports and Anchors, piping system identification materials and requirements, general duty valves, pipe insulation, fire protection piping, and plumbing equipment.

1.03 DEFINITIONS

A. Water Distribution Pipe: A pipe within the building or on the premises that conveys water from the water service pipe or meter to the points of usage.

B. Water Service Pipe: The pipe from the water main or other source of potable water supply to the water distributing system of the building served.

C. Pipe sizes used in this Specification are nominal pipe size (NPS).

1.04 SUBMITTALS

A. General: Submit the following in accordance with Conditions of Contract and Division 01 Specifications Sections.
   1. Product data for each piping specialty and valve specified.
   2. Test reports specified in Part 3 of this Section.
   3. Maintenance data for each piping specialty and valve specified for inclusion in Maintenance Manual specified in Division 01 and Division 22 Section "Common Work Results For Plumbing."

1.05 QUALITY ASSURANCE

A. Codes and Standards
   1. California Building Code 2022, Title 24, Part 2 for Accessibility Requirements.

a. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Section 11B-213.3.
b. Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6.
c. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
d. Accessible fixture controls shall comply with CBC Sections 11B-602.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for children's water closets, 11B-605.4 for urinals, 11B-606.4 for lavatories and sinks, 11B-604.9.5 for bathtubs, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.
e. Accessible lavatories and sinks shall be mounted with the front of the higher of the rim or counter surface 34" maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with CBC Section 11B-306 when a forward approach is required. CBC Sections 11B-606.3 and 11B-606.7.
f. Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Sections 11B-606.5.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Provide factory-applied plastic end caps on each length of pipe and tube, except for concrete, corrugated metal, hub-and-spigot, clay pipe. Maintain end-caps through shipping, storage and handling to prevent pipe-end damage and prevent entrance of dirt, debris, and moisture.

B. Protect stored pipes and tubes. Elevate above grade and enclose with durable, waterproof wrapping. When stored inside, do not exceed structural capacity of the floor.

C. Protect flanges, fittings and specialties, from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

D. Store CPVC, and PVC pipe and fittings where protected from direct sunlight.

E. Store pipe in a manner to prevent sagging and bending.

1.07 SEQUENCING AND SCHEDULING

A. Coordinate the size and location of concrete equipment pads. Cast anchor-bolt inserts into pad. Concrete, reinforcement, and formwork requirements are specified in Division 03.

B. Coordinate the installation of pipe sleeves for foundation wall penetrations.

1.08 EXTRA MATERIALS

A. Maintenance Stock: Furnish one valve key for each key-operated wall hydrant, hose bib, fixture supply, or faucet installed.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer Uniformity: Conform to the requirements specified in Division 22 Section "Common Work Results for Plumbing."
   1. Hose Bibs:
      a. Lee Brass Co.
      b. Acorn.
      c. Watts Regulator Co.
      d. Woodford Mfg. Co.
   2. Relief Valves:
      a. Cash (A. W.) Valve Mfg. Corp.
      b. Watts Regulator Co.
      c. Zurn Industries, Inc. Wilkins Regulator Divs.
   3. Water Hammer Arresters:
      a. Precision Plumbing Products, Inc.
      b. Smith (Jay R.) Mfg. Co.
      c. Sioux Chief.
      d. Watts Regulator Co.
      e. Zurn Industries, Inc.; Hydromechanics Div.
   4. Vacuum Breakers for Hose Connections:
      a. Cash (A.W.) Valve Mfg. Corp.
      b. Conbraco Industries, Inc.
      c. Watts Regulator Co.
   5. Mechanical Sleeve Seals:
      a. Thunderline Corp.
   6. Pipe Escutcheons:
      a. Chicago Specialty Mfg. Co.
      b. Grinnell.
   7. Dielectric Waterway Fittings:
      a. Epco Sales, Inc.
      b. Victaulic Company of America.
   8. Dielectric Unions:
      a. Eclipse, Inc.
      b. Perfection Corp.
      c. Watts Regulator Co.

2.02 PIPE AND TUBE MATERIALS, GENERAL

A. Pipe and Tube: Refer to Part 3, Article "Application, General," for identification of systems where the below materials are used.

B. Copper Tube: (Within Building) ASTM B88, Type L Water Tube, drawn temper of domestic manufacture.

C. Copper Tube: (Underground) ASTM B88, Type K Water Tube, annealed temper of domestic manufacture.

2.03 FITTINGS

A. Wrought Copper Solder-Joint Fittings: ANSI B16.22, streamlined pattern of domestic manufacture.

B. Wrought Copper and Bronze Grooved-End Fittings: ASTM B75 Tube and ASTM B584 Bronze Castings of domestic manufacture.

C. Unions: ASME B16.39, malleable iron, Class 150, hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces, female threaded ends. Threads shall conform to ASME B1.20.1. and of domestic manufacture.

D. Dielectric Unions: Threaded, solder, or grooved-end connections as required to suit application; constructed to isolate dissimilar metals, prevent galvanic action, and prevent corrosion of domestic manufacture.

E. Dielectric Unions: Flexible Connectors: Stainless-steel bellows with woven, flexible, bronze wire reinforced protective jacket; minimum 150 PSIG working pressure, maximum 250 deg. F. operating temperature. Connectors shall have flanged or threaded-end connections to match equipment connected and shall be 12" long and capable of 3/4-inch misalignment. Sweat ends are not acceptable. Fittings shall be of domestic manufacture.

2.04 JOINING MATERIALS

A. Solder Filler Metal: ASTM B32, 95-5 Tin-Antimony 'lead-free' solder.

B. Brazing Filler Metals: AWS A5.8, BCUP Series.

C. Gasket Material: Thickness, material, and type suitable for fluid to be handled and design temperatures and pressure.

2.05 GENERAL DUTY VALVES

A. General-duty valves (i.e., gate, globe, check, ball, and butterfly valves) are specified in Division 22 Section "General Duty Valves for Plumbing Piping and Equipment." Special duty valves are specified below by their generic name; refer to Part 3 Article "Valve Application" for specific uses and applications for each valve specified.

2.06 SPECIAL DUTY VALVES

A. Balance Cocks: 400 PSI WOG, 2 piece, ball valve, handle, memory stop, with threaded-end connections conforming to ASME B1.20.1.

B. Balance Cocks: 400 PSI WOG, 2 piece bronze, ball valve, handle, memory stop, with solder-end connections.

2.07 PIPING SPECIALTIES

A. Water Hammer Arresters:
   1. J.R. Smith or Approved Equal.
   2. Bellows type, with stainless steel casing and bellows, pressure rated for 250 psi, tested and certified in accordance with PDI Standard WH-201 shall be of the following sizes unless otherwise indicated on the drawings:
      a. Self-closing valves, lavatories, sinks, etc.

Supply header or pipe size (Inch)	Manufacturer Name	Water Hammer Arrester Model No.
1/2"	J.R. Smith	5005
3/4"	J.R. Smith	5005
1"	J.R. Smith	5010

3. Flushometer, automatic and solenoid valves:
   a. J.R. Smith or Approved Equal.

Supply header or pipe size (Inch)	Manufacturer Name (a)	Water Hammer Arrester Model No.
3/4”	J.R. Smith	5010
1”	J.R. Smith	5010

B. Y-Type Strainers: Provide strainers full line size of connecting piping, with ends matching piping system materials. Screens shall be Type 304 stainless steel, with 3/64" perforations at 233 per square inch. Strainers in copper lined to have bronze bodies.
   1. Provide strainers with 125 PSI working pressure rating for low pressure applications, and 250 PSI pressure rating for high pressure application.
   2. Threaded ends, 2" and Smaller: Cast-iron body, or bronze body, screwed screen retainer with centered blow-down fitted with pipe plug.
   3. Threaded Ends, 2-1/2" and Larger: Cast-iron body or bronze body bolted screen retainer with off-center blow-down fitted with pipe plug.
   4. Flanged Ends, 2-1/2" and Larger: Cast-iron body or bronze body, bolted screen retainer with off-center blow-down fitted with pipe plug.

C. Hose-Connections: Hose connections shall have garden hose threaded outlets conforming to ASME B1.20.7.

D. Hose Bibs: Bronze body with chrome- or nickel-plated finish, with renewable composition disc, removable wheel handle, vacuum breaker, 3/4- inch solder inlet, hose outlet.

E. Vacuum Breakers: Hose connection vacuum breakers shall conform to ASSE Standard 1011, with finish to match hose connection.

F. Relief Valves: Sizes for relief valves shall be in accordance with ASME Boiler and Pressure Vessel Codes for indicated capacity of the appliance for which installed.
   1. Combined Pressure-Temperature Relief Valves: Bronze body, test lever, thermostat, complying with ANSI Z21.22 listing requirements for temperature discharge capacity. Temperature relief valves shall be factory set at 210 degree F, and pressure relief at 150 psi.

G. Escutcheons: Chrome-plated, stamped steel, hinged, split-ring escutcheon, with set screw. Inside diameter shall closely fit pipe outside diameter, or outside of pipe insulation.

H. Sleeves:
   1. Sheet-Metal Sleeves: 10 gage, galvanized sheet metal, round tube closed with welded longitudinal joint.
   2. Steel Sleeves: Schedule 40 galvanized, welded steel pipe, ASTM A53, Grade A.

I. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine rough-in requirements for plumbing fixtures and other equipment with water connections to verify actual locations of piping connections prior to installation.

3.02 PREPARATION

A. Ream ends of pipes and tubes, and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris for both inside and outside of piping and fittings before assembly.

3.03 PIPE APPLICATIONS

A. Install Type L, drawn copper tube with wrought copper fittings and solder joints for pipe sizes 4 inches and smaller, above ground, within building.

B. Install Type K, annealed temper copper tube for pipe sizes 2 inches and smaller, with minimum number of joints, below ground.

C. Water piping in sizes 2-1/2 to 6 inches may be Type L drawn copper tube with roll-grooved ends and mechanical couplings, above ground within building.

3.04 PIPING INSTALLATION

A. General Locations and Arrangements; Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into consideration pipe sizing and friction loss, expansion, pump sizing, and other design considerations. So far as practical, install piping as indicated.

B. Use fittings for all changes in direction and branch connections.

C. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted unless expressly indicated.

D. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

E. Conceal all piping installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

F. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1-inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

G. Locate groups of pipes parallel to each other, spaced to permit applying full insulation and servicing of valves.

H. Install drains at low points in mains, risers, and branch lines consisting of a tee fitting, 3/4-inch ball valve, and short 3/4-inch threaded nipple and cap.

I. Pipe sleeves smaller than 6 inches shall be galvanized steel pipe; pipe sleeves 6 inches and larger shall be galvanized steel sheet metal.

J. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls with sleeves and mechanical sleeve seals.

K. Fire Barrier Penetrations: Where pipes pass though fire-rated walls, partitions, ceilings, and floors, maintain the fire-rated integrity. Refer to Division 07 for special sealers and materials.

3.05 HANGERS AND SUPPORTS

A. General: Hanger, support, and anchor devices conforming to MSS SP-69 are specified in Division 22, Section "Supports and Anchors." Conform to the table below for maximum spacing of supports:

B. Pipe Attachments: Install the following:
1. Adjustable steel clevis hangers, MSS Type 1, for individual horizontal runs less than 20 feet in length.
2. Adjustable roller hangers, MSS Type 43, and spring hangers, MSS Type 41 with Type 49, for individual horizontal runs 20 feet and longer.
3. Pipe roll, complete MSS Type 44 for multiple horizontal runs, 20 feet or longer, support on a trapeze.
4. Spring hangers to support vertical runs.

C. Install hangers for horizontal piping with the following maximum spacing and minimum rod sizes:

Steel & Copper Nom. Pipe Size – In.	Steel Pipe Max. Span – Ft.	Steel Pipe Min. Rod	Copper Tube Max. Span – Ft.	Copper Tube Min. Rod
Up to 3/4	7	3/8	5	3/8
1	7	3/8	6	3/8
1-1/4	7	3/8	7	3/8
1-1/2	9	3/8	8	3/8
2	10	3/8	8	3/8
2-1/2	11	3/8	9	3/8
3	12	1/2	10	1/2
3-1/2	13	1/2	11	1/2
4	14	5/8	12	1/2
5	16	5/8	13	1/2
6	17	3/4	14	5/8

D. Support vertical steel pipe and copper tube at each floor.

3.06 PIPE AND TUBE JOINT CONSTRUCTION

A. Soldered Joints: Comply with the procedures contained in the AWS "Soldering Manual."

B. Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."
   1. CAUTION: Remove stems, seats, and packing of valves and accessible internal parts of piping specialties before soldering and brazing.
   2. Fill the tubing and fittings during soldering and brazing with an inert gas (nitrogen or carbon dioxide) to prevent formation of scale.
   3. Heat joints to proper and uniform temperature.

C. Threaded Joints: Conform to ASME B1.20.1, tapered pipe threaded for field-cut threads. Join pipe fittings and valves as follows:
   1. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint.
   2. Align threads at point of assembly.
   3. Apply appropriate tape or thread compound to the external pipe threads (except where dry seal threading is specified).
   4. Assembly joint wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.
      a. Damaged Threads: Do not use pipe with corroded or damaged threads. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.

D. Flanged Joints: Align flange surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly with a torque wrench.

E. Grooved-End Joints: Prepare pipe and tubing and install in accordance with manufacturer's installation instructions.

3.07 SERVICE ENTRANCE

A. Extend water distribution piping to connect to water service piping, of size and in location indicated for service entrance to building. Water service piping is specified in separate section of Division 22.

B. Install sleeve and mechanical sleeve seal at penetrations through foundation wall for watertight installation.

3.08 VALVE APPLICATIONS

A. General-Duty Valve Applications: The Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
   1. Shut-off duty: Use gate, ball, and butterfly valves.
   2. Throttling duty: Use globe and ball valves.

3.09 INSTALLATION OF VALVES

A. Sectional Valves: Install sectional valves on each branch and riser, close to main, where branch or riser serves 2 or more plumbing fixtures or equipment connections, and elsewhere as indicated. For sectional valves 2 inches and smaller, use gate valves; for sectional valves 2-1/2 inches and larger, use gate or butterfly valves.

B. Shutoff Valves: Install shutoff valves at inlet and outlet of each plumbing equipment item and elsewhere as indicated.
   1. At plumbing equipment: 2" and smaller use gate or ball valves.
   2. At plumbing equipment: 2-1/2" and larger use gate or butterfly valves.
   3. For plumbing fixtures see fixture trim.
   4. All other locations use gate valves.

C. Drain Valves: Install drain valves on each plumbing equipment item, located to drain equipment completely for service or repair. Install drain valves at the base of each riser, at low points of horizontal runs, and elsewhere as required to drain distribution piping system completely. For drain valves use 3/4" hose end drain valve.

D. Hose Bibs: Install on exposed piping where indicated. Provide vacuum breaker.

3.10 INSTALLATION OF PIPING SPECIALTIES

A. Install backflow Preventers at each connection to mechanical equipment and systems and in compliance with the plumbing code and authority having jurisdiction. Install air cap fitting and pipe relief outlet drain without valves to nearest floor drain. Identify all piping downstream of backflow preventers as "industrial water".

B. Install pressure-regulating valves with inlet and outlet shutoff valves and balance cock bypass. Install pressure gage on valve outlet.

3.11 INSTALLATION OF PIPING WATER HAMMER ARRESTORS

A. Provide an air chamber at each valve water outlet or fixture supply for fixtures with manual closing valves. Air chamber shall be 18 inches long and one pipe size larger than supply to outlet. For a battery of fixtures, one air chamber 30 inches long and the full size of the header, but not less than 1 inch may be installed in lieu of individual air chambers. Precision Plumbing Products, JMJ "System Rated" arrestors are acceptable in lieu of air chambers.

B. Install water hammer arrestors on supply line to fixtures with self-closing, automatic or Flushometer valves. Arrestors shall be as close as possible to individual fixtures and on the end of the header for a battery of fixtures. Arrestors shall be installed in the wall or furring, whenever possible, behind an access panel large enough to permit removal of the arrestor. Sizes as shown on the drawings or as specified hereinafter. Sizes and model numbers are J. R. Smith; equivalent arrestors by Josam, Wade or Zurn are acceptable.

3.12 EQUIPMENT CONNECTIONS

A. Piping Run-outs to Fixtures: Provide hot and cold water piping Run-outs to fixtures of sizes indicated, but in no case smaller than required by plumbing code.

B. Equipment Connections: Connect hot and cold water piping system to equipment as indicated. Provide shutoff valve and union for each connection; provide drain valve on drain connection. For connections 2-1/2 inches and larger, use flanges instead of unions.

3.13 FIELD QUALITY CONTROL

A. Inspections: Inspect water distribution piping as follows:
   1. Do not enclose, cover, or put into operation water distribution piping system until it has been inspected and approved by the authority having jurisdiction.
   2. During the progress of the installation, notify the plumbing official having jurisdiction at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.
      a. Rough-In Inspection: After system is roughed in and prior to setting fixtures, arrange for inspection of the piping system before concealed or closed in.
      b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to ensure compliance with the requirements of the plumbing code.
   3. Re-inspections: Whenever the plumbing official finds that the piping system will not pass the test or inspection, make the required corrections and arrange for re-inspection by the plumbing official.
   4. Reports: Prepare inspection reports signed by the plumbing official.

B. Test water distribution piping as follows:
   1. Test for leaks and defects all new water distribution piping systems and parts of existing systems that have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
   2. Leave uncovered and unconcealed all new, altered, extended, or replaced water distribution piping until it has been tested and approved. Expose all such work for testing that has been covered or concealed before it has been tested and approved.
   3. Cap and subject the piping system to a static water pressure of 50 psig above the operating pressure without exceeding the pressure rating of the piping system materials. Isolate the test source and allow to-stand for 4 hours. Leaks and loss in test pressure constitute defects that must be repaired.
   4. Repair all leaks and defects with new materials and retest system or portion thereof until satisfactory results are obtained.
   5. Prepare reports for all tests and required corrective action.

3.14 ADJUSTING AND CLEANING

A. Clean and disinfect water distribution piping as follows:
   1. Purge all new water distribution piping systems and parts of existing systems that have been altered, extended, or repaired prior to use.
   2. Use the purging and disinfecting procedure prescribed by the authority having jurisdiction or, in case a method is not prescribed by that authority, the procedure described in either AWWA C651, or AWWA C652, or as described below:
      a. Flush the piping system with clean, potable water until dirty water does not appear at the points of outlet.

b. Fill the system or part thereof with a water/chlorine solution containing at least 50 parts per million of chlorine. Isolate (valve off) the system or part thereof and allow to stand for 24 hours.
c. Drain the system or part thereof of the previous solution and refill with a water/chlorine solution containing at least 200 parts per million of chlorine and isolate and allow to stand for 3 hours.
d. Following the allowed standing time, flush the system with clean, potable water until chlorine does not remain in the water coming from the system.
e. Submit water samples in sterile bottles to the authority having jurisdiction. Repeat the procedure if the biological examination made by the authority shows evidence of contamination.

B. Prepare reports for all purging and disinfecting activities.

3.15 COMMISSIONING

A. Fill the system. Check compression tanks, where used, to determine that they are not air bound and that the system is completely full of water.

B. Before operating the system, perform these steps:
1. Close drain valve, hydrants, and hose bibs.
2. Open valves to full open position.
3. Remove and clean strainers.
4. Check pumps for proper direction of rotation. Correct improper wiring.
5. Lubricate pump motors and bearings.

END OF SECTION 22 1116

SECTION 22 1119

PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies piping specialties and installation methods common to more than one section of Division 22.

1.02 RELATED SECTIONS

A. This section applies to all piping systems specified in Division 22.

B. Valves are specified in a separate section and in individual piping system Sections of Division 22.

C. Fire Barrier Penetration Seals are specified in Section 22 1100.

1.03 SUBMITTALS

A. Refer to Division 01 and Section 22 0500 “Common Work Results for Plumbing” for administrative and procedural requirements for submittals.

B. Product Data: Submit product data on the following items:
1. Escutcheons.
2. Dielectric Unions and Fittings.
3. Mechanical Sleeve Seals.
4. Strainers.
5. Post Indicator Valve (PIV).
6. Fire Department Connection (FDC).

1.04 DELIVERY, STORAGE, AND HANDLING

A. Protect flanges, fittings, and specialties from moisture and dirt by inside storage and enclosure, or by packaging with durable, waterproof wrapping.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer Uniformity: Conform to the requirements specified in Common Work Results for Plumbing, under "Product Options."

B. Manufacturer: Subject to compliance with requirements, provide piping materials and specialties from one of the following:
1. Pipe Escutcheons:
    a. McGuire
    b. BrassCraft
    c. Pasco

2. Dielectric Waterway Fittings:
   a. Epco Sales, Inc.
   b. Victaulic Company of America.
3. Dielectric Unions:
   a. Eclipse, Inc.
   b. Perfection Corp.
   c. Watts Regulator Co.
4. Strainers:
   a. Armstrong Machine Works.
   b. Hoffman Specialty ITT; Fluid Handling Div.
   c. Metraflex Co.
   d. R-P&C Valve; Div. White Consolidated Industries, Inc.
   e. SpiraxSarco.
   f. Trane Co.
   g. Victaulic Co. of America. (low-pressure applications only).
   h. Watts Regulator Co.
5. Mechanical Sleeve Seals:
   a. Thunderline Corp.
6. Post Indicator Valve:
   a. Mueller Co.
7. Fire Department Connection:
   a. Potter Roemer.

2.02 PIPE AND FITTINGS

A. Refer to the individual piping system specification sections in Division 22 for specifications on piping and fittings relative to that particular system.

2.03 JOINING MATERIALS

A. Welding Materials: Comply with Section II, Part C, ASME Boiler and Pressure Vessel Code for welding materials appropriate for the wall thickness and chemical analysis of the pipe being welded.

B. Brazing Materials: Comply with SFA-5.8, Section II, ASME Boiler and Pressure Vessel Code for brazing filler metal materials appropriate for the materials being joined.

C. Soldering Materials: Refer to individual piping system specifications for solder appropriate for each respective system.

D. Gaskets for Flanged Joints: Gasket material shall be full-faced for cast-iron flanges and raised-face for steel flanges. Select materials to suit the service of the piping system in which installed and which conform to their respective ANSI Standard (A21.11, B16.20, or B16.21). Provide materials that will not be detrimentally affected by the chemical and thermal conditions of the fluid being carried.

2.04 PIPING SPECIALTIES

A. Escutcheons: Chrome-plated, stamped steel, hinged, split-ring escutcheon, with set screw. Inside diameter shall closely fit pipe outside diameter or outside of pipe insulation where pipe is insulated. Outside diameter shall completely cover the opening in floors, walls, or ceilings.

B. Unions: Malleable-iron, Class 150 for low pressure service and class 250 for high pressure service; hexagonal stock, with ball-and-socket joints, metal-to-metal bronze seating surfaces; female threaded ends.

C. Dielectric Unions: Provide dielectric unions with appropriate end connections for the pipe materials in which installed (screwed, soldered, or flanged), which effectively isolate dissimilar metals, prevent galvanic action, and stop corrosion.

D. Dielectric Waterway Fittings: Electroplated steel or brass nipple, with an inert and non-corrosive, thermoplastic lining.

E. Y-Type Strainers: Provide strainers full line size of connecting piping, with ends matching piping system materials. Screens shall be Type 304 stainless steel, with 3/64" perforations at 225 holes per square inch.
   1. Provide strainers with 125 PSI working pressure rating for low-pressure applications, and 250 PSI pressure rating for high-pressure application.
   2. Threaded Ends, 2" and Smaller: Cast-iron body, screwed screen retainer with centered blow-down fitted with pipe plug.
   3. Threaded Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blow-down fitted with pipe plug.
   4. Flanged Ends, 2-1/2" and Larger: Cast-iron body, bolted screen retainer with off-center blow-down fitted with pipe plug.
   5. Butt Welded Ends, 2-1/2" and Larger for Low Pressure Application: Schedule 40 cast carbon steel body, bolted screen retainer with off-center blow-down fitted with pipe plug.
   6. Butt Welded Ends, 2-1/2" and Larger for High Pressure Application: Schedule 80 cast carbon steel body, bolted screen retainer with off-center blow-down fitted with pipe plug.
   7. Grooved Ends, 2-1/2" and Larger: Tee pattern, ductile-iron or malleable-iron body and access end cap, access coupling with EDPM gasket.

F. Mechanical Sleeve Seals: Modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.

G. Post Indicator Valve: Adjustable type indicator post, UL / FM, complete with Potter Roemer Model 6223 supervisory switch, 120v, UL Listed.

H. Fire Department Connection: Exposed fire department inlet connection, cast brass two-way inlet body, swing clapper and pin lug swivel. UL Listed, FM approved. Body identification “AUTO. SPKR.”

PART 3 - EXECUTION

3.01 ESCUTCHEONS

A. Install escutcheons at all exposed penetrations of piping through walls, ceilings, and floors in rooms with finish surfaces.

3.02 FITTINGS AND SPECIALTIES

A. Install strainers on the supply side of each control valve, pressure reducing or regulating valve, solenoid valve, and elsewhere as indicated.

B. Install unions adjacent to each valve and at the final connection to each piece of equipment and plumbing fixture having 2" and smaller connections, and elsewhere as indicated.

C. Install Flanges in piping 2-1/2" and larger, where indicated, adjacent to each valve, and at the final connection to each piece of equipment.

D. Install dielectric unions to connect piping materials of dissimilar metals in dry piping systems (gas, compressed air, vacuum).

E. Install dielectric fittings to connect piping materials of dissimilar metals in wet piping systems (water, steam).

END OF SECTION 22 1119

SECTION 22 1316

SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes building sanitary and storm drainage and vent piping systems, including drains and drainage specialties.

1.02 RELATED SECTIONS

A. The following sections contain requirements that relate to this section:
   1. Division 22 Section "Plumbing Identification," for labeling and identification of drainage and vent piping.

1.03 DEFINITIONS

A. Building Drain: That part of the lowest piping of a drainage system which receives the discharge from soil, waste, and other drainage pipes inside the walls of the building and conveys it to the building sewer.

B. Building Sewer: That part of the piping within public or private premises which conveys sewage, rain water or other liquid wastes to a point of disposal.

C. Drainage System: Includes all the piping within public or private premises which conveys sewage, rain water or other liquid wastes to a point of disposal. It does not include the mains of public sewer systems or a private or public sewage treatment or disposal plant.

D. Vent System: A pipe or pipes installed to provide a flow of air to or from a drainage system, or to provide a circulation of air within such system to protect trap seals from siphonage and backpressure.

1.04 SUBMITTALS

A. Product data for the following products:
   1. Drainage piping specialties

1.05 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the provisions of the following:
   1. California Plumbing Code (CPC): Current edition in use by authority having jurisdiction.

1.06 SEQUENCING AND SCHEDULING

A. Coordinate the installation of roof drains, flashing, and roof penetrations.

B. Coordinate flashing materials installation of roofing, waterproofing, and adjoining substrate work.

C. Coordinate the installation of drains in poured-in-place concrete slabs, to include proper drain elevations, installation of flashing, and slope of slab to drains.

D. Coordinate with installation of sanitary and storm sewer system as necessary to interface building drains with drainage piping system.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide drainage and vent systems from one of the following:
   1. Drainage Piping Specialties, including backwater valves, expansion joints, drains, trap primers, and vandal-proof vent caps:
      a. J. R. Smith Mfg. Co.
      b. Josam Mfg. Co.
      c. Zurn Industries Inc; Hydromechanics Div.
      d. Tyler Pipe; Subs. of Tyler Corp.

2.02 ABOVE GROUND DRAINAGE AND VENT PIPE AND FITTINGS

A. General: Select from the following options:
   1. Pipe Sizes Larger than 2": Cast-iron soil pipe. Conform to ASTM A74, for service weight, hub-and-spigot soil pipe and fittings, with clamps and compression gasket joints conforming to ASTM C564. Piping shall bear the CISPI stamp.
   2. Pipe Sizes Larger than 2": Hub-less cast-iron soil pipe. Conform to CISPI Standard 301, Service weight, cast-iron soil pipe and fittings, with neoprene gaskets conforming to CISPI Standard 310. Piping shall bear the CISPI stamp.

2.03 UNDERGROUND BUILDING DRAIN PIPE AND FITTINGS

A. Pipe and fittings shall have heavy coating of coal tar varnish or 'asphaltum' on both inside and outside surfaces.

B. General: For pipe and fittings below grade and/or below finish floor of floors on grade select from the following options:
   1. Pipe Sizes 15" and Smaller: Cast-iron soil pipe. Conform to ASTM A74, for standard weight hub and spigot soil pipe and fittings, with clamps and neoprene gasket, conforming to ASTM C564. Piping shall bear the CISPI stamp.
   2. Pipe Sizes 16" and Smaller: Hub-less cast iron soil pipe, conform to CISPI Standard 301, service weight; with "Best" or "MG" cast iron joint connection couplings. Coupling body shall conform to ASTM A-48 or ASTM A-74 with neoprene gasket conforming to ASTM C-564. Piping shall bear the CISPI stamp.

2.04 DRAINAGE PIPE SPECIALTIES

A. Trap Primers (Products of Domestic Manufacture): Bronze body valve with automatic vacuum breaker, with 1/2 inch connections matching piping system. Complying with ASSE 1018 of domestic manufacture.

B. Expansion Joints: Cast-iron body with adjustable bronze sleeve, bronze bolts with wing nuts.

C. Cleanout Plugs: Cast-bronze or brass, threads complying with ANSI B2.1, countersunk head.

2.05 CLEANOUTS

A. Cleanouts on cast iron soil pipe, iron body with ABS plugs screwed into caulking ferrules. Cleanouts on steel pipe, ABS plugs. Cleanouts on vitrified clay pipe, vitrified clay pipe. Where cleanouts occur in finished interior surfaces, smooth polished chromium plated. Exposed parts of floor cleanouts in finished rooms, non-slip polished nickel bronze. Floor cleanouts adjustable type. Where cleanouts occur in carpeted floor areas, the cover shall be elevated so as to be flush with finished carpeted areas.

B. Floor Cleanouts (Products of Domestic Manufacture): Cast-iron body and frame, with cleanout plug and adjustable round top as follows:
   1. Floor level type in rooms with concrete floor: Smith #4021, Josam 58330-2, or Zurn Z1420-25 with cast iron top.

C. Wall Cleanouts (Products of Domestic Manufacture): Cast-iron body adaptable to pipe with ABS plastic plug; stainless steel cover including screws.
   1. Wall type for cast-iron pipes: Smith #4532, Josam 58790-4, or Zurn Z-1445-1.
   2. Wall type for steel pipes: Smith #4472, Josam 58890-4, or Zurn 1460-8.

D. Flashing Flanges: Cast-iron watertight stack or wall sleeve with membrane flashing ring. Provide under-deck clamp and sleeve length as required.

E. Vent Flashing Sleeves: Cast-iron caulking type roof coupling for cast-iron stacks, cast-iron threaded type roof coupling for steel stacks.

F. Vandal-Proof Vent Caps (Products of Domestic Manufacture): Cast-iron body full size of vent pipe, with caulked base connection for cast-iron pipes, threaded base for steel pipes.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify all dimensions by field dimensions. Verify that all drainage and vent piping and specialties may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Verify existing grades, inverts, utilities, obstacles, and topographical conditions prior to installations.

C. Examine rough-in requirements for plumbing fixtures and other equipment having drain connections to verify actual locations of piping connections prior to installation.

D. Examine walls, floors, roof, and plumbing chases for suitable conditions where piping and specialties are to be installed.

E. Do not proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION FOUNDATION FOR UNDERGROUND BUILDING DRAINS

A. Grade trench bottoms to provide a smooth, firm, and stable foundation, free from rock, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated invert elevation.

C. Shape bottom of trench to fit bottom of pipe for 90-degrees (bottom 1/4 of the circumference). Fill unevenness with tamped sand backfill. At each pipe joint dig bell holes to relieve the bell of the pipe of all loads, and to ensure continuous bearing of the pipe barrel on the foundation.

3.03 PIPE APPLICATIONS - ABOVE GROUND, WITHIN BUILDING

A. General: Select from following options:
1. Install hub-and spigot, service weight, cast-iron soil pipe with compression gasket joints for larger than 2 inches drainage and vent pipe. Piping shall bear the CISPI stamp.
2. Install Hub-less, service weight, cast-iron soil pipe and fittings for larger than 2 inch drainage and vent pipe. Piping shall bear the CISPI stamp.

3.04 PIPE APPLICATIONS - BELOW GROUND, WITHIN BUILDING

A. General: Select from the following options:
1. Install hub-and-spigot, heavy service weight, cast-iron, soil pipe and fittings with gasket joints for 15 inch and smaller drainage pipe. Piping shall bear the CISPI stamp.
2. Install hub-less, service weight, cast-iron soil pipe with Anaco Husky SD 4000 stainless steel couplings with neoprene gaskets. Piping shall bear the CISPI stamp.

3.05 PIPE AND TUBE JOINT CONSTRUCTION

A. Copper Tubing (Products of Domestic Manufacture): Solder joints in accordance with the procedures specified in AWS "Soldering Manual."

B. Cast-Iron Soil Pipe (Products of Domestic Manufacture): Make lead and oakum caulked joints, compression joints, and hub-less joints in accordance with the recommendations in the CISPI Cast Iron Soil Pipe and Fittings Handbook, Chapter IV.

C. Install couplings per manufacturer's recommendations.

3.06 INSTALLATION

A. General Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of the piping systems. Location and arrangement of piping layout take into account many design considerations. So far as practical, install piping as indicated.

B. Use fittings for all changes in direction and all branch connections.

C. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

D. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

E. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

F. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Allow sufficient space above removable ceiling panels to allow for panel removal.

G. Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6 inch shall be steel; pipe sleeves 6 inches and larger shall be sheet metal.

H. Fire Barrier Penetrations: Where pipes pass through fire rated walls, partitions, ceilings and floors, maintain the fire rated integrity.

I. Make changes in direction for drainage and vent piping using appropriate 45 degree wyes, half-wye, or long sweep quarter, sixth, eight, or sixteenth bends. Sanitary tees or short quarter bends may be used on vertical stacks of drainage lines where the change in direction of flow is from horizontal to vertical, except use long-turn tees where two fixtures are installed back to back and have a common drain.
Straight tees, elbows, and crosses may be used on vent lines. No change in direction of flow greater than 90 degrees shall be made. Where different sizes of drainage pipes and fittings are connected, use proper size, standard increasers and reducers. Reduction of the size of drainage piping in the direction of flow is prohibited.

J. Install underground building drains to conform with the plumbing code, and in accordance with the Cast Iron Soil Pipe Institute Engineering Manual. Lay underground building drains beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install required gaskets in accordance with manufacturer's recommendations for use of lubricants, cements, and other special installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

K. Install building drain pitched down at minimum slope of 1/4 inch per foot (2 percent) for piping 3 inch and smaller, and 1/8 inch per foot (1 percent) for piping 4 inch and larger.

L. Extend building drain to connect to sewer piping, of size and in location indicated for service entrance to building. Sewer piping is specified in a separate section of Division 22.

M. Install sleeve and mechanical sleeve through foundation wall for watertight installation.

3.07 HANGERS AND SUPPORTS

A. General: Hangers, supports, and anchorage devices are specified in Division 22 Section "Plumbing Piping." Conform to the table below for maximum spacing of supports:

B. Install the following pipe attachments:
1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet in length.

C. Install hangers at the following intervals:

Pipe material	Max. Horizontal Spacing (Ft.)	Max. Vertical Spacing (Ft.)
Cast Iron Pipe	5	15
Copper Tubing 1-1/2" & Smaller	6	10
Copper Tubing 2" & Larger	10	10

3.08 INSTALLATION OF PIPE SPECIALTIES

A. Install backwater valves in sanitary building drain piping as indicated, and as required by the plumbing code. For interior installation, provide cleanout cover flush to floor centered over backwater valve cover and of adequate size to remove valve cover for service.

B. Install expansion joints on vertical risers as indicated, and as required by the plumbing code.

C. Above Ground Cleanouts: Install in above ground piping and building drain piping as indicated, and:
1. As required by plumbing code.
2. At each horizontal change in direction of piping greater than 135 degrees.
3. At maximum intervals of 50' for piping 3" and smaller and 100' for larger piping.
4. At base of each vertical soil or waste stack.

D. Cleanouts Covers: Install floor and wall cleanout covers for concealed piping.

E. Flashing Flanges: Install flashing flange and clamping device with each stack and cleanout passing through roof, secure over stack flashing in accordance with manufacturer's instructions.

3.09 INSTALLATION OF TRAP PRIMERS

A. Install trap primers with piping pitched towards drain trap, minimum of 1/8 inch per foot (1 percent). Adjust trap primer for proper flow. Provide trap primer for all floor drains and floor sinks. Multiple outlet primers are acceptable.

3.10 CONNECTIONS

A. Piping Run-outs to Fixtures: Provide drainage and vent piping run-outs to plumbing fixtures and drains, with approved trap, of sizes indicated; but in no case smaller than required by the plumbing code.

3.11 FIELD QUALITY CONTROL

A. Inspections:
1. Do not enclose, cover, or put into operation drainage and vent piping system until it has been inspected and approved by the authority having jurisdiction.
2. During the progress of the installation, notify the plumbing official having jurisdiction, at least 24 hours prior to the time such inspection must be made. Perform tests specified below in the presence of the plumbing official.

a. Rough-In Inspection: Arrange for inspection of the piping system before concealed or closed-in after system is roughed-in, and prior to setting fixtures.
b. Final Inspection: Arrange for a final inspection by the plumbing official to observe the tests specified below and to insure compliance with the requirements of the plumbing code.

3. Re-inspections: Whenever the piping system fails to pass the test or inspection, make the required corrections, and arrange for re-inspection by the plumbing official.
4. Reports: Prepare inspection reports, signed by the plumbing official.

B. Piping System Test: Test drainage and vent system in accordance with the procedures of the authority having jurisdiction, or in the absence of a published procedure, as follows:
1. Test for leaks and defects all new drainage and vent piping systems and parts of existing systems, which have been altered, extended or repaired. If testing is performed in segments, submit a separate report for each test, complete with a diagram of the portion of the system tested.
2. Leave uncovered and unconcealed all new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose all such work for testing, which has been covered or concealed before it has been tested and approved.
3. Rough Plumbing Test Procedure: Except for outside leaders and perforated or open jointed drain tile, test the piping of plumbing drainage and venting systems upon completion of the rough piping installation. Tightly close all openings in the piping system, and fill with water to the point of overflow, but not less than 10 feet head of water. Water level shall not drop during the period from 15 minutes before the inspection starts, through completion of the inspection. Inspect all joints for leaks.
4. Finished Plumbing Test Procedure: After the plumbing fixtures have been set and their traps filled with water, their connections shall be tested and proved gas and water-tight. Plug the stack openings on the roof and building drain where it leaves the building, and introduce air into the system equal to a pressure of 1" water column. Use a "U" tube or manometer inserted in the trap of a water closet to measure this pressure. Air pressure shall remain constant without the introduction of additional air throughout the period of inspection. Inspect all plumbing fixture connections for gas and water leaks.
5. Repair all leaks and defects using new materials and retest system or portion thereof until satisfactory results are obtained.
6. Prepare reports for all tests and required corrective action.

3.12 ADJUSTING AND CLEANING

A. Clean interior of piping system. Remove dirt and debris as work progresses.

B. Clean drain strainers, domes, and traps. Remove dirt and debris.

3.13 PROTECTION

A. Protect drains during remainder of construction period, to avoid clogging with dirt and debris, and to prevent damage from traffic and construction work.

B. Place plugs in ends of uncompleted piping at end of day or whenever work stops.

END OF SECTION 22 1316

SECTION 22 4200

COMMERCIAL PLUMBING FIXTURES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This section specifies plumbing fixtures and trim. The types of fixtures specified include the following:
   1. Water Closets.
   2. Urinals.
   3. Lavatories (including wheelchair type).
   4. Service Sinks.
   5. Mop Basins.
   6. Electric Water Coolers (including wheelchair type).
   7. Faucets.
   8. Flush Valves.
   9. Fixture Supports (including wheelchair type).
   10. Toilet Seats.
   11. Fittings, Trim, and Accessories.
   12. Floor Drains.
   13. Roof Drains.

1.02 RELATED SECTIONS

A. Separate grab bars and toilet accessories not in integral part of plumbing fixtures and are specified in Division 10.

B. Electrical Requirements for, Water Heaters, water conditioners, and other plumbing equipment are specified in other Sections of Division 22 and Division 26.

1.03 SUBMITTALS

A. Product Data: Submit Product Data and installation instructions for each fixture, faucet, specialties, accessories, and trim specified; clearly indicate rated capacities of selected models of water coolers, and water heaters.

B. Shop Drawings: Submit rough-in drawings. Detail dimensions, rough-in requirements, required clearances, and methods of assembly of components and anchorages. Coordinate requirements with Architectural Woodwork shop drawings specified in Division 6 for fixtures installed in countertops and cabinets. Furnish templates for use in woodwork shop.

C. Wiring Diagrams: Submit manufacturer's electrical requirements and wiring diagrams for power supply to units. Clearly differentiate between portions of wiring that are factory installed and field installed portions.

D. Maintenance Data: Include data in Maintenance Manual specified in Division 01 and Section 22 0500.

E. Quality Control Submittals:
   1. Submit certification of compliance with specified ANSI, UL, and ASHRAE Standards.
   2. Submit certification of compliance with performance verification requirements specified in this Section.

1.04 QUALITY ASSURANCE

A. Codes and Standards:
   1. California Building Code 2022, Title 24, Part 2 for Accessibility Requirements.
      a. Plumbing fixtures and accessories provided in a toilet room or bathing room required to comply with CBC Section 11B-213.2 shall comply with CBC Section 11B-213.3.
      b. Accessible plumbing fixtures shall comply with all the requirements in CBC Division 6.
      c. Heights and location of all accessible fixtures shall be mounted according to CBC Sections 11B-602 through 11B-612.
      d. Accessible fixture controls shall comply with CBC Sections 11B-602.3 for drinking fountains, 11B-604.6 for water closets, 11B-604.9.5 for children's water closets, 11B-605.4 for urinals, 11B-606.4 for lavatories and sinks, 11B-604.9.5 for bathtubs, 11B-608.5 for showers, and 11B-611.3 for washing machines and clothes dryers.
      e. Accessible lavatories and sinks shall be mounted with the front of the higher of the rim or counter surface 34" maximum above the finish floor or ground. Depth of lavatories or sinks shall not interfere with knee and toe clearance provided in accordance with CBC Section 11B-306 when a forward approach is required. CBC Sections 11B-606.3 and 11B-606.7.
      f. Water supply and drain pipes under accessible lavatories and sinks shall be insulated or otherwise configured to protect against contact. There shall be no sharp or abrasive surfaces under accessible lavatories and sinks. CBC Sections 11B-606.5

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store fixtures where environmental conditions are uniformly maintained within the manufacturer's recommended temperatures to prevent damage.

B. Store fixtures and trim in the manufacturer's original shipping containers. Do not stack containers or store in such a manner that may cause damage to the fixture or trim.

1.06 SEQUENCE AND SCHEDULING

A. Schedule rough-in installations with the installation of other building components.

1.07 MAINTENANCE

A. Extra Stock: Furnish special wrenches and other devices necessary for servicing plumbing fixtures and trim to Owner with receipt in a quantity of one device for each 10 fixtures.

B. Repair Kits: Furnish faucet repair kits complete with all necessary washers, springs, pins, retainer packings, O-rings, sleeves, and seats in a quantity of 1 kit for each 40 faucets.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer uniformity shall be as specified in Section 22 0500, "Common Work Results for Plumbing."

B. The following specification mentions manufacturers to establish a standard quality. The following fixtures and accessories are acceptable, if used throughout:
   1. Water Closets, Urinals, Lavatories, Service Sinks:
      a. Kohler Co.
      b. American Standard.
      c. Crane Co.
   2. Stainless Steel Sinks:
      a. Elkay Mfg. Co.
      b. Just Mfg. Co.
   3. Faucets:
      a. Chicago Faucet Co.
      b. American Standard.
      c. T & S Brass.
      d. Speakman.
   4. Flush Valves:
      a. Sloan Valve Co.
      b. Zurn.
   5. Water Closet Seats:
      a. Church Products.
      b. Bemis.
      c. Beneke Corp.
   6. Fixture Supports:
      a. Jay R. Smith Manufacturing Co.
      b. Josam Mfg. Co.
      c. Zurn Industries, Inc.; Hydromechanics Div.
   7. Drains:
      a. Jay R. Smith Manufacturing Co.
      b. Josam Mfg. Co.
      c. Zurn Industries, Inc.; Hydromechanics Div.

2.02 FIXTURES

A. Plumbing fixture trim and exposed supplies and wastes are to be brass with polished chromium plated finish unless otherwise specified. Provide individual lose key or screwdriver stops for all fixture supplies. Separately trap all wastes. Furnish chrome plated wall escutcheons for all exposed supplies and trap arms. Locate stops below fixtures or countertops. All fixtures for use by the disabled shall have exposed hot water pipe and tailpiece and trap insulated with 1/2" rubber foam insulation.

B. All plumbing fixture faucets submitted for review shall have identification label or certification showing compliance with California Title 24, Part 5, Article 1, "Energy Conservation Standards"; Article 1, T20-1406; Article 2, T20-1525 and Article 4, 1604, and 1606.

C. Provide fixtures as scheduled on plumbing drawings and requirements of this Section.

2.03 SINK FAUCET

A. Description: General Service faucet. Include hot- and cold-water indicators; coordinate faucet inlets with supplies and fixture holes; coordinate outlet with spout and fixture receptor.
   1. Maximum Flow Rate: 1.5 GPM.

2.04 FLUSHOMETER

A. Description: Flushometer for urinal and water-closet]-type fixture. Include brass body with corrosion-resistant internal components, non-hold-open feature, control stop with check valve, vacuum breaker, copper or brass tubing, and polished chrome-plated finish on exposed parts.
   1. Consumption for Urinal: Waterless is basis of design (0.5 Gal./Flush).
   2. Consumption for Water-closet: 1.28 Gal./Flush

2.05 WATER CLOSET

A. Description Accessible Wall-mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.
   1. Style: Flushometer valve.
      a. Design Consumption: 1.28 Gal./Flush

B. Description: Accessible Floor-mounting, floor-outlet, vitreous-china fixture designed for flushometer valve operation.
   1. Style: Flushometer valve.
      a. Design Consumption: 1.28 Gal./Flush

2.06 URINAL

A. Description: Accessible, Wall-mounting, back-outlet, vitreous-china fixture designed for flushometer valve operation.
   1. Design Consumption: Basis of design (0.125 Gal./Flush).

2.07 FIXTURE SUPPORTS

A. Lavatory Supports: Adjustable cast iron, with thin concealed arms and sleeves, and complete with escutcheons and mounting fasteners.

B. Water Closet Supports: Adjustable, factory painted, cast iron face plate, support base, and appropriate type waste fitting having face plate gasket; zinc plated steel fixture studs and fasteners; coated and threaded adjustable wall coupling with neoprene closet outlet gasket; and chrome plated fixture cap nuts and fiber fixture washers. Provide an appropriate model to suit deep or shallow rough-in, siphon jet or blow-out water closet, and type of sanitary piping system to which it is connected.

C. Wheelchair Water Closet Supports: Adjustable, factory painted, cast iron face plate, support base, and appropriate type waste fitting having face plate gasket; zinc plated steel fixture studs and fasteners; coated and threaded adjustable wall coupling with neoprene closet outlet gasket; and chrome plated fixture cap nuts and fiber fixture washers. Units shall have elevated mounting heights of wheelchair fixtures, siphon jet or blow-out water closet, and type of sanitary piping system to which it is connected.

2.08 ESCUTCHEONS

A. Select one of the two options below (Products of Domestic Manufacture):
   1. Chrome-plated cast brass with set screw.
   2. Chrome-plated sheet steel with friction clips.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify all dimensions by field measurements. Verify that all plumbing fixtures may be installed in accordance with pertinent codes and regulations, the original design, and the referenced standards.

B. Examine rough-in for potable water and waste piping systems to verify actual locations of piping connections prior to installing fixtures.

C. Examine walls, floors, and cabinets for suitable conditions where fixtures are to be installed.

D. Do not proceed until unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF FIXTURES

A. Install plumbing fixtures level and plumb, in accordance with fixture manufacturer's written instructions, rough-in drawings, and pertinent codes and regulations, the original design, and the referenced standards.

B. Comply with the installation requirements of the 2022 California Building Code "CBC" Division 6 for accessible plumbing fixtures. Reference Article 1.04, A.,1., a. thru f. of this Section.

C. Fasten plumbing fixtures securely to supports or building structure. Secure supplies behind or within wall construction to provide rigid installation.

D. Securely attach wall hung fixtures to a 3/8 inch x 6 inch wide steel plate. Steel plate to extend at least one stud beyond first and last mounting point. Drill and tap plate at time of installation of fixture or fixture hanger. Support fixture hanger with 1/2" diameter threaded studs, jamb nuts, C.P. Acorn nuts and completely free of wall by means of a second set of jamb nuts. Weld plate to each metal stud crossed by means of a continuous vertical fillet weld and same size as stud thickness. Secure plate to each wood stud crossed by securely bolting to each stud crossed with two 1/2-inch steel bolts, 4-inch center with 1/8-inch maximum x 1-1/2 inch steel back up plates. Notch studs to set plate flush with surface.

E. Set mop basins in a leveling bed of cement grout.

F. Install a stop valve in an accessible location in the water connection to each fixture.

G. Install chrome plated brass escutcheons at each wall, floor, and ceiling penetration in exposed finished locations and with cabinets and millwork.

H. Seal fixtures to walls and floors using silicone sealant as specified in Section 079000. Match sealant color to fixture color.

I. Provide abrasive washers under all single drilling deck mounted trim.

3.03 INSTALLATION OF FLOOR DRAINS

A. Install floor drains in accordance with manufacturer's written instructions and in locations indicated.

B. Install floor drains at low points of surface areas to be drained, or as indicated. Set tops of drains flush with finished floor.

C. Set drain elevation depressed below finished slab elevation as listed below to provide proper slope to drain:

Depression (Inch)	Radius Of Area Drained (Feet)
1/2	5
3/4	10
1	15
1-1/4	20
1-1/2	25

D. Trap all drains connected to the sanitary sewer.

E. Install drain flashing collar or flange so that no leakage occurs between drain and adjoining flooring. Maintain integrity of waterproof membranes, where penetrated.

F. Position drains so that they are accessible and easy to maintain.

3.04 INSTALLATION OF TRAP PRIMERS

A. Install trap primers with piping pitched towards drain trap, minimum of 1/8 inch per foot (1 percent). Adjust trap primer for proper flow.

3.05 INSTALLATION OF ROOF DRAINS

A. Install roof drains at low points of roof areas, in accordance with the roof membrane manufacturer's installation instructions.

B. Install drain flashing collar or flange so that no leakage occurs between roof drain and adjoining roofing. Maintain integrity of waterproof membranes, where penetrated.

C. Position roof drains so that they are accessible and easy to maintain.

3.06 FIELD QUALITY CONTROL

A. Test fixtures to demonstrate proper operation upon completion of installation and after units are water pressurized. Replace malfunctioning units, then retest.

B. Inspect each installed unit for damage. Replace damaged fixtures.

3.07 ADJUSTING

A. Adjust water pressure at drinking fountains, faucets, shower valves, and flush valves to provide proper flow and stream.

B. Replace washers or leaking or dripping faucets and stops.

C. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

3.08 CLEANING

A. Clean fixtures, trim, and strainers using manufacturer's recommended cleaning methods and materials.

3.09 PROTECTION

A. Provide protective covering for installed fixtures, water coolers, and trim.

B. Do not allow use of fixtures for temporary facilities unless expressly approved in writing by Owner.

3.10 MOUNTING HEIGHTS SCHEDULE

Fixture	Mounting Height
Water Closet	See Architectural Drawings
Accessible Water Closet	See Architectural Drawings
Urinal	See Architectural Drawings
Accessible Urinal	See Architectural Drawings
Lavatory or Sink	See Architectural Drawings
Accessible Lavatory / Sink	See Architectural Drawings
Accessible Water Cooler	See Architectural Drawings

3.11 ROUGH-IN FOR FIXTURES

A. Rough-in for all fixtures and/or equipment as shown on any drawings, including the architectural drawings, which forms a part of the contract documents. This shall include all fixtures and equipment shown and/or noted as N.I.C. (not in contract) or as U.O.S. (furnished under another section of the specification). Stub out all piping to the exact location of the fixtures and set symmetrical with the fixture. Stub out for fixture supply pipes with drop ear fittings secured to stud or backing plate. Stub out two pipe diameter and terminate with pipe cap. When liens are indicated as capped or plugged at floor level, plug flush with the finished floor.

END OF SECTION 22 4200

SECTION 23 0500

COMMON WORK RESULTS FOR HVAC

PART 1 -GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Project specification Sections, apply to this and the other sections of Division 23.

B. This Division is an integrated whole comprising interrelated and interdependent Section and shall be considered in its entirety in determining requirements of the Work.

C. Refer to other sections of this Division for additional requirements or information regarding the subjects of this Section.

1.02 SECTION INCLUDES

A. This Section includes general administrative and procedural requirements for HVAC installations. The following administrative and procedural requirements are included in this Section to expand the requirements specified in Division 01:
   1. Submittals.
   2. Coordination drawings.
   3. Record documents.
   4. Maintenance manuals.
   5. Rough-ins.
   6. Mechanical installations.
   7. Cutting and patching.

1.03 SUBMITTALS

A. General: Follow the procedures specified in Division 01.

B. HVAC submittals shall include shop drawings, product data, and samples per requirements of each section of the specifications.

C. HVAC Submittals and Product Data: Assemble “submittals” and “product data” into tabbed brochures according to main areas of work i.e. (HVAC); Temperature Control; Testing, Adjusting, and Balancing.
   1. Assemble each brochure with tabbed separators for each Specification Section where products are noted to be submitted, with separate tabs for each product listed.
   2. Temperature "control shop drawings" may be submitted separately after preparations for review.
   3. For items such as valves, hangers, and accessories, indicate specific items and where they are to be used.
   4. Contractor need only to submit for review those items specified to be submitted, unless requested by the Architect for special review.

D. All submittals shall be submitted in hard copy, electronic submittals are not acceptable.

E. Increase the number of HVAC related submittals including shop drawings, product data, and samples submitted to allow for required distribution by one additional copy, which will be retained by the Mechanical Consulting Engineer.

F. Submit for review, only the specific items required in this Section or other Sections of Division 23.

G. Additional submittals shall include, but not limited:
   1. Air balance reports and equipment data record drawings.
   2. Certification of completion of testing.
   3. Certification of completion of operation instructions.
   4. Operating instruction brochure.
   5. Maintenance instruction brochures.
   6. Equipment guarantees.
   7. 1/4" = 1'-0" or larger scale layouts of "Equivalent" equipment or "Or Approved Equal" equipment.
   8. Coordination Drawings, where requested or required.

H. Submittal materials will be reviewed for substantial conformity with the intent of the contract plans and specifications only. Such review does not indicate approval of dimensions, quantities, coordination with other trades, or work methods of the contractor, which are indicated thereon.

I. Additional copies may be required by individual sections of these specifications.

1.04 COORDINATION

A. The Contractor shall be totally responsible for coordinating the layout of all building elements to avoid conflict of the work of the structural, mechanical, electrical systems, and architectural features of the building.

B. The cost of any extra work of any kind caused by a conflict due to this lack of coordination shall be borne by the Contractor.

1.05 COORDINATION OF DRAWINGS

A. Prepare coordination drawings in accordance with requirements of Project Specification to a scale of 1/4" = 1'-0" or larger; detailing major elements, components, required clearances, and systems of HVAC equipment and materials in relationship with other systems, installations, and building components. Indicate locations where space is limited for installation and access and where sequencing and coordination of the installations are of importance to the efficient flow of the Work, including but not necessarily limited to the following:
   1. Indicate the proposed locations of piping, ductwork, equipment, and materials. Include the following:
      a. Clearances for servicing and maintaining equipment, including tube removal, filter removal, and space for equipment disassembly required for periodic maintenance.
      b. Equipment for connections and support details.
   2. Prepare reflected ceiling plans to coordinate and integrate installations with other systems and components, such as, air outlets and inlets, light fixtures, communication systems components, sprinklers, and other ceiling-mounted items.

B. Submittal of "Or Equal" substitutions of equipment will not be reviewed unless accompanied by coordination drawings.

1.06 RECORD DOCUMENTS

A. Prepare record documents in accordance with the requirements of project specification. In addition to the requirements of project specification, indicate the following installed conditions:
   1. Record drawings of all installed as specified in Division 01 the locations and invert elevations of underground installations.

1.07 MAINTENANCE MANUALS

A. Prepare maintenance manuals in accordance with Project specification and Division 23 Section "Supplementary Mechanical Requirements".

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the project properly identified with names, model numbers, types, grades, compliance labels, mill certification, and other information needed for identification.

1.09 EQUIVALENT EQUIPMENT

A. In these specification and drawings, whenever more than one (1) manufacturer's product is specified, the manufacturer specified on the drawings and the first named product in these specifications is the basis of design and the use of alternate-named manufacturer's product or substitutes may require modification in the design work and agency approvals. If such alternatives or substitutions are proposed by the contractor, contractor shall adhere to the following requirements:
   1. Contractor shall clearly identify all proposed alternatives or substitutions in the submittal package.
   2. The Contractor shall assume all costs required to make all necessary revisions and modifications of the contract documents resulting from the substitution or selection of an alternate manufacturer's product, including all professional fees and the cost of DSA approval.
   3. The Contractor shall assume all costs required for any additional modification to building structure, electrical and all other related construction costs resulting from the substitution or selection of an alternate manufacturer's product.

B. These specifications and/or drawings, names and specifies certain equipment in detail which are the basis of design and are explained in paragraph 1.09, A. above. It also names alternate equipment by manufacturer, which is not considered to be a "substitution."

C. Submit equivalent equipment to the Architect for review per the requirements of Division 01, and Section "Common Work Results for HVAC."

D. Equipment of Manufacturers named in Division 23 will be considered equivalent to that specified in detail and/or named on the drawings if:
   1. The proposed equipment is of equivalent quality, capacity.
   2. Equipment is as fully equipped, fits the space allotted, and has physical configuration and weight like the equipment specified in detail.

E. A complete lay out of an equipment room or area must be submitted for equivalent equipment. Notice space limitations. Layouts to include plans and section views at a scale of not less than 1/4" = 1 ft.

F. The Architect shall determine the acceptability of "Equivalent Equipment."

PART 2 - PRODUCTS (Not Applicable)

PART 3 -EXECUTION

3.01 ROUGH-IN

A. Verify final locations for rough-in with field measurements and with the requirements of the actual equipment to be connected.

3.02 MECHANICAL INSTALLATIONS

A. General: Sequence, coordinate, and integrate the various elements of HVAC systems, materials, and equipment. Comply with the following requirements:
   1. Coordinate HVAC systems, equipment, and materials installation with other building components.
   2. Verify all dimensions by field measurements.
   3. Arrange for chases, slots, and openings in other building components during progress of construction, to allow for HVAC installations.
   4. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed.
   5. Sequence, coordinate, and integrate installations of HVAC materials and equipment for efficient flow of the Work. Give particular attention to large equipment requiring positioning prior to closing in the building.
   6. Where mounting heights are not detailed or dimensioned, install systems, materials, and equipment to provide the maximum headroom possible as required by California Building Code.
   7. Coordinate connection of HVAC system with exterior underground and overhead utilities and services. Comply with requirements of governing regulations, franchised service companies, and controlling agencies. Provide required connection for each service.
   8. Install systems, materials, and equipment to conform with approved submittal data, including coordination drawings, to greatest extent possible. Conform to arrangements indicated by the Contract Documents, recognizing that portions of the Work are shown only in diagrammatic form. Where coordination requirements conflict with individual system requirements, refer conflict to the Architect prior to commencement of installation.
   9. Install systems, materials, and equipment level and plumb, parallel, and perpendicular to other building systems and components.
   10. Install all HVAC equipment to facilitate servicing, maintenance, and repair or replacement of equipment components in full compliance with California Building Code and the equipment manufacturer's recommendations. If the drawings or the manufacturer does not provide a specific space requirement for servicing equipment, provide as a minimum, horizontal distance of 36" from face of equipment to opposite vertical surface.

11. Install access panels or doors for all equipment and components which require access for adjustment and maintenance, where units are concealed behind finished surfaces.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Any equipment located above a ceiling that has any component, which is serviceable shall be installed within 12" from the top of the ceiling.

3.03 CUTTING AND PATCHING

A. General: Perform cutting and patching in accordance with project specification. In addition to the requirements specified in project specification, the following requirements apply:
   1. Protection of Installed Work: During cutting and patching operations, protect adjacent installations.

B. Perform cutting, fitting, and patching of HVAC equipment and materials required to:
   1. Uncover Work to provide for installation of ill-timed Work.
   2. Remove and replace defective work.
   3. Remove and replace Work not conforming to requirements of the Contract Documents.
   4. Remove samples of installed Work as specified for testing.
   5. Install equipment and materials in existing structures.
   6. Upon written instructions from the Architect, uncover and restore Work to provide for Architect/Engineer observation of concealed Work.

C. Cut, remove, and legally dispose of selected HVAC equipment, components, and materials as indicated, including but not limited to removal of HVAC piping, refrigerant lines, heating units, and other HVAC items made obsolete by the new Work.

D. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

E. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
   1. Patch existing finished surfaces and building components using experienced installers and new materials matching existing materials. For installer's qualifications refer to the materials and methods required for the surface and building components being patched.

END OF SECTION 23 0500

SECTION 23 0511

SUPPLEMENTARY HVAC REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies supplementary requirements for HVAC installations and includes requirements common to more than one section of Division 23. It expands and supplements the requirements specified in Section 23 0500 "Common Work Results for HVAC."

1.02 DESCRIPTION

A. Provide a complete and operable installation, including all labor, supervision, materials, equipment, tools, apparatus, transportation, warehousing, rigging, scaffolding and other equipment and services necessary to accomplish the work in accordance with the intent and meaning of these drawings and specifications.

1.03 COORDINATION

A. Coordination of the work is the responsibility of the Contractor.

B. Contractor shall designate an individual competent and versed in the HVAC trades to coordinate the HVAC work with the work of other trades.

1.04 DEFINITIONS (AS USED ON DIVISION 23 DRAWINGS AND HEREIN)

A. "Provide" means furnish, install, and connect unless otherwise described in specific instances.

B. "Piping" means pipes, fittings, valves, and all like pipe accessories connected thereto.

C. "Ductwork" means ducts, plenums, compartments, or casings including the building structure, which are used to convey or contain air.

D. "Extend", "Submit", "Repair" and similar words mean that the Contractor (or his designated subcontractor) shall accomplish the action described.

E. "Codes" or "Code" means all codes, laws, statutes, rules, regulations, ordinances, orders, decrees, and other requirements of all legally constituted authorities and public utility franchise holders having jurisdiction.

F. "Products", "Materials" and "Equipment" are used interchangeably and mean materials, fixtures, equipment, accessories, etc.

G. "Utility Areas" are defined as mechanical, electrical, janitorial, and similar rooms or spaces which are normally used or occupied only by custodial or maintenance personnel. "Public Areas" are defined as the rooms or spaces, which are not included in the utility areas definition.

H. "Building Boundary" includes concrete walkways immediately adjacent to the building structure.

I. "Below Grade" means buried in the ground.

J. "Substantial Completion" means all components of all systems are functioning but lacking in final adjustment.

K. Pressure rating specified (such as for valves and the like) means design working pressure for and with references to the fluid, which the device will serve.

1.05 RELATED WORK

A. Coordination: Refer to Architectural, HVAC, Plumbing, Civil, Structural, and Electrical Drawings for the construction details and coordinate the work of this Division with that of other Divisions. Order the work of this Division so that progress will harmonize with that of other Divisions and all work will proceed expeditiously. The work of this Division shall include direct responsibility for the correct placing and connection of HVAC work in relation to the work of other Divisions.

B. Examine other Divisions for work related to the Work of this Division, especially Divisions 22 & 26.

1.06 EXISTING CONDITIONS

A. Visit the site prior to bidding and investigate the existing conditions, which affect or will be affected by the work of this Division. Become thoroughly familiar with the working conditions and take, into account any special or unusual features peculiar to this job. By the act of submitting a Bid, the Contractor will be deemed to have complied with the foregoing, to have accepted such conditions, and to have made allowance therefore in preparing his Bid.

B. The locations of existing concealed utility lines are shown in accordance with reference data received by the Architect. The Architect does not guarantee the accuracy of such data. The points of connection are therefore approximate, and the Bidder shall include adequate funds in his Bid to cover costs of connection regardless of their exact location.

C. Exercise extreme caution during trenching operations. Repair the damage caused by such operations to the existing utility lines at no cost to the Owner, whether the lines are shown on drawings or not.

1.07 DRAWINGS AND SPECIFICATIONS

A. These drawings and specification do not include necessary components for construction safety.

B. All provisions shall be deemed mandatory except as expressly indicated as optional by the word "may" or "option."

C. Except where dimensioned, the drawings relating to this division are a diagrammatic presentation of the design concept, which indicates the general area where piping and ductwork is to be run. The drawings do not necessarily indicate any, and all offsets and configurations required for coordination with other trades. The contractor is responsible for the correct placing of his work, and the proper location and connection of his work in relation to the work or other trades.

1.08 PERMITS AND INSPECTIONS

A. Obtain, schedule, and pay for permits, licenses, approvals, tests, and inspections required by legally constituted authorities and public utility franchise holders having jurisdiction over the work.

B. Afford the Architect's representative every facility for evaluating the skill and competence of the mechanics and to examine the materials. Concealed work shall be reopened when so directed during his periodic visits.

1.09 CODES AND REGULATIONS

A. By submitting a Bid, Contractor is deemed to represent himself as competent to accomplish the work of this Division in conformance with applicable Codes. In case of conflict between the Contract Documents and Code requirements, the Codes shall take precedence. Should such conflicts appear, cease work on the parts of the contract affected and immediately notify the Architect in writing. It shall be the Contractor's responsibility to correct, at no cost to the Owner, any work he executes in violation of Code requirements. Specific references to codes elsewhere in this Division are either to aid the Contractor in locating applicable information or to deny him permission to use options, which are permitted by Codes.

B. Applicable Codes: Current editions unless otherwise noted:
   1. All local codes; city and/or county as applicable.
   2. OSHA requirements
   3. California Building Code
   4. California Code of Regulations (CCR) Titles (as applicable)
   5. Fire Marshal Regulations
   6. State, County, City Health Department Ordinances and Regulations
   7. Regulations of all other authorities having jurisdiction.
   8. California Mechanical Code.
   9. California Plumbing Code.

C. Where conflict or variation exists amongst Codes, the most stringent shall govern.

1.10 RECORD AND DOCUMENTATION

A. Accumulate the following and deliver to the Owner's representative prior to final acceptance of the work.
   1. Record (As-Built) Drawings:
      a. Maintain in good order in the field office a complete set of prints for all work being done under Division 23. Update the drawings daily with neat and legible annotations in red ink showing the work as actually installed.
      b. The actual size, location and elevation of all buried lines, valve boxes, manholes, monuments, and stubouts shall be accurately located and dimensioned from building walls or other permanent landmarks.

c. Furnish the original marked up AS-Built drawings and an electronic copy in AutoCAD-14 format.

2. Operation and Maintenance Manual: Furnish an operation and maintenance manual covering the stipulated HVACsystems and equipment. Seven copies of the manual, bond in hardback binders or an approved equivalent shall be provided to the Architect.
3. Furnish one complete manual prior to the time that system or equipment tests are performed.
4. Furnish the remaining manuals before the contract is completed.
5. The following identification shall be inscribed on the cover:

OPERATION AND MAINTENANCE MANUAL

PROJECT TITLE . . . . . .

CONTRACTOR NAME & CONTACT INFORMATION

6. Provide a Table of Contents.
   a. Insert tab sheets to identify discrete subjects.
   b. Instruction sheets shall be legible and easily understood, with large sheets of drawings folded in.
   c. The manual shall be complete in all respects for all materials, piping, valves, devices and equipment, controls, accessories, and appurtenances stipulated. Include as a minimum the following:
      1) Updated approved materials lists, shop drawings and catalog information of all items of HVAC system equipment.
      2) System layout showing piping, valves, and controls.
      3) Wiring and control diagrams with data to explain detailed operation and control of each component.
      4) A control sequence describing start-up, operation, and shutdown.
      5) Detailed description of the function of each principal component of the system.
      6) Procedure for starting.
      7) Procedure for operating.
      8) Shut-down instructions.
      9) Installation instructions.
      10) Adjustments, maintenance, and overhaul instructions.
      11) Lubrication schedule including type, grade, temperature range and frequency.
      12) Safety precautions, diagrams, and illustrations.
      13) Test procedures.
      14) Performance data.
      15) Parts list, with manufacturer's names and catalog numbers.
      16) Preventive maintenance schedule.
      17) Service organization with name, address, and telephone number.
      18) Valve identification chart and schedule.
      19) ASME certificates.
      20) Air balance report.
      21) Hydronic balance report.

B. Standards Compliance: Where equipment or materials are specified to conform to requirements of standards of recognized technical or industrial organizations such as American National Standards Institute (ANSI) American Society for Mechanical Engineers (ASME) American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), American Society for Testing Materials (ASTM), Underwriters Laboratories (UL), American Gas Association (AGA), American Refrigeration Institute (ARI), or National Electrical Manufacturer's Association (NEMA), that use a label or published listing as a method of indicating compliance, proof of such conformance shall be submitted and approved. The label or listing of the specified organization will be acceptable evidence.

C. Certificates of Conformance or Compliance: Submit original and not pre-printed certifications. Do not make statements in the certifications that could be interpreted to imply that the product does not meet all requirements.

D. Certified Test Reports: Certified Test Reports are reports of tests conducted on previously manufactured materials or equipment identical to that proposed for use. Before delivery of materials and equipment, submit certified copies of test reports specified in the individual sections.

E. Factory Tests: Factory tests are tests, which are required to be performed on the actual materials or equipment, proposed for use. Submit results of the tests in accordance with the requirements for laboratory test results of this Contract.

F. Permits and Certificates of Inspection: Furnish the originals.

G. Testing procedures and test results required in this and other sections. Furnish 2 copies.

H. Other data required by other sections of this Division. Furnish 2 copies.

1.11 CONSTRUCTION COST BREAKDOWN

A. Prepare and submit for review a construction cost breakdown for the major subdivisions of the HVAC work in accordance with General and Supplemental Conditions and Project Specification.

B. Subdivide each item on the breakdown into two headings: labor and materials. Include overhead and profit in each entry.

C. Submit one copy of the breakdown directly to the Engineer and the remaining copies sent through regular channels.

1.12 TOOLS

A. Provide all special tools needed for proper operation and routine adjustment and maintenance of systems and equipment. Deliver tools to Owner's representative and request a receipt for same.

1.13 WARRANTIES

A. Refer to Project Specification for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.

B. Where periods more than one year are specified in the specifications, such longer periods shall govern. However, when any component fails at any time during this period, the warranty period for such component and all other components, which are inactive because of, said failure shall be suspended. The warranty period for such components shall resume to run for the remaining portion of the warranty period when failed component is completely repaired and in operation; however, in no case shall the resumed portion of the warranty period be less than 3 months in duration.

C. Neither payment for work, nor total or partial occupancy of work by the Owner, within or prior to the warranty period specified, shall be construed as acceptance of faulty-work or shall condone any negligence or omission of Contractor in doing the work.

D. Compile and assemble the warranties specified in Division 23, into a separated set of vinyl covered, three ring binders, tabulated, and indexed for easy reference.

E. Provide complete warranty information for each item to include product or equipment to include date of beginning of warranty or bond; duration of warranty or bond; and names and addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

1.14 SEISMIC RESTRAINT

A. Provide seismic restraint for HVAC equipment, piping, and ductwork.

B. Contractor shall submit certification of suitability of seismic restraint methods signed by Licensed Structural Engineer registered in State of California.

C. Contractor may refer to details applicable in the SMACNA, "GUIDELINES FOR SEISMIC RESTRAINT OF HVAC SYSTEMS", using the 'g' forces for "other buildings" classification CCR Title 24 all such details shall be DSA approved. Deliver a copy of these Guidelines to the Owner's Resident Inspector.

1.15 SYSTEM OPERATIONAL TESTS

A. The Contractor shall inform the Owner one week prior to start of testing in order that the Owner's representative may be present.

B. After balancing and prior to final inspection, the contractor shall operate all systems continuously trouble free and stable for a minimum period of fourteen (14) consecutive days including Saturday and Sunday. Each day shall be a minimum of an 8-hour day. Should a problem arise, the fourteen (14) day period shall be restarted and repeated until successfully operated for full 14 days. A written report certified by the Owner's representative shall indicate the successful completion of a stable and trouble free 14-day period.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Standard Products: Materials and equipment shall be essentially the standard cataloged products of manufacturers regularly engaged in production of such materials or equipment and shall be their latest standard designs that comply with the specification requirements.

B. Materials and equipment shall duplicate items that have been in satisfactory commercial or industrial use at least two years prior to bid opening unless more stringent requirements are specified. Where two or more units of the same type of equipment are required, these units shall be products of a single manufacturer. The components thereof, however, are not required to be exclusively of the same manufacturer.

C. Each major component of equipment shall have manufacturer's name, address, model, and serial number on a nameplate securely affixed in a conspicuous place. The nameplate of the distributing agent will not be acceptable.

D. In these specification and drawings, whenever more than one (1) manufacturer’s product is specified, the manufacturer specified on the drawings and the first named product in these specifications is the basis of design and the use of alternate-named manufacturer’s product or substitutes shall comply with the requirements of Section 23 0500.

2.02 PRODUCT LISTING

A. When two or more items of same material or equipment are required (pipe, fittings, pumps, valves, air conditioning units, etc.) they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, sheet metal, wire, steel bar stock, welding rods, solder, fasteners, and similar items used in Work, except as otherwise indicated.

2.03 NAMEPLATE DATA

A. Provide permanent operational data nameplate on each item of power operated HVAC equipment, indicating manufacturer, product name, model name, serial number, capacity, operating and power characteristics, labels of tested compliances, and similar essential data. Locate nameplates in an accessible location.

2.04 SUBSTITUTIONS

A. General: Submittals of "Substitutions" shall be in accordance with requirements of Division 01.

B. By proposing a “Substitution” it is deemed that the Contractor shall bear the cost of any, and all design and construction changes (whether architectural, structural, electrical, HVAC and Plumbing) necessary to accommodate the substitution, if said substitution is accepted.

C. Specific: Refer to Specification Sections 23 0500 & 23 0512 for additional requirements.

2.05 SUBMITTALS

A. General: Make submittals in accordance with requirements of Division 01.

B. Specific: Refer to Specification Sections 23 0500 for additional requirements.

PART 3 - EXECUTION

3.01 WORKMANSHIP AND INSTALLATION METHODS

A. Workmanship shall be in the best standard practice of the trade.

B. Install equipment in accordance with the manufacturer's instructions and recommendations unless otherwise noted or specified.

3.02 TESTS

A. General:
1. Demonstrate that all components of the work of this Division have been provided and that they operate in accordance with the Contract Documents.
2. Provide instruments and personnel for tests and demonstrations. Submit signed test results.

B. Specific: Refer to the other sections of this Division for test requirements.

3.03 DELIVERY, HANDLING, STORAGE OF MATERIALS AND PROTECTION OF WORK

A. Protect materials against dirt, water, chemical and mechanical damages both while in storage and during construction.

B. Cover materials in such a manner that no finished surfaces will be damaged, marred or splattered with plaster or paint, and all moving parts will be kept clean and dry.

C. Replace or refinish any damaged materials including fronts of control panels, ductwork fittings, and shop-fabricated ductwork.

D. Air distribution systems shall be aggressively protected from dust during the construction process to ensure that no contamination of the duct system occurs.

E. The use of permanently installed AHUs and associated air distribution systems for temporary heating and cooling during construction is prohibited.

F. Keep cabinets and other openings closed to prevent entry of foreign matter.

G. Specific: Refer to other sections of this Division for additional requirements.

3.04 PROJECT CONDITIONS

A. Check and coordinate for clearance, accessibility, and placement of equipment either by going through openings provided or by placing equipment during construction. Ordering of equipment to be shipped disassembled, or disassembly of equipment at Project Site and reassembly of equipment to accomplish this requirement shall be executed without additional cost. Where provided openings are inadequate to accommodate equipment, provide new openings and restoration of same, all at no additional cost. Obtain written approval for new openings before proceeding.

B. Verify location of all equipment within finished spaces with the Architectural Drawings. In, the event that HVAC Drawings do not indicate exact locations, or are in conflict, with the Architectural Drawings, obtain information regarding proper locations. Installation of work without proper instruction under such circumstances will result in relocation of work, when directed, without additional cost.

3.05 INSTRUCTION TO OWNER PERSONNEL

A. Contractor shall furnish, without additional expense to the Owner, the services of competent instructors who will give full instruction to the designated personnel in the adjustment, operation, and maintenance, including pertinent safety requirements, of the equipment or system specified. Each instructor shall be thoroughly familiar with all parts of the installation and shall be trained in operating theory as well as practical operation and maintenance of work. Instruction shall be given at the Owner's convenience. The number of man-days (eight-hours) of instruction furnished shall be as specified in other sections. When more than four man-days of instruction are specified, approximately half of the time shall be used for classroom instruction. All other time shall be used for instruction with the equipment or system. When significant changes or modifications are made under the terms of the contract, provide additional instructions to acquaint the operating personnel with the changes or modifications.

B. Contractor shall videotape, both visual and audio, instruction to Owner's personnel on the maintenance and operation of the HVACsystems.

C. Submit certification, signed by Owner's agent that instructions have been completed and the videotape has been reviewed and delivered to the Owner.

D. Printed operating instructions and a copy of wiring diagrams are to be mounted in all equipment areas, framed and behind glass or encased in plastic. Printed operating instructions shall include steps for starting up and securing equipment. As a precedent to final acceptance four (4) copies of instructions are to be submitted to the Architect for review. Contractor shall turn over to Owner in a neat brochure form, equipment Guarantee and maintenance instructions.

3.06 CLEANING

A. Cleaning shall be done as the work proceeds. Periodically remove waste and debris to keep the site as clean as is practical.

B. Refer the Division 01 for general requirements for cleaning.

C. Leave exposed parts of the HVAC work in a neat, clean and usable condition, with painted surfaces unblemished and plated metal surfaces polished.

D. Thoroughly clean all materials, equipment, and appliances. Clean and prepare all surfaces to be painted. Clean the entire premises of unused materials, debris, spots and marks to the satisfaction of the Architect.

E. Remove, thoroughly clean, and replace all strainers and automatic valves after the system has been put in operation until system is clear of all foreign matter and repeat this operation after ten (10) days and again after the system has been in operation thirty (30) days. Submit certification that this operation has been completed.

3.07 SAFETY REQUIREMENTS

A. Enclose and guard belts, pulleys, chains, gears, couplings, projecting setscrews, keys, and other rotating parts in accordance with OSHA requirements. Insulate, guard, and cover any high-temperature equipment and piping so located as to endanger personnel or create a fire hazard.

END OF SECTION 23 0511

SECTION 23 0512

HVAC PRODUCT SUBSTITUTIONS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies administrative and procedural requirements for handling requests made after award of the Contract for substitutions of products specified in Division 23.

1.02 RELATED SECTIONS

A. Procedure for Contractor's construction Schedule and the Schedule of Submittals are included under Division 01.

B. Standards: Refer to Division 01 for applicability of industry standards to products specified.

C. Procedural requirements governing the Contractor's selection of products and product options are included under Division 01.

D. Refer to Division 01 for Products and Substitutions.

E. Refer to Sections 23 0500 & 23 0511 for additional requirements.

1.03 DEFINITIONS

A. "Products" is defined to include purchased items for incorporation into the work, regardless of whether specifically purchased for project or taken from Contractor's stock of previously purchased products. "Materials" is defined as products which must be substantially cut, shaped, worked, mixed, finished, refined, or otherwise fabricated, processed, installed, or applied to form units of work.

B. "Equipment" is defined as products with operational parts, regardless of whether motorized or manually operated, and particularly including products with service-connections (wiring, piping, etc.). Definitions in this paragraph are not intended to negate the meaning of other terms used in contract documents, including "specialties", "systems", "structure", "finishes", "accessories", "furnishings", "special construction", and similar terms, which are self-explanatory and have recognized meanings in the construction industry.

1.04 SUBSTITUTIONS

A. The requirements for substitutions do not apply to specified Contractor options on products and construction methods. Revisions to contract documents, where requested by Owner, Architect or Engineer, are "changes" not "substitutions". Substitutions requested during bidding period, which have been accepted prior to Contract Date, are included in contract document and are not subject to requirements for substitutions as specified herein.

Contractor's determination of and compliance with governing regulations and orders issued by governing authorities do not constitute "substitutions"; and do not constitute a basis for change orders, except as provided for in contract documents. Otherwise, contractor's requests of changes in products, materials and methods of construction required by contract documents are considered requests for "substitutions" and are subject to requirements hereof.

B. Conditions: The Contractor's substitution request will be received and considered by the Architect when one or more of the following conditions are satisfied, as determined by the Architect, otherwise requests will be returned without action except to record noncompliance with these requirements.
   1. Extensive revisions to Contract Documents are not required.
   2. Proposed changes are in keeping with the general intent of Contract Documents.
   3. The request is directly related to an "or approved equal" clause or similar language in the Contract Documents.
   4. All costs required to-make all necessary revisions and modifications to the contract documents resulting from the substitution, including but not limited to, all professional fees and the cost of DSA approval will be the Contractor’s responsibility.
   5. All costs required to make all necessary revisions and modifications to the building structure, electrical and all other related construction costs resulting from the substitution, including but not limited to, material, products, equipment, testing, and inspection will bethe Contractor’s responsibility.
   6. The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
   7. Contractor will coordinate the installation of the accepted substitute, making such changes as may be required for the work to be complete in all respects.
   8. Contractor certifies that the substitution is not heavier than the specified item and does not necessitate any structural and electrical redesign; will fit within the room or area designed for the specified item; and will not exceed any maximum dimensions specified or shown on the original contract Documents. All roof mounted equipment must be less than or equal to the maximum height dimension from the finished roof as shown on the drawings.
   9. Contractor represents that he has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified.
   10. Contractor represents that he will provide the same warranty for the substitution that he would for that specified.

1.05 SUBMITTALS

A. Requests for Substitutions: Any request for substitution shall follow the guidelines of Substitution Requirements in Division 01, Section 23 0500 & 23 0511.

B. Substitution Warranty: All submittals of Request for Substitutions under the General and Supplementary Conditions of this Section shall be accompanied by a completely executed (filled out) and signed Substitution Warranty in the form entitled "Substitution Warranty", bound herein. Substitutions will not be accepted without the Substitution Warranty.

In addition to other requirements, Contractor shall warrant in writing on his own letterhead that substituted materials shall perform as specified, and assume complete responsibility for same, including responsibility and costs required for modifications to building or other materials or equipment, and any additional coordination with work of other trades. Testing, if required, shall be paid by Contractor.

C. Responsibility of Contractor: The contractor shall be solely and directly responsible for fitting accepted substitute material and equipment into the available space in a manner acceptable to the Architect, and for the proper operation of the substituted equipment with all other equipment with which it may be associated. The Contractor shall bear all costs of meeting the above requirements for presenting a proposed substitution, and if the substitution is accepted, he must bear all costs involved.

D. Submit the following as part of the Request for Substitutions:
   1. Data showing proposed equipment is "equal" to that specified and is fully equipped, fits the space allotted and has physical configuration and weight like the equipment specified in detail.
   2. A complete layout, where applicable, of equipment room or area must be submitted for equipment proposed in "Request for Substitution". Submittal shall conform to requirements of Division 01 and Section 23 0500 "Common Work Results for HVAC" as it applies to "Coordination Drawings."
   3. Seismic Restraint: Where seismic restraint is required for products or equipment as specified, methods of seismic restraint signed by licensed Structural Engineer registered in the State of California, shall be submitted for review to the Division of the State Architect.

1.06 ARCHITECT'S ACTION

A. The Architect may request additional information or documentation necessary for evaluation of the request. Requests, by the Architect, for additional information or documentation will be in accordance with Division 01 requirements. The Architect will notify the Contractor of acceptance or rejection of the proposed substitution. If a decision on use of a proposed substitute cannot be made or obtained within the time allocated, Contractor shall use the “Bases of Design” product specified by name in the contract documents. Acceptance will be in the form of a Change Order.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Substitutions shall conform to the product requirements for the specified products or equipment.

PART 3 - EXECUTION (Not Applicable)

END OF SECTION 23 0512

SAMPLE

S U B S T I T U T I O N S W A R R A N T Y

In addition to other requirements, Contractor shall warrant in writing that substituted materials shall perform as specified, and assume complete responsibility for same, including responsibility and costs required for modifications to building or other materials or equipment, and any additional coordination with work of other trades. Testing, if required, shall be paid by contractor. The following is an example of the type of Substitution Warranty which shall be executed by the Contractor, on his own letterhead:

SUBSTITUTION WARRANTY

We propose to provide,

_____
(Describe items being proposed for substitution)

for_____ in lieu of
(List project name)

as indicated on the drawings and described in Section _____ of the Specifications.

We agree to assume the cost of any, and all modifications to the Contract Documents and to other portions of the work as indicated in the Specification Sections 23 0500, 23 0511, & 23 0512, and as necessary to accommodate for substituted material(s) and system(s) as indicated in this letter of “Substitution Warranty.”

We hereby warrant that _____
(Provide Description)

is the equivalent of _____
(Specified Product)

in every respect and will perform satisfactorily under the conditions and use indicated on the Drawings and described in the Specifications.

Signed: _____ Date: _____
(Manufacturer/Supplier)

Signed: _____ Date: _____
(Subcontractor)

Signed: _____ Date: _____
(Contractor)

NOTE: Affix Corporate Seal over Signatures.

SECTION 23 0513

COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section specifies the basic requirements for electrical components, which are an integral part of packaged HVAC equipment. These components include, but are not limited to factory-installed motors, starters, and disconnect switches furnished as an integral part of packaged HVACequipment.

B. Specific electrical requirements (i.e., horsepower and electrical characteristics) for HVAC equipment are scheduled on Drawings.

C. All motors, power driven equipment and automatic control equipment, except motor starters as hereinafter set forth required and connected with the work of this section of the specifications are to be furnished and installed under Division 23.

D. Control low (24V) and control line (120V) voltage wiring, conduit and related switches and relays required for the automatic control and/or interlock of motors and equipment includes final connection, are to be furnished and installed under Division 23. Materials and installation to conform to Class 1 or 2, CAC Title 24, Article E725, and as restricted under Division 26 of these specifications.

E. Power wiring, conduit, and convenience outlets, disconnect switches, motor starters and motor-rated contactors, and making of final connections, except as hereinafter specified, are to be furnished and installed under the Division 26 of these Specification.

F. All power supply wiring for providing a power source to control dampers, control valves, VAV boxes, control transformers, etc., shall be furnished and installed under Division 23.

G. Identify circuits and equipment as outlined in the Electrical Sections of these Specifications.

H. Coordinate requirements for underground conduit only between buildings for control interlocks shown on the drawings. This conduit to be furnished and installed under Division 26 of these Specifications.

I. Space provisions have been made on electrical panels for control power source.

1.02 RELATED SECTIONS

A. Separate electrical components and materials required for field installation and electrical connections are specified in Division 26.

B. This section applies to all Division 23 sections specifying packaged HVAC equipment.

1.03 REFERENCES

A. NEMA Standards MG 1: Motors and Generators.

B. NEMA Standards ICS 2: Industrial Control Devices, Controllers, and Assemblies.

C. NEMA Standard 250: Enclosures for Electrical Equipment.

D. NEMA Standard KS 1: Enclosed Switches.

E. Comply with National Electrical Code (NFPA 70).

1.04 SUBMITTALS

A. No separate submittal is required. Submit product data for motors, starters, and other electrical components with submittal data required for the equipment for which it serves, as required by the individual equipment specification sections.

1.05 QUALITY ASSURANCE

A. Electrical components and materials shall be UL labeled.

PART 2 - PRODUCTS

2.01 MOTORS

A. Provide all motors necessary for equipment under the HVAC Work. See Electrical Drawings for voltage and phase of electrical services.

B. The following are basis requirements for simple or common motors. For special motors, more detailed and specific requirements are specified in the individual equipment specifications.
   1. Torque characteristics shall be sufficient to satisfactorily accelerate the driven loads.
   2. Motor sizes shall be large enough so that the driven load will not require the motor to operate in the service factor range.
   3. 2-speed motors shall have 2 separate windings on poly-phase motors.
   4. Temperature Rating: As a minimum, motors shall be rated for 40 deg. C. environment with maximum 50 deg. C. temperature rise for continuous duty at full load (Class A Insulation).
   5. Starting capability: Frequency of starts as indicated by automatic control system, and not less than 5 evenly time spaced starts per hour for manually controlled motors.
   6. Service Factor: 1.23 for poly-phase motors and 1.35 for single-phase motors.
   7. Motor construction: NEMA Standard MG 1, general purpose, continuous duty, deign "B", except "C" where required for high starting torque.
      a. Frames: NEMA Standard No. 48 or 54; use driven equipment manufacturer's standards to suit specific application.
      b. Bearings:
         1) Ball or roller bearings with inner and outer shaft seals.
         2) Re-greasable bearings, except permanently sealed where motor is normally inaccessible for regular maintenance.
         3) Bearings designed to resist thrust loading where belt drives or other drives produce lateral or axial thrust in motor.
         4) Bearings for fractional horsepower, light duty motors, sleeve type bearings are permitted.

c. Enclosure Type:
   1) Open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation.
   2) Guarded drip-proof motors where exposed to contact by employees or building occupants.
   3) Weather protected Type I for outdoor use, Type II where not housed (Epoxy encapsulated or TEFC).

d. Overload protection: Polyphase built-in thermal overload protection and, where indicated, internal sensing device suitable for signaling and stopping motor at starter. Single phase, provide thermal overload protection.

e. Noise rating: "Quiet".

f. Efficiencies shall be guaranteed minimum values in accordance with the following tabulation. Efficiencies shall be established in accordance with NEMA Test Standards MG1-12.53A using IEEE Test Procedure 112, Method B:

HP	EFFICIENCY
1 - 2	81.5
3 – 5	86.5
7-1/2 - 10	90.6
15 - 30	92.0

g. Nameplate: Indicate the full identification of manufacturer, ratings, characteristics, construction, special features and similar information.

h. Provide all motors with junction boxes or terminals boxes and provide adjustable slide rails for all motors with belt drives.

i. Motors rated 1 HP and larger shall have shaft, bearings, etc. capable of operating with multiple grooved sheaves and two or more belts.

j. V Type Belt Drives: Drives requiring not more than 2 belts; variable pitch type; size for mid-point of operating range. Drives requiring 3 or more belts; nonadjustable constant speed type. Provide belts in matched sets.

2.02 MOTOR STARTERS

A. Unless provided as part of packaged HVAC equipment or otherwise indicated, starters for motors will be provided under Division 26. Provide to Division 26 the data necessary for motor starter heater sizing for all motors.

B. Starters for factory packaged HVAC equipment specified under Division 23 shall be provided as part of the package.

C. Motor Starter Characteristics:
   1. Enclosures: NEMA 1, general purpose enclosures with padlock ears, except in wet locations shall be NEMA 3R with conduit hubs, or units in hazardous locations, which shall have NEC proper class and division.
   2. Type and size of starter shall be as recommended by motor manufacturer and the driven equipment manufacturer for applicable protection and start-up condition.

D. Manual switches shall have:
   1. Pilot lights and extra positions for multi-speed motors.
   2. Overload protection: melting alloy type thermal overload relays.

E. Magnetic Starters:
   1. Maintained contact push buttons and pilot lights, properly arranged for single speed or multi-speed operation as indicated.
   2. Trip-free thermal overload relays, each phase.
   3. Interlocks, switches, and similar devices as required for coordination with control requirements.
   4. Built-in control circuit transformer, fused from line side, where service exceeds 240 volts.
   5. Externally operated manual reset.
   6. Under-voltage release or protection.

F. Motor Connections:
   1. Flexible conduit, except where plug-in electrical cords are specifically indicated.

2.03 DISCONNECT SWITCHES

A. When applied as part of factory furnished and mounted equipment, disconnects shall meet the requirements for disconnect switches set forth in Division 26.

PART 3 - EXECUTION

3.01 SEISMIC RESTRAINT

A. All electrical devices shall be seismically restrained.

END OF SECTION 23 0513

SECTION 23 0515

ACCESS DOORS AND PANELS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This Section includes limited scope of general construction materials and methods for access doors and panels in walls and ceilings for access to HVAC materials.

B. Requirements of access doors are outlined in Division 08.

C. Access doors and panels are required for all HVAC equipment requiring maintenance, inspection, adjustment, monitoring, etc., which are installed in inaccessible areas such as behind walls, above ceiling, under floor, etc.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of access door or panel.

1.03 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Firms regularly engaged in manufacture of types and sizes required, whose products have been in satisfactory use in similar service for not less than 5 years.

B. Installer Qualifications: Engage an experienced Installer for the installation of access panels and doors.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the Work include, but are not limited to, the following:
   1. Elmdor / Stoneman.
   2. Jay R. Smith Mfg. Co.
   3. Milcor Inc.

2.02 ACCESS DOORS

A. Steel Access Doors and Frames: Factory-fabricated and assembled units, complete with attachment devices and fasteners ready for installation. Joints and seams shall be continuously welded steel, with welds ground smooth and flush with adjacent surfaces.

B. Frames: 16-gage steel, with a 1-inch-wide exposed perimeter flange.
   1. For installation in masonry, pre-cast, or cast-in-place concrete, ceramic tile, or wood paneling: 1 inch-wide-exposed perimeter flange and adjustable metal masonry anchors.
   2. For gypsum wallboard or plaster: perforated flanges with wallboard bead.

3. For full-bed plaster applications: galvanized expanded metal lath and exposed casing bead, welded to perimeter frame.

C. Flush Panel Doors: 14-gage sheet steel, with concealed spring hinges or concealed continuous piano hinge set to open 175 degrees; factory-applied prime paint.
1. Fire-Rated Units: Insulated flush panel doors, with continuous piano hinge and self-closing mechanism.

D. Locking Devices: Flush, screwdriver-operated cam locks.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which access door and panel products are to be installed. Do not proceed with work until unsatisfactory conditions have been in manner acceptable to Installer.

3.02 APPLICATION

A. Nonrated Walls and Ceilings: Prime coat finish door and frame, Allen key latch face of wall type; Smith 4760, Elmdor / Stoneman DW Series.

B. Fire Rated Walls and Ceilings: "B" Labeled U.L. 1-1/2 hours, prime coat finish door and frame, flush keyed cylinder lock; Milcor.

C. Tile Walls: Cover and frame 18-8 satin stainless steel, face-of-wall type, vandal resistant screws; J. R. Smith 4762, Elmdor / Stoneman DW Series.

3.03 INSTALLATION OF ACCESS DOORS

A. Set frames accurately in position and securely attached to supports, with face panels plumb and level in relation to adjacent finish surfaces.

B. Adjust hardware and panels after installation for proper operation.

3.04 COORDINATION

A. General: Coordinate locations of ceilings access doors with lights, air outlets, speakers, etc. Submit drawings showing relative locations of doors to other ceiling items for acceptance by the Architect prior to installation. Transparencies of floor plans and/or reflected ceiling plans will be available from the Architect for this purpose.

B. Location: Doors may be located to serve more than one item where feasible, providing they are approved as specified. Sizes suitable for purpose intended, with 12" x 12" minimum.

C. Access doors and panels not required in accessible ceiling systems where direct access to HVAC items is possible.

END OF SECTION 23 0515

SECTION 23 0529

SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Extent of supports and anchors required by this section is indicated on drawings or in other Division 23 sections and include the following:
   1. Horizontal-Piping Hangers and Supports.
   2. Vertical-Piping Clamps.
   3. Hanger-Rod Attachments.
   4. Building Attachments.
   5. Saddles and Shields.
   6. Miscellaneous Materials.
   7. Anchors.
   8. Equipment Supports.

1.02 RELATED SECTIONS

A. This section is part of each Division 23 section making a reference to or requiring supports and anchors specified herein.

B. Supports and anchors furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 23 sections.

C. Section 03 3000: Cast-in-Place Concrete.

1.03 QUALITY ASSURANCE

A. Codes and Standards:
   1. Code Compliance: Comply with applicable plumbing codes pertaining to product materials and installation of supports and anchors.
   2. UL and FM Compliance: Provide products which are UL-Listed and FM approved.
   3. MSS Standard Compliance:
      a. Provide pipe hangers and supports of which materials, design, and manufacturer comply with MSS SP-58.
      b. Select and apply pipe hangers and supports, complying with MSS SP-69.
      c. Fabricate and install pipe hangers and supports, complying with MSS SP-89.
      d. Terminology used in this section is defined in MSS SP-90.

1.04 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including installation instructions for each type of support and anchor.

PART 2 - PRODUCTS

2.01 MANUFACTURED UNITS

A. Hangers and support components shall be factory fabricated of materials, design, and manufacturer complying with MSS SP-58.
   1. Components shall have galvanized coatings where, installed for piping and equipment that will not have field-applied finish.
   2. Pipe attachments shall have nonmetallic coating for electrolytic protection where attachments are in direct contact with copper tubing.

B. Thermal Hanger Shield Inserts: 100 PSI average compressive strength, waterproofed calcium silicate, encased with a sheet metal shield. Insert and shield shall cover entire circumference of the pipe and shall be of length indicated by manufacturer for pipe size and thickness of insulation.

2.02 HORIZONTAL PIPING HANGERS AND SUPPORTS

A. General: Except as otherwise indicated, provide factory fabricated horizontal-piping hangers and supports complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hangers and supports to exactly fit pipe size for bare piping, and to exactly fit around piping insulation with saddle or shield for insulated piping. Provide copper-plated hangers and supports for copper-piping systems.
   1. Adjustable Steel Clevis Hangers: MSS Type 1.
   2. Adjustable Swivel Pipe Rings: MSS Type 6.

2.03 VERTICAL PIPING CLAMPS

A. General: Except as otherwise indicated, provide factory fabricated vertical-piping clamps complying with MSS SP-58, of one of the following types listed, selected by Installer to suit vertical piping systems, in accordance with MSS SP-69 and manufacturer's published product information. Select size of vertical piping clamps to exactly fit pipe size of bare pipe. Provide copper-plated clamps for copper-piping systems.

B. Two-Bolt Riser Clamps: MSS Type 8.

2.04 HANGER ROD AND BUILDING ATTACHMENTS

A. General Hanger Rod Attachment: Refer to structural drawings for requirements of hanger rod and building attachments. If a specific attachment that is required is not detailed on the structural drawings, one of the following attachments may be submitted for review by the structural engineer prior to installation. Except as otherwise indicated, provide factory fabricated hanger-rod attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit horizontal-piping hangers, and building attachments, in accordance with MSS SP-69 and manufacturer's published product information. Use only one type by one manufacturer for each piping service. Select size of hanger-rod attachment to suit hanger rods. Provide copper-plated hanger-rod attachments for copper-piping systems.

B. General Building Attachment: Except as otherwise indicated, provide factory fabricated building attachments complying with MSS SP-58, of one of the following MSS types listed, selected by Installer to suit building substrate conditions, in accordance with MSS SP-69 and manufacturer's published product information. Select size of building attachments to suit hanger rods. Provide copper-plated building attachments for copper-piping systems.
1. Concrete Inserts: MSS Type 18.
2. Center Beam Clamps: MSS Type 21.
3. Steel Beam Clamps W/Eye Nut: MS Type 28.
4. Linked Steel Clamps W/Eye Nut: MSS Type 29.
5. Malleable Beam Clamps: MSS Type 30.
6. Steel Brackets: One of the following for indicated loading:
7. Light Duty: MSS Type 31.

2.05 SADDLES AND SHIELDS

A. General: Except as otherwise indicated, provide saddles, or shields under piping hangers and supports, factory-fabricated, for all insulated piping. Size saddles and shields for exact fit to mate with pipe insulation.

B. Protection Shields: MSS Type 40; provide high density insert of same thickness of insulation.

2.06 MANUFACTURERS OF HANGERS AND SUPPORTS

A. Manufacturers: Subject to compliance with requirements, provide hangers and supports of one of the following:
1. B-Line Systems, Inc.
2. Tolco, Inc.
3. Elcen Metal Products Co.
4. Fee & Mason Mfg. Co.; Div. Figgie International.
5. ITT Grinnel Corp.

2.07 MISCELLANEOUS MATERIALS

A. Steel Plates, Shapes and Bars: ASTM A36.

B. Cement Grout: Portland cement (ASTM C150, Type I or Type III) and clean uniformly graded, natural sand (ASTM C 404, Size No. 2). Mix at a ratio of 1.0-part cement to 3.0 parts sand, by volume, with minimum amount of water required for placement and hydration.

C. Pipe Alignment Guides: Factory fabricated, of cast semisteel or heavy fabricated steel, consisting of bolted two-section outer cylinder and base with two-section guiding spider that bolts tightly to pipe. Length of guides shall be as recommended by manufacturer to allow indicated travel.

D. Pipe Roll Stand: Factory fabricated cast iron stand, size as required, with insulation installed on piping.

2.08 ISOLATORS

A. Isolators: Provide factory-fabricated isolators of size required.

B. Spring Isolators: Refer to Section 23 0548 "Vibration Control for HVAC."

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine substrates and conditions under which supports and anchors are to be installed. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Proceed with installation of hangers, supports and anchors only after required building structural work has been completed in areas where the work is to be installed. Correct inadequacies including (but not limited to) proper placement of inserts, anchors and other building structural attachment.

B. Prior to installation of hangers, supports, anchors and associated work, installer shall meet at project site with Contractor, installer of each component of associated work, inspection and testing agency representatives (if any), installers of other work requiring coordination with work of this section and Architect/Engineer for purpose of reviewing material selections and procedures to be followed in performing the work in compliance with requirements specified.

3.03 INSTALLATION OF BUILDING ATTACHMENTS

A. Install building attachments at required locations within concrete or on structural steel for proper piping support. Space attachments within maximum piping span length indicated in MSS SP-69. Install additional building attachments where support is required for additional concentrated loads, including valves, flanges, guides, strainers, expansion joints, and at changes in direction of piping. Install concrete inserts before concrete is placed; fasten insert securely to forms. Where concrete with compressive strength less than 2500 PSI is indicated, install reinforcing bars through openings at top of inserts.

3.04 INSTALLATION OF HANGERS AND SUPPORTS

A. General: Install hangers, supports, clamps and attachments to support piping properly from building structure; comply with MSS SP-69. Arrange for grouping of parallel runs of horizontal piping to be supported together on trapeze type hangers where possible. Install supports with maximum spacings complying with MSS SP-69. Where piping of various sizes is to be supported together by trapeze hangers, space hangers for smallest pipe size or install intermediate supports for smaller diameter pipe. Do not use wire or perforated metal to support piping, and do not support piping from other piping.

B. Install hangers and supports complete with necessary inserts, bolts, rods, nuts, washers, and other accessories. Except as otherwise indicated for exposed continuous pipe runs, install hangers, and supports of same type and type as installed for adjacent similar piping.

C. Prevent electrolysis in support of copper tubing by use of hangers and supports which are copper plated, or by other recognized industry methods.

D. Provisions of Movement: Install hangers and supports to allow controlled movement of piping systems and to permit freedom of movement between pipe anchors.

E. Load Distribution: Install hangers and supports so that piping live and dead loading and stresses from movement will not be transmitted to connected equipment.

F. Pipe Slopes: Install hangers and supports to provide required pipe slopes, and so that maximum pipe deflections allowed by ANSI B31 Pressure Piping Codes are not exceeded.

G. Bare Piping: Install isolators for all bare domestic water and bare hydronic piping.

H. Insulated Piping: Comply with the following installation requirements.
   1. Clamps: Attach clamps, including spacers (if any), to piping with clamps projecting through insulation; do not exceed pipe stresses allowed by ANSI B31.
   2. Shields: Where low-compressive-strength insulation or vapor barriers are indicated on cold or chilled water piping, install coated protective shields. Provide rigid insulation reinforcement at shields.

I. Hangers and supports to be capable to resist the minimum seismic forces indicated in drawings.

3.05 EQUIPMENT SUPPORTS

A. Concrete housekeeping bases will be provided as work of Division 03.

B. Furnish to Contractor, scaled layouts of all required bases, with dimensions of bases, and location to column center lines. Furnish templates, anchor bolts, and accessories, necessary for base construction.

3.06 ADJUSTING AND CLEANING

A. Hanger Adjustment: Adjust hangers so as, to distribute loads equally on attachments.

B. Support Adjustment: Provide grout under supports so as, to bring piping and equipment to proper level and elevations.

C. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

D. Touch-Up Painting: Immediately after erection of anchors and supports, clean field welds and abraded areas of shop paint and paint exposed areas with same material as used for shop painting to comply with SSPC-PA-1 requirements for touch-up of field-painted surfaces.
   1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

E. For galvanized surfaces clean welds bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A-780.

END OF SECTION 23 0529

SECTION 23 0548

VIBRATION CONTROL FOR HVAC

PART 1 - GENERAL

1.01 DESIGN REQUIREMENTS

A. It is the intent of this Specification to provide the necessary design for the avoidance of excessive noise or vibration in the building due to the operation of machinery or equipment, or due to interconnected piping, ductwork, or conduit and to seismically restraint piping, ductwork, and equipment per the applicable codes against seismic forces in any direction.
   1. All isolators shall:
      a. Be provided by a single manufacturer.
      b. Be designed or treated for resistance to corrosion. Structural steel bases shall be cleaned of welding slag and coated with an SCAQMD compliant primer.
      c. Be selected to perform their function without undue stress or overloading. All isolators shall have a method for leveling and have a 1/4" thick ribbed neoprene acoustical pad under the spring baseplate.
      d. Be installed in a manner to prevent the transmission of vibration to the structure. No rigid connections between rotating or oscillating equipment or piping and the building will be permitted.
      e. Be designed to be non-resonant with equipment forcing frequencies or support structure natural frequencies.
   2. Anchor floor mounted isolated equipment to concrete housekeeping pads of sufficient size to accommodate the anchorage of seismic restraints. Housekeeping pads shall be anchored to the structure as specified by the Structural Engineer of Record.
   3. Each fan and motor assembly shall be supported on a single structural steel frame. Flexible duct connections shall be provided at inlet and discharge ducts.
   4. Where called for in the specifications or on the drawings, all structural steel bases, including concrete pouring form bases, shall be designed, and fabricated by the isolation manufacturer. Isolation manufacturer shall be a licensed fabricator for the City of Los Angeles, California.
   5. Unless otherwise indicated, all equipment mounted on vibration bases shall have a minimum operating clearance of 1" between structural steel base and floor or support base beneath. The minimum operating clearance between concrete inertia bases and housekeeping pads shall be 1 inch. Check clearance space after installation to ensure that no debris has been left to possibly short circuit isolation bases.
   6. Where necessary due to height limitations, provide height saving brackets.
   7. Design isolators for positive anchorage against uplift and overturning.

1.02 MANUFACTURERS

A. Acceptable Isolation Manufacturer:
   1. M. W. Sausse' & Co., Inc. (Vibrex)
   2. Mason Industries, Inc
   3. Or Approved Equal.

B. Purchased and/or fabricated equipment must be designed and manufactured with provision for positive anchorage against seismic forces.

C. Seismic restraints for pipes and ducts shall be as per the SMACNA Guidelines for seismic Restraint of Mechanical Systems and shall be approved by DSA.

D. Seismic restraints for equipment and piping shall be designed to meet the criteria of the current California Code of Regulations.

E. The manufacturer of Vibration Isolation and Seismic Control Equipment shall have the following responsibilities:
   1. Determine adequate vibration isolation and seismic restraint sizes and locations.
   2. Provide piping and equipment isolation systems and seismic restraints as scheduled and/or specified.
   3. Provide installation instructions and drawings to assure proper installation and performance.

1.03 SUBMITTALS

A. Make Submittals in Accordance with:
   1. Contract General Provisions - Division 01.
   2. Mechanical General Provisions - Sections 230500 and 230511.

B. Submit Shop Drawings and Manufacturer's Literature
   1. Specific vibration isolators and seismic restraints to be utilized showing compliance with the specifications.
   2. Isolation frame construction for each machine including dimensions, structural member sizes, support points and restraint locations and details.
   3. Methods for isolation and restraint of suspended piping, ductwork, and equipment.
   4. Methods for guides and isolation of piping risers.
   5. Seismic restraint calculations signed and stamped by an engineer licensed in the State of California and experienced in the design of isolation and seismic restraint for flexibly mounted equipment.

PART 2 - PRODUCTS

2.01 VIBRATION ISOLATOR TYPES

A. "RMS" shall be a laterally stable un-housed spring isolator. Spring, top plate, and baseplate assembly shall be welded. Mounting shall comply with all requirements stated in paragraph above.

B. "RMSG" shall be the same as "RMS" above but shall include height saving brackets for attachment to the equipment frame or isolation base.

C. "RMSP-EQ" shall be the same as "RMS" above except that the spring shall be enclosed in a welded steel cylinder with uplift restraints for horizontal and vertical seismic control.

D. "RMLS-EQ" shall be the same as "RMS" above and shall be equipped with a steel housing designed for seismic restraint and with vertical limit stops to prevent the equipment changing from its loaded height should it be necessary to remove a portion of its weight. This housing may also be used as rigid blocking during rigging so that the installed height and the operating height of the isolated equipment remain the same. O.S.H.P.D. (HCAi) pre-approval # OPA-0029.

E. "RMLS-SB" shall be a steel frame constructed of structural wide flange members unless shown otherwise and shall be rectangular in shape. The depths of the steel members shall not be less than one tenth (1/10) of the longest span between base supports or designed for a maximum beam deflection of .005". If the latter method is used, submittals shall include calculations showing the necessary moment of inertia. All steel members shall be coped and fitted, or constructed using the overlap insert method to assure a structural strength that is greater than the individual member strength. The steel frame is placed directly on top of the RMLS-EQ type isolators. O.S.H.P.D. (HCAi) pre-approved isolator/seismic restraints.

F. "RMU-EQ-SH": shall be an individual semi-housed steel spring isolator complete with vertical motion limit stops incorporating seismic restraints, leveling, and ribbed neoprene pad bonded to the baseplate. O.S.H.P.D. pre-approval # OPA-0098.

G. "AS" shall be air spring isolators and shall incorporate the following:
   1. A complete vibration isolation system consisting of a minimum of three air springs and a total of three height sensing valves. If there are two or more air springs per location, they shall be connected to the outlet of the height control valve in parallel. An associated interconnecting air supply system is required which is not included in this work.
   2. The air spring shall operate at its normal operating height and the maximum pressure shall not exceed the manufacturer's recommended rating of 100 PSI. The system shall maintain an elevation of +/- 1/8", once adjusted.
   3. The type of air spring to be utilized shall be based upon the required natural frequency as indicated in the schedule. In order, to avoid instability, auxiliary height saving brackets, housings, etc. may be utilized, subject to approval.

H. "RP-EQ" shall be a rubber pad type elastomer mounting, consisting of a steel bearing plate with 1/4" thick neoprene ribbed acoustical pad. Maximum loading shall be 60 PSI. Proper anchorage for seismic loads shall be indicated on drawings.

I. FUD-EQ shall be rubber-in-shear isolators incorporating mounting bolts for bolting to equipment base, a bottom steel plate for bolting isolator to subbase or structure and built in seismic restraints.

J. "RMXA" shall be a rectangular steel housing that shall be bolted to the overhead structure and designed to allow up to 30 degrees rod misalignment. Hanger shall consist of a steel spring located in a molded neoprene retaining cup with hanger rod bushing.

K. "PRMXA" - Same as type "RMXA" with the addition of a steel load transfer plate so that the equipment or piping operating height is the same as the installed height.

L. "HXA" -Same as type "RMXA" with the addition of a neoprene element in series to isolate the upper connection.

M. "PHXA" - Same as type "HXA" with the addition of a steel load transfer plate so that the equipment or piping operating height is the same as the installed height.

N. "HSS" - shall be a 'rubber in shear' isolator element contained within a rectangular steel housing.

2.02 RAIL AND BASE TYPES

A. "RMR" spring rail isolator. Rails shall have springs of proper size and constant, installed between a continuous structural steel channel (upper member) and a continuous flat steel plate (bottom member) in such manner, quantity, and location that efficient uniform deflection and loading to the structure is assured. Rails shall be furnished with Vibrex hold down stabilizers to restrict excessive amplitudes. Cross bracing must be used when necessary for seismic stability.

B. "RMB" shall be the same as "RMR" above except that it shall be designed as an integral fan and motor base with an adjustable motor slide base.

C. "RMSR" shall be a set of wide flange structural steel rails supplied with height saving brackets to reduce the mounting height of the equipment. The maximum allowable deflection of any point on the loaded frame relative to the unloaded frame shall be 0.005". A wide flange section depth greater than 1/10 the supporting span between isolators will be accepted as satisfying the deflection requirement.

D. "RMSB" shall be a steel frame constructed of structural wide flange members unless shown otherwise and shall be rectangular in shape. The depths of the steel members shall not be less than one tenth (1/10) of the longest span between base supports or designed for a maximum beam deflection of .005". If the latter method is used, submittals shall include calculations showing the necessary moment of inertia. All steel members shall be coped and fitted, or constructed using the overlap insert method to assure a structural strength that is greater than the individual member strength. Adjustable motor slide bases shall be included when required for centrifugal fan applications. The steel bases shall have an operating clearance of one (1") inch above the supporting structure. Where bases are used to mount pumps, the bases shall be large enough to support the pipe elbows if required.

E. "RMSBI" shall be a steel frame inertia base with all welded members and constructed of structural channel shapes. The base shall be designed for a thickness or inertia mass to equipment weight ratio as shown on the schedule with a minimum thickness of six (6") inches. The bases shall include a template and anchor bolts to anchor the equipment. Inertia bases shall have 1/2" (#4) rebar spaced a maximum of 12" on centers in each direction and located 1-1/2" from the bottom of the base. Adjustable motor slide bases shall be included when required for centrifugal fan applications. Bases shall be supplied with height saving brackets to reduce the mounting height of the equipment.

F. “RMUAB-EQ” shall be a steel frame made of structural angle with type “RMU-EQ-SH” O.S.H.P.D. (HCAi) pre-approved combination isolator/restraints.

G. "RMLSR" shall be a set of multiple wide flange structural steel rails supplied with type RMLS-EQ vibration isolator/seismic restraints and height saving brackets to reduce the mounting height of the equipment. The maximum allowable deflection of any point on the loaded frame relative to the unloaded frame shall be 0.005". A wide flange section depth greater than 1/10 the supporting span between isolators will be accepted as satisfying the deflection requirement.

H. Type "RMLSB" shall be a steel frame constructed of structural wide flange members unless shown otherwise and shall be rectangular in shape. The depths of the steel members shall not be less than one tenth (1/10) of the longest span between base supports or designed for a maximum beam deflection of .005". If the latter method is used, submittals shall include calculations showing the necessary moment of inertia. All steel members shall be coped and fitted, or constructed using the overlap insert method to assure a structural strength that is greater than the individual member strength. Frame shall be supplied complete with height saving brackets and type RMLS-EQ, O.S.H.P.D. (HCAi) pre-approved isolator/seismic restraints.
   1. Type RMLS-SB is the same as type “RMLSB” but rather than utilizing height saving brackets the steel frame is placed directly on top of the RMLS-EQ type isolators.

2.03 CURB TYPES

A. Type "VIC-EQ-SS" shall be a factory fabricated combination roof mounting curb and vibration isolation base for rooftop package units over 25 tons. The curb assembly shall be designed so that it can be re-roofed without disturbing the HVAC equipment. Curbs must be designed so that roofing material cannot cover access to isolators. The vibration isolation portion of the assembly shall be constructed of structural steel and designed to mate with the bottom of the rooftop unit. System shall include factory fabricated duct supports and any required bracing welded in place. The sheet metal weather proofing curb portion shall be supplied complete with a wood-nailer strip to facilitate flashing by the roofing contractor. Internal vibration isolator/seismic restraints shall be O.S.H.P.D. (HCAi) pre-approved number OPA-0029 as manufactured by MW Sausse’ & Company, Inc. Required anchorage calculations shall be supplied with submittal package. When required, curb shall include an optional acoustical package for sound reduction.

B. Type "VIC-EQ" shall be a factory fabricated combination roof mounting curb and vibration isolation base for rooftop package units up to 20 tons. Steel members and cross bracing shall all be welded. The assembly shall be shipped and installed in one piece complete with curb, weather-seal, removable O.S.H.P.D. (HCAi) pre-approved isolator/restraints #OPA-0098, exterior accessible leveling device, and minimum 14 gage galvanized steel top section to match the unit. Curb shall be fabricated of minimum 12 gage galvanized steel designed to carry the seismic loads to the supporting structure. System shall include factory fabricated duct supports welded in place as well as insulated panels when required. Required anchorage and lower curb structural calculations shall be supplied with submittal package. When required, curb shall include an optional acoustical package for sound reduction. Curb shall be manufactured to match roof slope if specified in drawings.

2.04 SEISMIC RESTRAINTS

A. Shall be capable of safely accepting external forces as specified in the applicable codes without failure. Restraints shall maintain equipment, duct, and piping in a captive position during an earthquake. Restraints shall not short circuit vibration isolation systems or transmit objectionable vibration or noise under normal operating conditions. Seismic restraints shall be provided on all equipment as scheduled on the drawings. Submit calculations by a Licensed Structural Engineer Registered in State of California to verify snubber capacities.

B. Type "3500" seismic restraint shall be constructed of steel plate, concentric steel pipes, and structural members in an all-welded assembly. All contact points shall be cushioned with minimum 1/4" thick resilient pad. Restraints shall be O.S.H.P.D. (HCAi) pre-approved type OPA-0029.

C. Type "3200" seismic restraint shall be all directional type with interlocking steel members constructed of structural angle and A-36 threaded rod. All contact points shall be cushioned with minimum 1/4" thick resilient pad or bushing.

D. Type "CR" seismic restraints shall be constructed of 7x19 strand galvanized aircraft cable. Cable assembly shall come complete with minimum (2) "U" bolt clamps per end and thimbles to protect cable from chafing. Allowed loads shall be the cable breaking strength with a safety factor of three. Actual loads shall be calculated with the worst case of all loads applied to one cable and anchor pattern. Cable shall be installed with 1/4" slack to prevent the transmission of vibration to the structure.

PART 3 - EXECUTION

3.01 GENERAL

A. Install in accordance with manufacturer's written instructions. Vibration isolators must not be installed in a manner that will result in piping stress or misalignment.

B. The structural steel or concrete inertia base shall be placed in position and supported temporarily by blocks or shims, as appropriate, prior to the installation of the equipment or isolators. The isolators shall be installed without raising the equipment and frame assembly.

C. After the entire installation is complete and under full operational load, the isolator shall be adjusted so that the load is transferred from the blocks or shims to the isolator. When all isolators are properly adjusted, the blocks or shims shall be barely free and shall be removed.

D. Once the equipment is in operation, install and anchor the seismic restraints with proper operating clearances as indicated on drawings.

E. HVAC equipment shall be isolated from the building structure by vibration isolators as scheduled on the drawings.

F. All piping 1 1/4" and over located in mechanical equipment rooms, and for a minimum of fifty (50) feet or 100 pipe diameters whichever is greater, from connection to vibrating mechanical or electrical equipment, shall be isolated from the building structure by means of vibration isolators as identified above.

G. All HVAC piping and vertical risers shall be isolated from the building structure by means of vibration isolators and guides.

H. All piping and ductwork to be isolated shall freely pass through walls and floors without contact. Penetration points shall be sleeved or otherwise formed to allow passage of piping or ductwork and maintain adequate clearance (Minimum of 2 inches all around) around the outside surfaces. Any materials used to fill the clearance space shall be permanently flexible so that vibration will not pass through it.

I. No rigid connections between equipment and building structure, including electrical conduit and refrigerant lines, shall be made that degrades the vibration isolation system herein specified. Inform other following trades, such as plastering, or electrical, to avoid any contact which would short-circuit the vibration isolation.

J. Bring to the Architect's attention prior to installation any conflicts with other trades which will result in unavoidable rigid contact with equipment or piping as described herein, due to inadequate space or other unforeseen conditions. Corrective work necessitated by conflicts after installation shall be at the contractor's expense.

K. Bring to the Architect's attention any discrepancies between the specifications and field conditions or changes required due to specific equipment selection, prior to installation. Corrective work necessitated by discrepancies after installation shall be at the contractor's expense.

L. Obtain inspection and approval of any isolation installation to be covered or enclosed, prior to such closure.

M. Thrust restraints shall consist of spring hangers with the same deflection as specified for the spring mountings. Thrust restraints shall be attached to the fan at the centerline of air discharge opening.

N. Correct, at no additional cost, all installations that are deemed defective in workmanship or materials.

3.02 PIPING ISOLATORS

A. All piping except fire standpipe systems, are included under this section.

B. Isolate piping within 50 feet of rotating equipment and pressure reducing stations.

C. The isolators shall be installed with the isolator hanger box attached to, or hung as close as possible to, approved locations on the supporting structure.

D. The isolators shall be suspended from substantial structural members, not from slab diaphragm unless specifically permitted.

E. Hanger rods shall be aligned to clear the hanger box.

F. Horizontal floor supported piping shall be isolated by type "RMLS-EQ", with a minimum static deflection of 1.0 inch or the same deflection as isolated equipment to which pipe is connected, whichever is greater.

G. Vertical riser pipe support and restraint system shall consist of type "RMS" springs and type "PG-EQ" guides. Install vertical riser guides so that clearances are maintained around concentric pipes in the guides. Install vertical restraints on the floor location as shown on drawings.

H. Pipe anchors, where required, shall utilize resilient pipe anchors, type "RPA" or equivalent, to avoid direct contact of piping with building.

I. Pipe Extension and Alignment connectors: Provide connectors at pump suction and discharge, riser take offs, cooling and heating coils, and elsewhere as required to accommodate thermal expansion and misalignment.

J. Seismic restraint spacing shall be in accordance with applicable codes.

3.03 INSPECTION

A. On completion of installation of all vibration isolation and seismic control devices herein specified, the local representative of the isolation materials manufacturer shall inspect the completed system and report in writing any installation error, improperly selected isolation devices, or other faults in the system that could affect the performance of the system. The contractor shall submit a report to the Architect, including the above report with consequent steps taken to properly complete the isolation work.

END OF SECTION 23 0548

SECTION 23 0553

HVAC IDENTIFICATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Extent of HVAC identification work required by this section is indicated on drawings or specified in other Division 23 sections, and includes the following:
   1. Painted Identification Materials.
   2. Plastic Pipe Markers.
   3. Plastic Tape.
   4. Underground-Type Plastic Line Marker.
   5. Plastic Duct Markers.
   6. Valve Tags.
   7. Diagram and Schedule Frames.
   8. Engraved Plastic-Laminate Signs.
   9. Plastic Equipment Markers.
   10. Plasticized Tags.

1.02 RELATED SECTIONS

A. This section is part of each Division 23 section making a reference to identification devices specified herein.

B. HVAC identification furnished as part of factory-fabricated equipment is specified as part of equipment assembly in other Division 23 sections.

C. Refer to Division 26 Sections for identification requirements of electrical work; not work of this section.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each identification material and device required.

B. Samples: Submit samples of each color, lettering style and other graphic representation required for each identification material or system.

C. Schedules and Diagrams:
   1. Submit valve schedule for each piping system, typewritten and reproduced on 8-1/2" x 11" bond paper. Tabulate valve number, piping system, system abbreviation (as shown on tag), location of valve (room or space), and variations for identification (if any). Mark valves which are intended for emergency shut-off and similar special uses, by special "flags", in margin of schedule.
   2. Submit temperature control diagrams and Sequence of Operation on bond paper suitable for framing.

D. Maintenance Data: Include product data and schedules in maintenance manuals; in accordance with requirements of Division 01 and Division 23 Section 230511 "Supplementary HVAC Requirements."

1.04 QUALITY ASSURANCE

A. Codes and Standards:
   1. ANSI Standards: Comply with ANSI A13.1 for lettering size, length of color field, colors, and viewing angles of identification devices.
   2. No adhesive type of identification markers will be accepted. All markers and tags shall be permanently attached to pipe, etc.
   3. All identification markers installed exterior of buildings shall be ultra-violet resistant.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide HVAC identification materials of one of the following:
   1. Seton Name Plate Corp.
   2. Allen Systems, Inc.
   3. Brady (W.H.) Co.; Signmark Div.
   4. Industrial Safety Supply Co., Inc.

2.02 HVAC IDENTIFICATION MATERIALS

A. General: Provide manufacturer's standard products of categories and types required for each application as referenced in other Division 23 sections. Where more than single type is specified for application, selections is Installer’s option, but provide single selection for each product category.

2.03 PLASTIC PIPE MARKERS

A. Snap-On Type: Provide manufacturer's standard pre-printed, semi-rigid snap-on, color-coded pipe markers, complying with ANSI A13.1.

B. Insulation: Furnish 1" thick molded fiberglass insulation with jacket for each plastic pipe marker to be installed on uninsulated pipes subject to fluid temperatures of 125°F. (52°C.) or greater. Cut length to extend 2" beyond each end of plastic pipe marker.

C. Small Pipes: For external diameters less than 6" (including insulation if any), provide full-band pipe markers, extending 360 degrees around pipe at each location, fastened by one of the following methods:
   1. Snap-on application of pre-tensioned semi-rigid plastic pipe marker.
   2. Laminated or bonded application of pipe marker to pipe (or insulation).
   3. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 3/4" wide; full circle at both ends of pipe marker, tape lapped 1-1/2".

D. Large Pipes: For external diameters of 6" and larger (including insulation if any), provide either full-band or strip-type pipe markers, but not narrower than 3 times letter height (and of required length), fastened by one of the following methods:
   1. Laminated or bonded application of pipe marker to pipe (or insulation).
   2. Taped to pipe (or insulation) with color-coded plastic adhesive tape, not less than 1-1/2" wide; full circle at both ends of pipe marker, taped lapped 3".
   3. Strapped-to-pipe (or insulation) application of semi-rigid type, with manufacturer's standard stainless-steel bands.

E. Lettering: Manufacturer's standard pre-printed nomenclature which best describes piping system in each instance, as selected by Architect/Engineer in cases of variance with names as shown or specified.
   1. Arrows: Print each pipe marker with arrows indicating direction of flow, either integrally with piping system service lettering (to accommodate both directions), or as a separate unit of plastic.

2.04 PLASTIC TAPE

A. General: Provide manufacturer's standard color-coded pressure-sensitive (self-adhesive) vinyl tape, not less than 3 mils thick.

B. Width: Provide 1-1/2" wide tape markers on pipes with outside diameters (including insulation, if any) of less than 6", 2-1/2" wide tape for larger pipes.

C. Color: Comply with ANSI A13.1, except where another color selection is indicated.

2.05 UNDERGROUND TYPE PLASTIC LINE MARKER

A. General: Manufacturer's standard permanent, bright-colored, continuous-printed plastic tape, intended for direct-burial service; not less than 6" wide x 4 mils thick. Provide tape with printing which most accurately indicates the type of service of buried pipe.
   1. Provide multi-ply tape consisting of solid aluminum foil core between 2-layers of plastic tape.

2.06 VALVE TAGS

A. Brass Valve Tags: Provide 19-gage polished brass valve tags with stamped-engraved piping system abbreviation in 1/4" high letters and sequenced valve numbers 1/2" high and with 5/32" hole for fastener.
   1. Provide 1-1/2" diameter tags, except as otherwise indicated.
   2. Fill tag engraving with black enamel.

B. Valve Tag Fasteners: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves and manufactured specifically for that purpose.

C. Access panel markers: Provide manufacturer's standard solid brass chain (wire link or beaded type), or solid brass S-hooks of the sizes required for proper attachment of tags to valves and manufactured specifically for that purpose.

D. Access Panel Markers: Provide manufacturer's standard 1/16" thick engraved plastic laminate access panel markers, with abbreviations and numbers corresponding to concealed valve. Include 1/8" center hole to allow attachment.

2.07 DIAGRAM AND SCHEDULE FRAMES

A. General: For each page of schedule and/or diagrams, provide glazed display frame, with screws for removable mounting on masonry walls. Provide frames of finished hardwood or extruded aluminum, with SSB-grade sheet glass.

2.08 ENGRAVED PLASTIC LAMINATE SIGNS

A. General: Provide engraving stock melamine plastic laminate, complying with FS L-P-387, in the sizes and thicknesses indicated, engraved with engraver's standard letter style of the sizes and wording indicated, white with black core (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.

B. Thickness: 1/16" for units up to 20 sq. in. or 8" length; 1/8" for larger units.

C. Fasteners: Self-tapping stainless-steel screws, except contact-type permanent adhesive where screws cannot or should not penetrate the substrate.

2.09 LETTERING AND GRAPHICS

A. General: Coordinate names, abbreviations and other designations used in HVAC identification work, with corresponding designations shown, specified, or scheduled. Provide numbers, lettering and wording as indicated, as recommended by the manufacturers, or as required for proper identification and operation/maintenance of HVAC systems and equipment.
   1. Multiple Systems: Where multiple systems of same generic name are shown and specified, provide identification which indicates individual system number as well as service (as examples; Boiler No. 3, Air Supply No. 1H, Standpipe F12).

2.10 EQUIPMENT MARKERS

A. Equipment Nameplates: Metal, with data engraved or stamped, for permanent attachment on equipment.
   1. Data:
      a. Manufacturer, product name, model number, and serial number.
      b. Capacity, operating and power characteristics, and essential data.
      c. Labels of tested compliances.
   2. Location: Accessible and visible.
   3. Fasteners: As required to mount on equipment.

B. Equipment Markers: Engraved, color-coded laminated plastic. Include contact-type, permanent adhesive.
   1. Terminology: Match schedules as closely as possible.
   2. Data.
   3. Name and plan number.
      a. Equipment service.
      b. Design capacity.
      c. Other design parameters such as pressure drop, entering and leaving conditions, and speed.
   4. Size: 2-1/2 by 4 inches for control devices, dampers, and valves; 4-1/2 by 6 inches for equipment.

C. Equipment Signs: ASTM D 709, Type I, cellulose, paper-base, phenolic-resin-laminate engraving stock; Grade ES-2, black surface, black phenolic core, with white melamine sub-core, unless otherwise indicated. Fabricate in sizes required for message. Provide holes for mechanical fastening.
   1. Data: Instructions for operation of equipment and for safety procedures.

2. Engraving: Manufacturer's standard letter style, of sizes and with terms to match equipment identification.
3. Retain and edit subparagraph above or first subparagraph below.
4. Thickness: 1/16 inch for units up to 20 sq. in. or 8 inches in length, and 1/8 inch for larger units.
5. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

D. Access Panel and Door Markers: 1/16-inch thick, engraved laminated plastic, with abbreviated terms and numbers corresponding to identification. Provide 1/8-inch center hole for attachment.
1. Fasteners: Self-tapping, stainless-steel screws or contact-type, permanent adhesive.

2.11 PLASTIC DUCT MARKERS

A. Engraved, color-coded laminated plastic. Include direction and quantity of airflow and duct service (such as supply, return, and exhaust). Include contact-type, permanent adhesive.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Coordination: Where identification is to be applied to surfaces which require insulation, painting or other covering or finishes, including valve tags in finished mechanical spaces, install identification after completion of covering and painting. Install identification prior to installation of acoustical ceilings and similar removable concealment.

3.02 PIPING SYSTEM IDENTIFICATION

A. General: Install pipe markers of one of the following types on each system indicated to receive identification, and include arrows to show normal direction of flow:
1. Plastic pipe markers, with application system as indicated under "Materials" in this section. Install on pipe insulation segment where required for hot-non-insulated pipes.

B. Locate pipe markers as follows wherever piping is exposed to view in occupied spaces, machine rooms, accessible maintenance spaces (shafts, tunnels, plenums) and exterior non-concealed locations.
1. Near each valve and control device.
2. Near each branch, mark each pipe at branch, where there could be question of flow pattern.
3. Near locations where pipes pass through walls, floors ceilings, or enter non-accessible enclosures.
4. At access doors, manholes similar access points which permit view of concealed piping.
5. Near major equipment items and other points of origination and termination.
6. Spaced intermediately at maximum spacing of 50' along each piping run, except reduce spacing to 25' in congested areas of piping and equipment. On piping above removable acoustical ceilings, except omit intermediately.

3.03 UNDERGROUND PIPING IDENTIFICATION

A. General: During back-filling/top soiling of each exterior underground piping systems, except sanitary sewer and storm drainage install continuous underground-type plastic line marker, located directly over buried line at 6" to 8" below finished grade. Where multiple small lines are buried in common trench and do not exceed overall width of 16", install single line marker.

3.04 VALVE IDENTIFICATION

A. General: Provide valve tag on every valve, cock, and control device in each piping system; exclude check valves, valves within factory-fabricated equipment units. List each tagged valve on valve schedule for each piping system.

B. Mount valve schedule frames and schedules in machine rooms, where indicated or, if not otherwise indicated, where directed by Architect/Engineer.

3.05 HVAC EQUIPMENT IDENTIFICATION

A. General: Install engraved plastic laminate sign or plastic equipment marker on or near each major item of HVAC equipment and each operational device, as specified herein if not otherwise specified for each item or device. Provide signs for the following general categories of equipment and operational devices:
   1. Fuel-burning units including boilers, furnaces, heaters.
   2. Pumps, compressors, chillers, condensers, and similar motor-driven units.
   3. Fans and blowers.
   4. Packaged HVAC central-station or zone-type units.
   5. Split air conditioner indoor and outdoor units
   6. Single Duct terminal units and all equipment in ceiling space.
   7. In addition to the equipment tag, install an identification tag for VAV units in locations approved by Architect to indicate where each unit is installed above the ceiling. Coordinate the installation location, type, size, and color of this tag with the Architect.

B. Lettering Size: Minimum 1/4" high lettering for name of unit where viewing distance is less than 2'-0", 1/2" high for distances up to 6'-0", and proportionately larger lettering for greater distances. Provide secondary lettering of 2/3 to 3/4 of size of the principal lettering.

C. Test of Signs: In addition to name of identified unit, provide lettering to distinguish between multiple units, inform operator of operational requirements, indicate safety and emergency precautions, and warn of hazards and improper operations.

3.06 ADJUSTING AND CLEANING

A. Adjusting: Relocate any HVAC identification device which has become visually blocked by work of this division or other divisions.

B. Cleaning: Clean face of identification devices, and glass frames of valve charts.

END OF SECTION 23 0553

SECTION 23 0593

TESTING, ADJUSTING, AND BALANCING

PART 1 -GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes testing, adjusting, and balancing HVAC systems to produce design objectives and measurement and reporting of sound and vibration levels. including the following:
   1. Balancing airflow and water flow within distribution systems, including sub-mains, branches, and terminals, to indicated quantities according to specified tolerances.
   2. Test, adjust and balance hydronic system based on the requirements of the existing variable flow chilled and heating water systems.
   3. Adjusting total HVAC systems to provide indicated quantities.
   4. Measuring electrical performance of HVAC equipment.
   5. Setting quantitative performance of HVAC equipment.
   6. Verifying that automatic control devices are functioning properly.
   7. Reporting results of the activities and procedures specified in this Section.

B. Related Sections include the following:
   1. Testing and adjusting requirements unique to these systems and equipment are included in the Sections that specify those systems and equipment.
   2. Field quality-control testing to verify that workmanship quality for system and equipment installation is specified in system and equipment Sections.

1.03 DEFINITIONS

A. Adjust: To regulate fluid flow rate and air patterns at the terminal equipment, such as to reduce fan speed or adjust a damper.

B. Balance: To proportion flows within the distribution system, including sub-mains, branches, and terminals, according to design quantities.

C. Draft: A current of air, when referring to localized effect caused by one or more factors of high air velocity, low ambient temperature, or direction of airflow, whereby more heat is withdrawn from a person's skin than is normally dissipated.

D. Procedure: An approach to and execution of a sequence of work operations to yield repeatable results.

E. Report Forms: Test data sheets for recording test data in logical order.

F. Static Head: The pressure due to the weight of the fluid above the point of measurement. In a closed system, static head is equal on both sides of the pump.

G. Suction Head: The height of fluid surface above the centerline of the pump on the suction side.

H. System Effect: A phenomenon that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system.

I. System Effect Factors: Allowances used to calculate a reduction of the performance ratings of a fan when installed under conditions different from those presented when the fan was performance tested.

J. Terminal: A point where the controlled medium, such as fluid or energy, enters or leaves the distribution system.

K. Test: A procedure to determine quantitative performance of a system or equipment.

L. Testing, Adjusting, and Balancing Agent: The entity responsible for performing and reporting the testing, adjusting, and balancing procedures.

M. AABC: Associated Air Balance Council.

N. T&B: Testing, adjusting, and balancing.

O. T&B Agency: An independent entity certified by AABC to perform testing and balancing work.

P. TBE: AABC certified test and balance engineer.

Q. TBT: AABC certified test and balance technician.

R. HVAC: Heating, ventilating, and air conditioning.

S. BAS: Building automation systems.

T. Contract documents: the mechanical drawings and test and balance specification.

U. NC: noise criteria.

V. RC: room criteria.

W. SMACNA: Sheet Metal and Air Conditioning Contractors' National Association.

1.04 SUBMITTALS

A. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation T&B of AABC certification of T&B agency and personnel, including a sample copy of the AABC "National Performance Guaranty." If not submitted within the timeframe specified, the engineer has the right to choose an AABC agency at the Contractor’s expense.

B. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit T&B strategies and step-by-step procedures as specified in "Preparation" Article. Include a complete set of report forms intended for use on this Project.

C. System Readiness Checklists: Within 60 days of Contractor's Notice to Proceed, submit system readiness checklists as specified in "Preparation" Article to be used and filled out by systems Installers verifying that systems are ready for T&B.

D. Examination Report: Within 60 days of Contractor's Notice to Proceed, provide a summary report of the examination review required in Part 3 “Examination”, if issues are discovered that may preclude the proper testing and balancing of the systems.

E. Certified T&B reports: Within 14 days of completion of balancing work, submit AABC-Certified T&B report.
1. Submit one copy of the final T&B Report directly to the design professional of record. Provide five additional copies to the contractor.

F. Warranty: Submit 6 copies of special warranty specified in the "Warranty" Article below.

G. Provide a summary of any discrepancies found in the system, by Air balance contractor to each system as described hereafter. Include a complete list of deficiencies and problems found in system being tested and balanced. Add this report to final submittal package.

1.05 QUALITY ASSURANCE

A. T&B Agency Qualifications: Engage a T&B entity certified by AABC.
1. T&B Field Supervisor: Employee of the T&B Agency who is certified by AABC.
2. T&B Technician: Employee of the T&B Agency and who is certified by AABC as a TBT.

B. Testing, Adjusting, and Balancing Conference: Meet with the Owner's and the Architect's representatives on approval of the testing, adjusting, and balancing strategies and procedures plan to develop a mutual understanding of the details. Ensure the participation of testing, adjusting, and balancing team members, equipment manufacturers' authorized service representatives, HVAC controls Installer, and other support personnel. Provide 7 days' advance notice of scheduled meeting time and location.
1. Agenda Items: Include at least the following:
   a. Submittal distribution requirements.
   b. Contract Documents examination report.
   c. Testing, adjusting, and balancing plan.
   d. Work schedule and Project site access requirements.
   e. Systems readiness checklists.
   f. Coordination and cooperation of trades and subcontractors.
   g. Coordination of documentation and communication flow.

C. Certification of Testing, Adjusting, and Balancing Reports: Certify the testing, adjusting, and balancing field data reports. This certification includes the following:
1. Review field data reports to validate accuracy of data and to prepare certified testing, adjusting, and balancing reports.
2. Certify that the testing, adjusting, and balancing team complied with the approved testing, adjusting, and balancing plan and the procedures specified and referenced in this Specification.

D. Testing, Adjusting, and Balancing Reports: Use standard forms from AABC "National Standards for Testing, Adjusting, and Balancing."

E. Instrumentation Type, Quantity, and Accuracy: As described in AABC national standards.

F. Instrumentation Calibration: Calibrate instruments at least every 6 months or more frequently if required by the instrument manufacturer.

1.06 PROJECT CONDITIONS

A. Full Owner Occupancy: Owner will occupy the site and existing building during entire T&B period. Cooperate with Owner during T&B operations to minimize conflicts with Owner's operations.

B. Partial Owner Occupancy: Owner may occupy completed areas of building before Substantial Completion. Cooperate with Owner during T&B operations to minimize conflicts with Owner's operations.

1.07 COORDINATION

A. Coordinate the efforts of factory-authorized service representatives for systems and equipment, HVAC controls installers, and other mechanics to operate HVAC systems and equipment to support and assist testing, adjusting, and balancing activities.

B. Notice: Provide 7 days advance notice for each test. Include scheduled test dates and times.

C. Perform testing, adjusting, and balancing after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

D. Review Division 23 contract documents to assure that the design has considered all required components necessary for a complete and successful testing, adjusting and balancing of the system as described hereafter. Prepare a report for this examination of contract documents and propose any additional components required to complete the scope of work this section no later than 45 days after the award of the contract.

1.08 WARRANTY

A. General Warranty: The national project performance guarantee specified in this Article shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by the Contractor under requirements of the Contract Documents.

B. National Project Performance Guarantee: Provide a guarantee on AABC "National Standards" forms stating that AABC will assist in completing the requirements of the Contract Documents if the testing, adjusting, and balancing Agent fails to comply with the Contract Documents. Guarantee includes the following provisions:
   1. The certified Agent has tested and balanced systems according to the Contract Documents.
   2. Systems are balanced to optimum performance capabilities within design and installation limits.

PART 2 -PRODUCTS (Not Applicable)

PART 3 -EXECUTION

3.01 EXAMINATION

A. Examine Contract Documents to become familiar with project requirements and to discover conditions in systems' designs that may preclude proper testing, adjusting, and balancing of systems and equipment.
   1. Contract Documents are defined in the General and Supplementary Conditions of the Contract.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers.
   1. Verify that quantities and locations of these balancing devices are accessible and appropriate for effective balancing and for efficient system and equipment operation. Note the locations of devices that are not accessible for testing and balancing.

C. Examine approved submittal data of HVAC systems and equipment.

D. Examine project record documents described in Division 01 Section "Project Record Documents."

E. Examine ceiling plenums and under-floor air plenums used for supply, return, or relief air to verify that are properly separated from adjacent areas. Verify that penetrations in plenum walls are sealed and fire-stopped if required.

F. Examine HVAC equipment and verify that bearings are greased, belts are aligned and tight, clean permanent filters are installed, and equipment with functioning controls is ready for operation.

G. Examine Architect's and Engineer's design data, including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC system and equipment controls.

H. Examine equipment performance data, including fan and pump curves. Relate performance data to project conditions and requirements, including system effects that can create undesired or unpredicted conditions that cause reduced capacities in all or part of a system. Calculate system effect factors to reduce the performance ratings of HVAC equipment when installed under conditions different from those presented when the equipment was performance tested at the factory. To calculate system effects for air systems, use tables and charts found in AMCA 201, "Fans and Systems," Sections 7 through 10; or in SMACNA "HVAC Systems--Duct Design," Sections 5 and 6. Compare this data with the design data and installed conditions.

I. Examine system and equipment installations to verify that they are complete and that testing, cleaning, adjusting, and commissioning specified in individual Specification Sections have been performed.

J. Examine system and equipment test reports.

K. Examine HVAC system and equipment installations to verify that indicated balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers, are properly installed, and their locations are accessible and appropriate for effective balancing and for efficient system and equipment operation.

L. Examine systems for functional deficiencies that cannot be corrected by adjusting and balancing.

M. Examine air-handling equipment to ensure clean filters have been installed, bearings are greased, belts are aligned and tight, and equipment with functioning controls is ready for operation.

N. Examine terminal units, such as variable-air-volume boxes, and verify that they are accessible and their controls are connected, configured by the Control's Contractor, and functioning.

O. Examine strainers to verify that mechanical contractor has replaced startup screens with permanent screens and that all strainers have been cleaned.

P. Examine 2-Way valves for proper installation for their intended function.

Q. Examine 3-Way valves for proper installation for their intended function of diverting or mixing fluid flows.

R. Examine heat-transfer coils for correct piping connections and for clean and straight fins.

S. Examine air vents to verify that mechanical contractor has removed all air from all hydronic systems.

T. Examine equipment for installation and for properly operating safety interlocks and controls.

U. Prior to examination of the vibration isolation system, verify that all system and equipment installations are complete and that testing, adjusting, and balancing specified in the contract documents have been performed.

V. Examine all vibration Isolation system. All vibration isolated equipment and piping must be inspected and examined before startup and shall include the following:
   1. Verify that all isolators are installed in accordance with manufacturer's recommendations.
   2. Verify that piping, duct, and conduit penetrations through mechanical equipment room envelope are sealed, and if required, rigid contact with building structure does not exist.
   3. Steel isolation bases must be inspected for cracked welds, excessive bending or twisting of steel members.
   4. Concrete isolation bases must be examined for cracked concrete. Isolator retainer brackets must be checked for looseness. The concrete base must be flat and true in plane.
   5. Elastomer isolators must be examined for cracks in the rubber and for loose bonds between the rubber and steel plates or other steel components. Adequate clearance must be provided between bolts and the side of the bolt holes to prevent short circuiting.

6. Steel spring isolators must be examined for loose or missing bolts, nuts, or lock washers. Check for spring overloading or under-loading, completely collapsed spring coils, and cocked springs. Note if rubber or glass fiber pad between the bottom plate of the steel spring and the concrete slab or supporting structure is present.
7. Housed steel springs must be examined for proper centering of the springs, clearance between the cast housing and rubber snubber, and the steel spring for tilted or cocked springs.
8. When the specifications require that the isolators be bolted to the concrete slab or other supporting structure, the bolts may be isolated by means of rubber bushings and rubber washers.
9. Inspect isolators with restraint devices to make sure that all shims have been removed and supportive nuts have been properly adjusted to allow for free floating of the isolated system.
10. Seismic restraints shall not prevent the proper functioning of vibration isolation system.
11. Pneumatic isolators must be inspected for overload or under-load by checking the air pressure gauge against manufacturer's submittals or catalog. The pneumatic isolator system should include the isolator, strainer, oil separator, height regulator, and air pressure gauge. Inspect the vicinity of the isolator. Note if the isolator is exposed to damage from vehicle or other traffic.
12. Carefully inspect the space under all isolated bases to assure that these spaces are clean and free of debris to prevent short-circuiting.
13. Check to ensure that all shipping bolts associated with spring isolators have been removed.
14. Inspect all flexible piping, hoses, and expansion joints as to type, length and location as called for by the specifications. Examine flexible hose for excessive elongation.
15. Inspect all electrical and control connections to ensure that they do not restrain the movement of the vibration isolated equipment.
16. Inspect all fabric connections between fans and ductwork to ensure that a fabric "bellows" exists when the fans are operating.
17. Each piece of vibration isolated machinery must be free of any structural tie or rigid connection that may "short circuit" the isolation system. All limit stops, shipping bolts, and leveling bolts on all isolators must be inspected to ensure that they are not "short circuiting" the isolation system.
18. Hanger isolators should be free of misalignment and over / under-loading. Under no circumstances the isolator rod should be allowed to make rigid contact with the hanger housing.
19. Report deficiencies as discovered to the appropriate parties.

W. Examine automatic temperature system components to verify the following:
1. Dampers, valves, and other controlled devices operate by the intended controller.
2. Dampers and valves are in the position indicated by the controller.
3. Integrity of valves and dampers for free and full operation and for tightness of fully closed and fully open positions. This includes dampers in multi-zone units, mixing boxes, and variable-air-volume terminals.
4. Automatic modulating and shutoff valves, including 2-way valves, are properly connected.
5. Thermostats are located to avoid adverse effects of sunlight, drafts, and cold walls.
6. Sensors are located to sense only the intended conditions.

7. Sequence of operation for control modes is according to the Contract Documents.
8. Controller set points are set at design values. Observe and record system reactions to changes in conditions. Record default set points if different from design values.
9. Interlocked systems are operating.
10. Changeover from heating to cooling mode occurs according to design values.

X. Report deficiencies discovered before and during performance of testing, adjusting, and balancing procedures.

3.02 PREPARATION

A. Prepare a testing, adjusting, and balancing plan that includes strategies and step-by-step procedures that includes the following:
   1. Equipment and systems to be tested.
   2. Strategies and step-by-step procedures for balancing the systems.
   3. Instrumentation to be used.
   4. Sample forms with specific identification for all equipment.

B. Prepare system-readiness checklists, as described in the "AABC National Standards for Total System Balance," for use by systems installers in verifying system readiness for T&B. These shall include, at a minimum, the following:
   1. Airside:
      a. Ductwork is complete with terminals installed.
      b. Volume, smoke, and fire dampers are open and functional.
      c. Clean filters are installed.
      d. Fans are operating, free of vibration, and rotating in correct direction.
      e. Variable-frequency controllers' start-up is complete, and safeties are verified.
      f. Automatic temperature-control systems are operational.
      g. Ceilings are installed.
      h. Windows and doors are installed.
      i. Suitable access to balancing devices and equipment is provided.
   2. Hydronics:
      a. Piping is complete with terminals installed.
      b. Water treatment is complete.
      c. Systems are flushed, filled and air purged.
      d. Strainers are pulled and cleaned.
      e. Control valves are functioning per the sequence of operation.
      f. Shutoff and balance valves have been verified to be 100 percent open.
      g. Pumps are started and proper rotation is verified.
      h. Pump gage connections are installed directly at pump inlet and outlet flanges or in discharge and suction pipe prior to valves or strainers.
      i. Variable-frequency controllers' start-up is complete, and safeties are verified.
      j. Suitable access to balancing devices and equipment is provided.
   3. General
      a. Permanent electrical power wiring is complete.
      b. Equipment and duct access doors are securely closed.

3.03 GENERAL TESTING AND BALANCING PROCEDURES

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC "National Standards for Total System Balance" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for T&B procedures.

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control levers, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.04 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain approved submittals and recommended testing procedures. Cross-check the summation of required outlet volumes with required fan volumes.

B. Prepare single-line schematic diagram of systems "as-built" for the purpose of identifying HVAC components.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check condensate drains for proper connections and functioning.

H. Check for proper sealing of air-handling-unit components.

I. Check the airflow patterns from the outside-air louvers and dampers and the return- and exhaust-air dampers, through the supply-fan discharge and mixing dampers.

J. Check dampers for proper position to achieve desired airflow path.

K. Check for airflow blockages.

3.05 PROCEDURES FOR CONSTANT VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure total airflow.
      a. Set outside air, return air and relief air dampers for proper position that simulates minimum outdoor air conditions.
      b. Where duct conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
      c. Where duct conditions are not suitable for Pitot-tube traverse measurements, a coil traverse may be acceptable.

d. If a reliable Pitot-tube traverse or coil traverse is not possible, measure airflow at terminals and calculate the total airflow.

2. Measure fan static pressures as follows:
   a. Measure static pressure directly at the fan outlet or through the flexible connection.
   b. Measure static pressure directly at the fan inlet or through the flexible connection.
   c. Measure static pressure across each component that makes up the air-handling system.
   d. Report any artificial loading of filters at the time static pressures are measured.

3. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for main duct, sub-main ducts, and major branch ducts to indicated airflows.
   1. Measure airflow of sub-main and branch ducts.
   2. Adjust sub-main and branch duct volume dampers for specified airflow. Re-measure each sub-main and branch duct after all have been adjusted.

C. Adjust air inlets and outlets for each space to indicated airflows.
   1. Set airflow patterns of adjustable outlets for proper distribution without drafts.
   2. Measure airflow at all inlets and outlets.
   3. Adjust each inlet and outlet for specified airflow.
   4. Re-measure each inlet and outlet after all have been adjusted.

D. Verify final system conditions.
   1. Re-measure and confirm minimum outdoor air, return and relief airflows are within design. Readjust to design if necessary.
   2. Re-measure and confirm total airflow is within design.
   3. Re-measure all final fan-operating data, RPM, Volts, Amps, static profile.
   4. Mark all final settings.
   5. Test system in economizer mode. Verify proper operation and adjust, if necessary.
   6. Measure and record all operating data.
   7. Record final fan performance data.

3.06 TEMPERATURE TESTING

A. During testing, adjusting, and balancing, report need for adjustment in temperature regulation within the automatic temperature control system.

B. Measure indoor wet-bulb and dry-bulb temperatures every other hour for a period of 2 successive 8-hour days, in each separately controlled zone, to prove correctness of final temperature settings. Measure when the building or zone is occupied.

C. Measure outside air wet-bulb and dry-bulb temperatures.

3.07 PROCEDURES FOR VIBRATION MEASUREMENTS

A. Perform vibration measurements when other building and outdoor vibration sources are at a minimum level and will not influence measurements of equipment being tested.
   1. Turn off equipment in the building that might interfere with testing.
   2. Restrict people from occupying areas where human activity may affect accuracy of measurements.
   3. Note all exterior vibration sources i.e., trains, roadway traffic, adjacent construction activities, etc.

B. Attach and secure the vibration transducer in accordance with the latest edition of the AABC S&V Procedural Standards for Measurement of Sound and Vibration.

C. Measure and record, on all pumps and fans over 3 HP, and all chillers and compressors over 5 HP, at discrete frequencies or in 1/3 octave bands as follows:
   1. Discrete vibration levels from 1 to 200 Hz in 1 Hz increments, or
   2. In each 1/3 octave band from 12.5 Hz to 100 Hz.

D. Measure and record equipment vibration, bearing vibration, equipment base vibration, and on building structure adjacent to equipment. Record velocity and displacement readings in the radial vertical, radial horizontal and axial planes, where measurements can be performed safely.
   1. Pumps:
      a. Pump Bearing: Drive end and opposite end.
      b. Motor bearing: Drive and opposite end.
      c. Pump Base: Top and side, within 6” of each isolator.
      d. Building: Floor adjacent to pump/motor, within 6” of each isolator.
   2. Fans and HVAC Equipment with Fans:
      a. Fan Bearing: Drive end and opposite end.
      b. Motor Bearing: Drive and opposite end.
      c. Equipment Base: Top and side, within 6” of each isolator.
      d. Building: Floor adjacent to fan/motor, within 6” of each isolator.
   3. Chillers and HVAC Equipment with Compressors:
      a. Compressor Bearing: Drive end and opposite end.
      b. Motor Bearing: Drive end and opposite end.
      c. Equipment Base: Top and side, within 6” of each isolator.
      d. Building: Floor adjacent to equipment, within 6” of each isolator.

E. Vibration Measurement Reports:
   1. Date and time of test
   2. Equipment designation, location, equipment speed, motor speed and motor horsepower.
   3. Measured acceleration (in units of g’s, inches/sec^2), and measured velocity (in units of inches/sec) and measured displacement (in units of inches).

3.08 PROCEDURES FOR SOUND LEVEL MEASUREMENTS

A. Close windows and doors to the space.

B. Perform measurements when the space is not occupied, or when the occupant noise levels from other spaces in the building and outside are at a minimum, or do not affect sound readings.

C. Clear the space of temporary sound sources so unrelated disturbances will not be measured. Turn off all sound sources (personal computers, printers, fax machines, etc.) in the space that may affect sound readings.

D. Position testing personnel during measurements to achieve a direct line-of-sight between the sound source and the sound-level meter.

E. Take sound measurements at a height approximately 48 inches above the floor and at least 36 inches from a wall, column, or any other large surface capable of altering the measurements.

F. Take sound measurements in dB (linear or flat), with the slow time constant, in the octave bands from 31.5 to 8000 Hz.

G. Take sound measurements with the HVAC systems off to establish the background levels and take sound measurements with the HVAC systems operating. Calculate the difference between measurements. Apply a correction factor depending on the difference and adjust measurements.

H. Perform sound testing in all occupied space horizontally and vertically adjacent to all mechanical equipment rooms and all mechanical chases.

I. Perform sound testing at 10% of locations on the project for each type of the following spaces. For each space type tested, select a measurement location that has the greatest anticipated sound level. If testing multiple locations for each space type, select at least one location that is near and at least one location that is remote from the predominant sound source.
   1. Private office.
   2. Open office area.
   3. Conference room.
   4. Auditorium/large meeting room/lecture hall.
   5. Classroom/training room.
   6. Library open space.
   7. Public areas (such as, lobbies, hallways, break rooms).
   8. Perform sound testing in all spaces with a design criterion of NC or RC 25 or less.

J. Sound Measurement Reports: Record sound measurements on appropriate test forms, indicating the decibel levels measured in for both “background” and “HVAC system operating” readings. Record each tested location on a separate NC or RC chart. Record the following on the forms.
   1. Date and time of test.
   2. Equipment operational parameters – speed / frequency at time of measurements.
   3. Indoor measurements - space location within building including floor level and room /space number.
   4. Outdoor measurements – location identifier such as location relative to equipment, building, or property line.
   5. Indicate where measurements meet or exceed design criteria.

3.09 CONTROL VERIFICATION

A. In conjunction with system balancing perform the following:
   1. Work with the temperature control contractor to ensure the system is operating within the design limitations and gain a mutual understanding of intended control performance.
   2. Confirm that the sequences of operation are, in compliance with the approved drawings. Note air pressures and device positions and correlate with airflow and water-flow measurements. Note the speed of response to input changes.
   3. Verify that controllers are calibrated and function as intended.
   4. Verify that controller setpoints are as specified.
   5. Verify operation of limiting controllers (i.e., high, and low-temperature controllers).
   6. Verify the operation of lockout or interlock systems.
   7. Verify the operation of all valve and damper actuators.
   8. Verify that all controlled devices are properly installed and connected to the correct controller.
   9. Verify that all controlled devices travel freely and are in the position indicated by the controller: open, closed, or modulating.
   10. Verify the location and installation of all sensors to ensure they will sense only the intended temperatures, humidity, or pressures. Note conditions that would adversely affect control functions.
   11. Record controller settings and note variances between set points and actual measurements.
   12. Confirm interaction of electrically operated switch transducers.
   13. Verify main control supply-air pressure and observe compressor and dryer operations.
   14. Record voltages of power supply and controller output. Determine if the system operates on a grounded or non-grounded power supply.
   15. Note operation of electric actuators using spring return for proper fail-safe operations.

B. Reporting
   1. The report shall include a summary of verifications performed, remaining deficiencies, and any variations from specified conditions.

3.10 TOLERANCES

A. Set HVAC system airflow and water flow rates within the following tolerances:
   1. Supply, Return, and Exhaust Fans: Minus 10 to plus 10 percent.
   2. Fresh air intake: 0 to plus 5%.
   3. Air Outlets and Inlets: Minus 10 to plus 10 percent.
   4. Heating-Water Flow Rate: Minus 5 to plus 5 percent.
   5. Cooling-Water Flow Rate: Minus 5 to plus 5 percent.

B. Maintaining pressure relationships as designed shall have priority over the tolerances specified above.

3.11 REPORTING

A. Initial Construction Phase Report: Based on examination of the Contract Documents as specified in "Examination" Article above, prepare a report on the adequacy of design for systems' balancing devices.

Recommend changes and additions to systems' balancing devices to facilitate proper performance measuring and balancing. Recommend changes and additions to HVAC systems and general construction to allow access for performance measuring and balancing devices.

B. Status Reports: As Work progresses, prepare reports to describe completed procedures, procedures in progress, and scheduled procedures. Include a list of deficiencies and problems found in systems being tested and balanced. Prepare a separate report for each system and each building floor for systems serving multiple floors.

3.12 FINAL REPORT

A. General: Computer printout in letter-quality font, on standard bond paper, in a fine quality 3-ring binder, tabulated and divided into sections by tested and balanced systems.

B. The final report for sound and vibration measurement shall be in accordance with the requirements of the current edition of the AABC Procedural Standards for Measurement of Sound and Vibration.

C. Include a certification sheet in front of binder signed and sealed by the certified testing and balancing engineer.
   1. Include a list of the instruments used for procedures, along with proof of calibration.

D. Final Report Contents: In addition to the certified field report data, include the following:
   1. Fan curves.
   2. Manufacturers' test data.
   3. Field test reports prepared by system and equipment installers.
   4. Other information relative to equipment performance, but do not include approved Shop Drawings and Product Data.

E. General Report Data: In addition to the form titles and entries, include the following data in the final report, as applicable:
   1. Title page.
   2. Name and address of testing, adjusting, and balancing Agent.
   3. Project name.
   4. Project location.
   5. Architect's name and address.
   6. Engineer's name and address.
   7. Contractor's name and address and field technician responsible for the project.
   8. Report date.
   9. Signature of testing, adjusting, and balancing Agent who certifies the report.
   10. Summary of contents, including the following:
      a. Design versus final performance.
      b. Notable characteristics of systems.
      c. Description of system operation sequence if it varies from the Contract Documents.
   11. Nomenclature sheets for each item of equipment.
   12. Data for terminal units, including manufacturer, type size, and fittings.

13. Notes to explain why certain final data in the body of reports vary from design values.
14. Test conditions for fans and pump performance forms, including the following:
    a. Settings for outside-air, return-air, and exhaust-air dampers.
    b. Conditions of filters.
    c. Cooling coil, wet-bulb, and dry-bulb conditions.
    d. Face and bypass damper settings at coils.
    e. Fan drive settings, including settings and percentage of maximum pitch diameter.
    f. Inlet vane settings for variable-air-volume systems.
    g. Settings for supply-air, static-pressure controller.
    h. Other system operating conditions that affect performance.

F. System Diagrams: Include schematic layouts of air and hydronic distribution systems. Present with single-line diagrams and include the following:
1. Quantities of outside, supply, return, and exhaust airflows.
2. Water and steam flow rates.
3. Duct, outlet, and inlet sizes.
4. Pipe and valve sizes and locations.
5. Balancing stations.

G. Air-Handling Unit Test Reports: For air-handling units with coils, include the following:
1. Unit Data: Include the following:
    a. Unit identification.
    b. Location.
    c. Make and type.
    d. Model number and unit size.
    e. Manufacturer's serial number.
    f. Unit arrangement and class.
    g. Discharge arrangement.
    h. Sheave make, size in inches, and bore.
    i. Sheave dimensions, center to-center and amount, of adjustments in inches.
    j. Number of belts, make, and size.
    k. Number of filters, type, and size.
2. Motor Data: Include the following:
    a. Make and frame type and size.
    b. Horsepower and RPM.
    c. Volts, Phase, and Hertz.
    d. Full-load amperage and service factor.
    e. Sheave make, size in inches, and bore.
    f. Sheave dimensions, center to-center and amount, of adjustments in inches.
3. Test Data: Include design and actual values for the following:
    a. Total airflow rate in CFM.
    b. Total system static pressure in Inches W.G.
    c. Fan RPM.
    d. Discharge static pressure in Inches W.G.
    e. Filter static-pressure differential in Inches W.G.
    f. Preheat coil static-pressure differential in Inches W.G.
    g. Cooling coil static-pressure differential in Inches W.G.
    h. Heating coil static-pressure differential in Inches W.G.
    i. Outside airflow in CFM.

j. Return airflow in CFM.
k. Outside-air damper position.
l. Return-air damper position.
m. Vortex damper position.

H. Apparatus-Coil Test Reports: For apparatus coils, include the following:
1. Coil Data: Include the following:
a. System identification.
b. Location.
c. Coil type.
d. Number of rows.
e. Fin spacing in fins per inch.
f. Make and model number.
g. Face area in Sq. Ft.
h. Tube size in NPS.
i. Tube and fin materials.
j. Circuiting arrangement.
2. Test Data: Include design and actual values for the following:
a. Airflow rate in CFM.
b. Average face velocity in FPM.
c. Air pressure drop in Inches W.G.
d. Outside-air, wet- and dry-bulb temperatures in deg. F.
e. Return-air, wet- and dry-bulb temperatures in deg. F.
f. Entering-air, wet- and dry-bulb temperatures in deg. F.
g. Leaving-air, wet- and dry-bulb temperatures in deg. F.
h. Water flow rate in GPM.
i. Water pressure differential in Feet of Head or PSIG.
j. Entering-water temperature in deg. F.
k. Leaving-water temperature in deg. F.
l. Refrigerant expansion valve and refrigerant types.
m. Refrigerant suction pressure in PSIG.
n. Refrigerant suction temperature in deg. F.
o. Inlet steam pressure in PSIG.

I. Fan Test Reports: For supply, return, and exhaust fans, include the following:
1. Fan Data: Include the following:
a. System identification.
b. Location.
c. Make and type.
d. Model number and size.
e. Manufacturer's serial number.
f. Arrangement and class.
g. Sheave make, size in inches, and bore.
h. Sheave dimensions, center to-center and amount, of adjustments in inches.
2. Motor Data: Include the following:
a. Make and frame type and size.
b. Horsepower and RPM.
c. Volts, Phase, and Hertz.
d. Full-load amperage and service factor.
e. Sheave make, size in inches, and bore.
f. Sheave dimensions, center to-center and amount, of adjustments in inches.

g. Number of belts, make, and size.

3. Test Data: Include design and actual values for the following:
   a. Total airflow rate in CFM.
   b. Total system static pressure in Inches W.G.
   c. Fan RPM.
   d. Discharge static pressure in Inches W.G.
   e. Suction static pressure in Inches W.G.

J. Round and Rectangular Duct Traverse Reports: Include a diagram with a grid representing the duct cross-section and record the following:
   1. Report Data: Include the following:
      a. System and air-handling unit number.
      b. Location and zone.
      c. Traverse air temperature in deg. F.
      d. Duct static pressure in Inches W.G.
      e. Duct size in Inches.
      f. Duct area in Sq. Ft.
      g. Design airflow rate in CFM.
      h. Design velocity in FPM.
      i. Actual airflow rate in CFM.
      j. Actual average velocity in FPM.
      k. Barometric pressure in PSIG.

K. Air-Terminal-Device Reports: For terminal units, include the following:
   1. Unit Data: Include the following:
      a. System and air-handling unit identification.
      b. Location and zone.
      c. Test apparatus used.
      d. Area served.
      e. Air-terminal-device manufacturer.
      f. Air-terminal-device number from system diagram.
      g. Air-terminal-device type and model number.
      h. Air-terminal-device size.
      i. Air-terminal-device effective area in Sq. Ft.
   2. Test Data: Include design and actual values for the following:
      a. Airflow rate in CFM.
      b. Air velocity in FPM.
      c. Preliminary airflow rate as needed in CFM.
      d. Preliminary velocity as needed in FPM.
      e. Final airflow rate in CFM.
      f. Final velocity in FPM.
      g. Space temperature in deg. F.

L. System-Coil Reports: For reheat coils and water coils of terminal units, include the following:
   1. Unit Data: Include the following:
      a. System and air-handling unit identification.
      b. Location and zone.
      c. Room or riser served.
      d. Coil make and size.
      e. Flow-meter type.
   2. Test Data: Include design and actual values for the following:
      a. Airflow rate in CFM.

b. Entering-water temperature in deg. F.
c. Leaving-water temperature in deg. F.
d. Water pressure drop in Feet of Head or PSIG.
e. Entering-air temperature in deg. F.
f. Leaving-air temperature in deg. F.

M. Instrument Calibration Reports: For instrument calibration, include the following:
1. Report Data: Include the following:
a. Instrument type and make.
b. Serial number.
c. Application.
d. Dates of use.
e. Dates of calibration.

3.13 ADDITIONAL TESTS

A. Within 90 days of completing testing, adjusting, and balancing. Perform additional testing and balancing to verify that balanced conditions are being maintained throughout and to correct unusual conditions.

B. Seasonal Periods: If initial testing, adjusting, and balancing procedures were not performed during near-peak summer and winter conditions, perform additional inspections, testing, and adjusting during near-peak summer and winter conditions.

C. Duct Leakage Testing:

1. Perform duct pressure/leakage testing on newly constructed ductwork.
2. Verify that proper test methods are used and that leakage rates are within specified tolerances per section 23 3113.
3. Report any deficiencies observed.

END OF SECTION 23 0593

SECTION 23 0700

HVAC INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Extent of HVAC insulation required by this section is indicated on drawings and schedules, and by requirements of this section, and includes the following:
   1. Piping Systems Insulation:
      a. Fiberglass.
      b. Calcium Silicate.
      c. Flexible Unicellular.
   2. Ductwork System Insulation:
      a. Fiberglass.
      b. Flexible Unicellular.
   3. Equipment Insulation:
      a. Fiberglass.
      b. Calcium Silicate.
      c. Flexible Unicellular.
   4. Acoustical Insulation:
      a. Fiberglass.

1.02 RELATED SECTIONS

A. Refer to Division 23 Section "Supports and Anchors" for protection saddles, protection shields, and thermal hanger shields; not work of this section.

B. Refer to Division 23 Section "HVAC Identification" for installation of identification Devices for piping, ductwork, and equipment; not work of this section.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for each type of HVAC insulation. Submit schedule showing manufacturer's product number, K-value, thickness, and furnished accessories for each HVAC system requiring insulation.

B. Maintenance Data: Submit maintenance data and replacement material lists for each type of HVAC insulation. Include this data and product data in maintenance manual.

1.04 QUALITY ASSURANCE

A. Flame/Smoke Ratings: Provide composite mechanical insulation (insulation, jackets, coverings, sealers, mastics, and adhesives) with flame-spread index of 25 or less, and smoke-developed index of 50 or less, as tested by ASTM E 84 (NFPA 255) method.

B. As a minimum, insulation shall meet installed conductance as set forth in Title 24 California Code of Regulations (CCR) 2022 Building Energy Efficiency Standards or as indicated in contract documents, whichever is greater.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver insulation, coverings, cements, adhesives, and coatings to site in containers with manufacturer's stamp or label, affixed showing fire hazard indexes of products.

B. Protect insulation against dirt, water, and chemical and mechanical damage. Do not install damaged or wet insulation; remove from project site.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
   1. Owens-Corning Fiberglas Corp.
   2. Manville Products Corp.
   3. CertainTeed Corp.
   4. Armstrong World Industries, Inc.
   5. Knauf Fiber Glass GmbH.

2.02 PIPING INSULATION MATERIALS

A. Fiberglass (Mineral Fiber) Piping Insulation: ASTM C547, Class 1 unless otherwise indicated. Manville Products Corp. Micro-Lok, Owens-Corning Fiberglas Corp., ASJ/SL-II or equivalent.

B. Calcium Silicate Piping Insulation: ASTM C533, Type I. Owens-Corning Fiberglass Corp. "Kaylo Asbestos Free" or equivalent.

C. Flexible Unicellular Piping Insulation: ASTM C534, Type I. Armstrong World Industries, Inc. meeting ASTM E-84 25/50 index.

D. Jackets for Piping Insulation: ASTM C921, Type I (Vapor Barrier) for piping with temperatures below ambient. (Type II (Water Vapor Permeable) for piping with temperatures above ambient. Type I may be used for all piping at Installer's option.
   1. Encase pipe fittings insulation with one-piece pre-molded PVC fitting covers, fastened as per manufacturer's recommendations. Zeston PVC Insulated fitting covers or equivalent.
   2. Encase exterior piping insulation with aluminum jacket with weather-proof construction.

E. Staples, Bands, Wires, and Cement: As recommended by insulation manufacturer for applications indicated.

F. Adhesives, Sealers, and Protective Finishes: As recommended by insulation manufacturer for applications indicated.

G. All Insulation shall be U.L. listed showing flame spread not greater than 25, nor smoke greater than 50, per NFPA 90A.

2.03 DUCTWORK INSULATION MATERIALS

A. Flexible Fiberglass Ductwork Insulation: ASTM C553, Type I, Class B-2, Owens-Corning Fiberglas Inc. un-faced duct wrap insulation, Type 100 or equivalent.
   1. Nominal thickness or equivalent to provide installed R-value as follows:
      a. 1.5" thick - Installed R = 4.2
      b. 2.0" thick - Installed R = 5.6

B. Flexible Fiberglass Ductwork Insulation: ASTM C612, with ASTM C921 Type I vapor barrier jacket. Owens/Corning Fiberglas All Service Wrap Insulation, Type 100 or equivalent:
   1. Nominal thickness or equivalent to provide an installed R-value as follows:
      a. 1.5" thick - Installed R = 4.2
      b. 2.0" thick - Installed R = 5.6

C. Ductwork Insulation Accessories: Provide staples, bands, wires, tape, anchors, corner angles and similar accessories as recommended by insulation manufacturer for applications indicated.

D. Rooftop ductwork and ductwork that are not in conditioned space or indirectly conditioned spaces are to be insulated with material to achieve minimum installed R value equal to 8.0 to meet the 2016 Building Energy Efficiency Standards. For double wall rooftop ductwork see HVAC drawings.

E. Ductwork Insulation Compounds: Provide cements, adhesives, coatings, sealers, protective finishes and similar compounds as recommended by insulation manufacturer for applications indicated.

F. All Insulation shall be U.L. listed showing flame spread not greater than 25, nor smoke greater than 50, per NFPA 90A.

2.04 EQUIPMENT INSULATION MATERIALS

A. Flexible Fiberglass Equipment Insulation: ASTM C553, Type II, Class F-1, Owens-Corning Fiberglass, Inc., Type 701 1.5 lbs/Ft3.

B. Calcium Silicate Equipment Insulation: ASTM C533, Type I, Block; Owens/Corning Fiberglass, Inc., Kaylo Asbestos Free, U-Grooved block insulation.

C. Jacketing Material for Equipment Insulation: Provide canvas jacketing material, not less than 7.8 ounces per square yard, or metal jacket at Installer's option, except as otherwise indicated.

D. Equipment Insulation Compounds: Provide adhesives, cements, sealers, mastics and protective finishes as recommended by insulation manufacturer for applications indicated.

E. Equipment Insulation Accessories: Provide staples, bands, wire, wire netting, tape corner angles, anchors and stud piping as recommended by insulation manufacturer for applications indicated.

F. All Insulation shall be U.L. listed showing flame spread not greater than 25, nor smoke greater than 50, per NFPA 90A.

2.05 ACOUSTICAL INSULATION

A. Rigid Fiberglass Insulation: ASTM C612, Class 1, Owens/Corning Fiberglass, Inc., 10 Lbs/Cu. Ft.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which HVAC insulation is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 HVAC PIPING SYSTEM INSULATION

A. Insulation Omitted: Omit insulation on the following:
   1. Hot piping within radiation enclosures
   2. Hot unions, flanges, strainers, flexible connections and expansion joints.

B. Cold Piping (40ºF to ambient):
   1. Application Requirements: Insulate the following cold HVAC piping systems:
      a. HVAC chilled water supply and return piping.
      b. Air conditioner condensate drains piping.
   2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
      a. Fiberglass: 1" thick for pipe sizes up to and including 4", 1-1/2" thick for pipe sizes over 4".
      b. Flexible Unicellular: 1/2" thick for pipe sizes up to 1-1/2" (A.C. condensate piping only).

C. Hot Low-Pressure Piping (to 250ºF.):
   1. Application Requirements: Insulate the following hot low pressure HVAC piping systems (steam piping up to 15 PSI, water piping up to 250ºF. (121ºC.).
      a. HVAC heating water supply and return piping.
   2. Insulate each piping system specified above with one of the following types and thicknesses of insulation:
      a. Fiberglass: 1" thick for pipe sizes up to and including 1", 1-1/2" thick for pipe sizes 1-1/2"; 2" thick for piping over 2".

3.03 DUCTWORK SYSTEM INSULATION

A. Insulation Omitted:
   1. Do not insulate outside air and exhaust air ductwork unless otherwise indicated.
   2. Do not insulate exhaust air ductwork unless otherwise indicated.
   3. All ductwork specified to be insulated that is located, in mechanical rooms, located on roofs or where, exposed in conditioned spaces or to weather shall be internally lined under Section 233113 "Metal Ductwork"; unless noted otherwise in these specifications or on the drawings.

B. Insulate the following with flexible fiberglass insulation, un-faced, 1.5" thickness unless otherwise noted. Firmly wrap insulation around duct work with all joints lapped a minimum of 2 inches. Secure insulation to ducts by means of 16 gauge soft-annealed galvanized wire spaced 12 inches on centers at loose ends.
   1. Warm air heating ductwork in concealed spaces, unless in ceiling plenum provide all service wrap insulation.
   2. Return air ductwork in non-conditioned concealed spaces unless in ceiling supply plenum uses all service wrap insulation.
   3. Return air ductwork located in return air ceiling plenums outside air ductwork supplying fan coil units.

C. Insulate the following with Flexible Fiberglass insulation with all service vapor barrier facing, 1.5" thickness unless noted otherwise.
   1. HVAC hot/cold mixed air ductwork between fan discharge or HVAC unit discharge, and room terminal unit.
   2. Outdoor air intake ductwork between air entrance and indoor fan inlet or indoor HVAC unit inlet.
   3. Installation:
      a. Neatly wrap insulation around ducts with all joints tightly butted together.
      b. Seal transverse joints with vapor barrier facing tab overlapping all joints 2-inches and secure with vapor barrier adhesive or outward-clinch stapes on 4-inches centers.
      c. Seal longitudinal joints with 4-inch, wide vapor barrier adhesive tape.
      d. Secure insulation to underside of ducts, 100 percent coverage, with ductwork insulation adhesive.
      e. In addition to adhesive, on underside of ducts 24-inches or greater in width, use mechanical fasteners on maximum 12-inch centers.
      f. Seal all penetrations of vapor barrier facing with vapor barrier mastic.

D. Insulate the following with Rigid Fiberglass Insulation, 2.0" thickness unless noted otherwise.
   1. HVAC and unit housings not pre-insulated at the factory or where lining has been specifically omitted.
   2. Installation: Fasten to ductwork with adhesive and pins per manufacturer's recommendations. Provide all Butt-joints with a 16 gage corner angles at corners. Seal all joints with approved duct tape.

E. Contractor's Option: Contractor may provide duct liner as set forth in Section 233113, using equivalent installed "R" values; in lieu of external duct wrap or rigid insulation as specified above unless ductwork is specifically indicated as being unlined.

F. Hot Ductwork:
   1. Application Requirements: Insulate range and hood exhaust ductwork with PABCO "Super Fire Temp" asbestos free, non-combustible fireproofing board.
      a. Provide 1 to 4-hour fire rating as indicated.
      b. Install per manufacturer's instructions.

3.04 EQUIPMENT INSULATION

A. Cold Equipment (Below Ambient Temperature):
   1. Application requirements: Insulate the following cold equipment:
      a. Refrigeration equipment, including chillers, tanks, and pumps.

b. Drip pans under chilled equipment.
c. Cold and chilled water pumps.
d. Pneumatic water tanks.

2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation:
   a. Fiberglass: 2" thick for cold surfaces above 35ºF. and 3" thick for surfaces 35ºF. and lower.

B. Hot Equipment (Above Ambient Temperature):
1. Application Requirements: Insulate the following hot equipment:
   a. Boilers (not pre-insulated at factory).
   b. Water heaters.
   c. Hot water expansion tanks.
   d. Hot water pumps.
2. Insulate each item of equipment specified above with one of the following types and thicknesses of insulation.
   a. Fiberglass: 2" thick, except 3" thick for low-pressure boilers and steam-jacketed heat exchangers.

C. Breeching and Stacks:
1. Application Requirements: Insulate the following breechings and stacks:
   a. Breechings between heating equipment outlet and stack or chimney connection, except for double wall or factory insulated breechings.

3.05 INSTALLATION OF PIPING INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation on pipe systems subsequent to installation of heat tracing, painting, testing, and acceptance of tests.

C. Install insulation materials with smooth and even surfaces. Insulated each continuous run of piping with full-length units of insulation, with a single cut piece to complete run. Do not use cut pieces or scraps abutting each other.

D. Clean and dry pipe surfaces prior to insulating. Butt insulation joints firmly together to ensure a complete and tight fit over surfaces to be covered.

E. Maintain integrity of vapor barrier jackets on pipe insulation and protect to prevent puncture or other damage.

F. Cover valves, fittings, and similar items in each piping system with equivalent thickness and composition of insulation as applied to adjoining pipe run. Install factory molded, precut or job fabricated units (at Installer's option) except where specific form or type is indicated.

G. Extend piping insulation without interruption through walls, floors, and similar piping penetrations, except where otherwise indicated.

H. Butt pipe insulation against pipe hanger insulation inserts. For hot pipes, apply 3" wide vapor barrier tape or band over the butt joints. For cold piping apply wet coat of vapor barrier lap cement on butt joints and seal joints with 3" wide vapor barrier tape or band.

3.06 INSTALLATION OF DUCTWORK INSULATION

A. General: Install insulation products in accordance with manufacturer's written instructions, and in accordance with recognized industry practices to ensure that insulation serves its intended purpose.

B. Install insulation materials with smooth and even surfaces.

C. Clean and dry ductwork prior to insulating. Butt insulation joints firmly together to ensure complete and tight fit over surfaces to be covered.

D. Maintain integrity of vapor barrier on ductwork insulation and protect it to prevent puncture and other damage.

E. Extend ductwork insulation without interruption through walls, floors, and similar ductwork penetrations, except where otherwise indicated.

F. Lined Ductwork: Except as otherwise indicated, omit insulation on ductwork where internal insulation or sound absorbing linings have been installed.

G. Ductwork Exposed to Weather: Where external insulation has been specifically indicated, protect outdoor insulation from weather by installing outdoor protective finish or jacketing as recommended by manufacturer.

H. Corner Angles: Except for oven and hood exhaust duct insulation, install corner angles on external corners of insulation on ductwork in exposed finished spaces before covering with jacketing.

3.07 INSTALLATION OF EQUIPMENT INSULATION

A. General: Install equipment thermal insulation products in accordance with manufacturer's written instructions, and in compliance with recognized industry practices to ensure that insulation serves intended purpose.

B. Install insulation materials with smooth and even surfaces and on clean and dry surfaces. Redo poorly fitted joints. Do not use mastic or joint sealer as filler for gaping joints and excessive voids resulting from poor workmanship.

C. Maintain integrity of vapor-barrier on equipment insulation and protect it to prevent puncture and other damage.

D. Do not apply insulation to equipment, breechings, or stacks while hot.

E. Apply insulation using the staggered joint method for both single and double-layer construction, where feasible. Apply each layer of insulation separately.

F. Coat insulated surfaces with layer of insulating cement, trowel in workmanlike manner, leaving a smooth continuous surface. Fill in scored block, seams, chipped edges and depressions, and cover over wire netting and joints with cement of sufficient thickness to remove surface irregularities.

G. Cover insulated surfaces with all-service jacketing neatly fitted and firmly secured. Lap seams at least 2". Apply over vapor barrier where applicable.

H. Do not insulate boiler manholes, hand-holes, cleanouts, ASME stamp, and manufacturer's nameplate. Provide neatly beveled edge at interruptions of insulation.

I. Provide removable insulation sections to cover parts of equipment which must be opened periodically for maintenance; include metal vessel covers, fasteners, flanges, frames and accessories.

J. Equipment exposed to Weather: Protect outdoor insulation from weather by installation of weather-barrier mastic protective finish, or jacketing, as recommended by the manufacturer.

3.08 ACOUSTICAL INSTALLATION

A. Install within confines of roof curbs for roof mounted air handlers and air conditioning units, and elsewhere as indicated on drawings.

B. Cut to fit snugly within curb and around duct at duct penetrations, 4" minimum thickness.

3.09 PROTECTION AND REPLACEMENT

A. Replace damaged insulation which cannot be repaired satisfactorily, including units with vapor barrier damage and moisture saturated units.

B. Protection: Insulation Installer shall advise Contractor of required protection for insulation work during remainder of construction period, to avoid damage and deterioration.

END OF SECTION 23 0700

SECTION 23 2300

REFRIGERANT PIPING

PART 1 -GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

A. This Section includes refrigerant piping used for air-conditioning applications.

B. Related Sections include the following:
1. List below only products that the reader might expect to find in this Section but are specified elsewhere.
2. Division 01 Section "Roof Accessories" for roof curbs, piping supports, and roof penetration boots.
3. Division 01 Section "Through-Penetration Fire-stop Systems" for materials and methods for sealing pipe penetrations through fire and smoke barriers.
4. Division 01 Section "Joint Sealants" for materials and methods for sealing pipe penetrations through exterior walls.
5. Division 23 Section "Supports and Anchors" for pipe supports and installation requirements.
6. Delete first subparagraph below if requirements in Division 23 Section "Common Work Results for HVAC" are sufficient.
7. Division 23 Section "HVAC Identification" for labeling and identifying refrigerant piping.
8. Division 23 Section "Meters and Gages" for thermometers and pressure gages.
9. Division 23 Section "Instrumentation and Control for HVAC" for thermostats, controllers, automatic-control valves, and sensors.

1.03 SUBMITTALS

A. Product Data: For each type of valve and refrigerant piping specialty indicated. Include pressure drop, based on manufacturer's test data, for thermostatic expansion valves, solenoid valves, and pressure-regulating valves.

B. Shop Drawings: Show layout of refrigerant piping and specialties, including pipe, tube, and fitting sizes, flow capacities, valve arrangements and locations, slopes of horizontal runs, oil traps, double risers, wall and floor penetrations, and equipment connection details. Show interface and spatial relationship between piping and equipment.
1. Refrigerant piping indicated is schematic only. Size piping and design the actual piping layout, including oil traps, double risers, specialties, and pipe and tube sizes, to ensure proper operation and compliance with warranties of connected equipment.

C. Welding Certificates: Copies of certificates for welding procedures and personnel.

D. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

E. Maintenance Data: For refrigerant valves and piping specialties to include in maintenance manuals specified in Division 01.

1.04 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to ASME Boiler and Pressure Vessel Code: Section IX; "Welding and Brazing Qualifications."

B. ASHRAE Standard: Comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration." ASHRAE 15 - Safety Code for Mechanical Refrigeration & ASHRAE 34 - Number Designation of Refrigerants.

C. ASME Standard: Comply ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes. ASME B31.5 - Refrigeration Piping. ASME B31.9 - Building Services Piping. ASTM Standard: Comply with ASTM B88 - Seamless Copper Water Tube. ASTM B280 - Seamless Copper Tube for Air Conditioning and Refrigeration Field Service. ASTM F708 - Design and Installation of Rigid Pipe Hangers.

D. UL Standard: Provide products complying with UL 207, "Refrigerant-Containing Components and Accessories, Nonelectrical"; or UL 429, "Electrically Operated Valves."

E. Comply with ARI 710 - Liquid Line Dryers. ARI 730 - Flow-Capacity Rating and Application of Suction-Line Filters and Filter-Driers.

F. Comply with AWS A5.8 - Brazing Filler Metal.

G. Comply with MSS SP58 - Pipe Hangers and Supports - Materials, Design and Manufacturer. MSS SP69 - Pipe Hangers and Supports - Selection and Application. MSS SP89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.05 COORDINATION

A. Coordinate layout and installation of refrigerant piping and suspension system components with other construction, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

B. Coordinate pipe sleeve installations for foundation wall penetrations.

C. Coordinate installation of roof curbs, equipment supports, and roof penetrations. These items are specified in Division 07 Section "Roof Accessories."

D. Coordinate pipe sleeve installations for penetrations in exterior walls and floor assemblies. Coordinate with requirements for fire-stopping specified in Division 07 Section "Through-Penetration Fire-stop Systems" for materials and methods for sealing pipe penetrations through fire and smoke barriers.

E. Coordinate pipe fitting pressure classes with products specified in related Sections.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

1.07 QUALIFICATIONS

A. Installer: Company specializing in performing the work of this section with minimum three years documented experience.

B. Design piping system under direct supervision of a Professional Engineer experienced in design of this work, licensed in one of the states of the United States of America, and employed or approved by the manufacturer of the equipment.

1.08 REGULATORY REQUIREMENTS

A. Conform to IMC ASME B31.9 for installation of piping system.

B. Products Requiring Electrical Connection: Listed and classified by UL, as suitable for the purpose indicated.

PART 2 -PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Refrigerants:
      a. Allied Signal, Inc./Fluorine Products; Genetron Refrigerants.
      b. DuPont Company; Fluorochemicals Div.
      c. Elf Atochem North America, Inc.; Fluorocarbon Div.
      d. ICI Americas Inc./ICI KLEA; Fluorochemicals Bus.
   2. Refrigerant Valves and Specialties:
      a. Climate & Industrial Controls Group; Parker-Hannifin Corp.; Refrigeration & Air Conditioning Division.
      b. Danfoss Electronics, Inc.
      c. Emerson Electric Company; Alco Controls Div.
      d. Henry Valve Company.
      e. Sporlan Valve Company.

2.02 COPPER TUBE AND FITTINGS

A. Drawn-Temper Copper Tube: ASTM B 280, Type ACR.

B. Annealed-Temper Copper Tube: ASTM B 280, Type ACR.

C. Wrought-Copper Fittings: ASME B16.22.

D. Wrought-Copper Unions: ASME B16.22.

E. Bronze Filler Metals: AWS A5.8, Classification BCuP silver/phosphorus/copper alloy with melting range 1190 to 1480 degrees F.

2.03 VALVES

A. Diaphragm Pack-less Valves: 500 PSIG working pressure and 275 deg. F. working temperature; globe design with straight-through or angle pattern; forged-brass or bronze body and bonnet, phosphor bronze and stainless-steel diaphragms, rising stem and hand-wheel, stainless-steel spring, nylon seat disc, and with solder-end connections.

B. Packed-Angle Valves: 500 PSIG working pressure and 275 deg. F. working temperature; forged-brass or bronze body, forged-brass seal caps with copper gasket, back seating, rising stem and seat, molded stem packing, and with solder-end connections.

C. Check Valves smaller than NPS 1 (DN 25): 400 PSIG operating pressure and 285 deg. F. operating temperature; cast-brass body, with removable piston, polytetrafluoroethylene seat, and stainless-steel spring; globe design. Valve shall be straight-through pattern, with solder-end connections.

D. Check Valves, NPS 1 and Larger: 400 PSIG operating pressure and 285 deg. F. operating temperature; cast-bronze body, with cast-bronze or forged-brass bolted bonnet; floating piston with mechanically retained polytetrafluoroethylene seat disc. Valve shall be straight-through or angle pattern, with solder-end connections.

E. Service Valves: 500 PSIG pressure rating; forged-brass body with copper stubs, brass caps, removable valve core, integral ball check valve, and with solder-end connections.

F. Solenoid valves below are made normally closed and normally open. Normally closed are direct acting and pilot operated. Holding coils are available in several voltages. Manual operator is optional.

G. Solenoid Valves: Comply with ARI 760; 250 deg. F. temperature rating and 400 PSIG working pressure; forged brass, with polytetrafluoroethylene valve seat, 2-way, straight-through pattern, and solder-end connections; manual operator; fitted with suitable NEMA rated enclosure of type required by location, with 1/2-inch (16-GRC) conduit adapter and [24] [120]-V, normally [closed] [open] holding coil.

H. Select one of two paragraphs below unless both are required for Project.

I. Pressure-Regulating Valves: Comply with ARI 770; pilot operated, forged brass or cast bronze, stainless-steel bottom spring, pressure-gage tapping, 24-V dc standard coil, and wrought-copper fittings for solder-end connections; suitable for refrigerant specified.

J. Pressure-Regulating Valves: Comply with ARI 770; direct acting, brass; with pilot operator, stainless-steel diaphragm, standard coil, and solder-end connection; suitable for refrigerant specified.

K. Pressure Relief Valves: Straight-through or angle pattern, brass body and disc, neoprene seat, and factory sealed and ASME labeled for standard pressure setting.

L. Thermostatic expansion valves below are factory adjusted to proper superheat settings for evaporator before shipment. Fine tuning is not normally required unless application or operation conditions are different from those anticipated.

M. Thermostatic Expansion Valves: Comply with ARI 750; brass body with stainless-steel parts; thermostatic-adjustable, modulating type; size and operating characteristics as recommended by manufacturer of evaporator, and factory set for superheat requirements; solder-end connections; with sensing bulb, distributor having side connection for hot-gas bypass line, and external equalizer line.

N. Hot-Gas Bypass Valve: Pulsating-dampening design, stainless-steel bellows and polytetrafluoroethylene valve seat; adjustable; sized for capacity equal to last step of compressor unloading; with solder-end connections.

2.04 REFRIGERANT PIPING SPECIALTIES

A. Straight- or Angle-Type Strainers: 500 PSIG working pressure; forged-brass or steel body with stainless-steel wire or brass-reinforced Monel screen of 80 to 100 mesh in liquid lines up to 1-1/8 inches, 60 mesh in larger liquid lines, and 40 mesh in suction lines; with screwed cleanout plug and solder-end connections.

B. Moisture/Liquid Indicators: 500 PSIG maximum working pressure and 200 deg. F. operating temperature; all-brass body with replaceable, polished, optical viewing window with color-coded moisture indicator; with solder-end connections.

C. Replaceable-Core Filter-Dryers: 500 PSIG maximum working pressure; heavy gage protected with corrosion-resistant-painted steel shell, flanged ring and spring, ductile-iron cover plate with steel cap screws; wrought-copper fittings for solder-end connections; with replaceable-core kit, including gaskets and the following:

D. Permanent Filter-Dryer: 350 PSIG maximum operating pressure and 225 deg. F. maximum operating temperature, steel shell and wrought-copper fittings for solder-end connections; molded-felt core surrounded by desiccant.

E. Mufflers: 500 PSIG operating pressure, welded-steel construction with fusible plug; sized for refrigeration capacity.

2.05 FLEXIBLE CONNECTORS

A. Corrugated stainless steel hose with single layer of stainless-steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure 500 PSIG.

2.06 RECEIVERS

A. Receivers, 6-Inch Diameter and Smaller: ARI 495, UL listed, steel, brazed, 400 PSIG pressure rating, with tapping for inlet, outlet, and pressure relief valve.

B. Receivers Larger Than 6-Inch Diameter: ARI 495, welded steel, tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII; 400 PSIG pressure rating, with tapping for liquid inlet and outlet valves, pressure relief valve, and liquid-level indicator.

2.07 REFRIGERANTS

A. ASHRAE 34, R-410A.

2.08 DRAIN PIPING

A. Type DWV copper with wrought, copper fittings.

PART 3 -EXECUTION

3.01 PIPING APPLICATIONS

A. Aboveground, within Building: Type ACR drawn-copper tubing.

B. Belowground for NPS 2 and Smaller: Type L annealed-copper tubing.

3.02 VALVE APPLICATIONS

A. Install diaphragm pack-less or packed-angle valves in suction and discharge lines of compressor, for gage taps at hot-gas bypass regulators, on each side of strainers.

B. Install check valves in compressor discharge lines and in condenser liquid lines on multiple condenser systems.

C. Install packed-angle valve in liquid line between receiver shutoff valve and thermostatic expansion valve for system charging.

D. Install diaphragm pack-less or packed-angle valves on each side of strainers and dryers, in liquid and suction lines at evaporators, and elsewhere as indicated.

E. Install a full-sized, three-valve bypass around each dryer.

F. Install solenoid valves upstream from each expansion valve and hot-gas bypass valve.
   1. Install solenoid valves in horizontal lines with coil at top.
   2. Electrical wiring for solenoid valves is specified in Division 26 Section. Coordinate electrical requirements and connections.

G. Install thermostatic expansion valves as close as possible to evaporator.
   1. If refrigerant distributors are used, install them directly on expansion-valve outlet.
   2. Install valve so diaphragm case is warmer than bulb.
   3. Verify proper location for bulb with valve manufacturer.
   4. Secure bulb to clean, straight, horizontal section of suction line using two bulb straps. Do not mount bulb in a trap or at bottom of the line.
   5. If external equalizer lines are required, make connection where it will reflect suction-line pressure at bulb location.

H. Install pressure-regulating and pressure relief valves as required by ASHRAE 15. Pipe pressure relief valve discharge to outside.

3.03 SPECIALTY APPLICATIONS

A. Install liquid indicators in liquid line leaving condenser, in liquid line leaving receiver, and on leaving side of liquid solenoid valves.

B. Install strainers immediately upstream from each automatic valve, including expansion valves, solenoid valves, hot-gas bypass valves, and compressor suction valves.

C. Install strainers in main liquid line where multiple expansion valves with integral strainers are used.

D. Install strainers in suction line of steel pipe.

E. Install moisture-liquid indicators in liquid lines between filter-dryers and thermostatic expansion valves and in liquid line to receiver.

F. Install pressure relief valves on ASME receivers; pipe discharge to outdoors.

G. Install replaceable-core filter-dryers in vertical liquid line adjacent to receivers and before each solenoid valve.

H. Install permanent filter-dryers in low-temperature systems, in systems using hermetic compressors, and before each solenoid valve.

I. Install solenoid valves in liquid line of systems operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems, and in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into suction line when system shuts down.

J. Install receivers, sized to accommodate pump-down charge, on systems 5 tons and larger and on systems with long piping runs.

K. Install flexible connectors at or near compressors where piping configuration does not absorb vibration.

3.04 PIPING INSTALLATION

A. Install refrigerant piping according to ASHRAE 15.

B. Install refrigeration specialties in accordance with manufacturer's instructions.

C. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient. Install piping to conserve building space and not interfere with use of space.

D. Group piping whenever practical at common elevations and locations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required.

F. Provide clearance for installation of insulation and access to valves and fittings.

G. Continuously purge piping system with nitrogen when brazing.

H. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

I. Insulate piping; refer to Section 230700.

J. Follow ASHRAE 15 procedures for charging and purging of systems and for disposal of refrigerant.

K. Locate expansion valve sensing bulb immediately downstream of evaporator on suction line.

L. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

M. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

N. Fully charge completed system with refrigerant after testing.

O. Provide electrical connection to solenoid valves.

P. Basic piping installation requirements are specified in Division 23 Section "Common Work Results for HVAC."

Q. Install piping as short and direct as possible, with a minimum number of joints, elbows, and fittings.

R. Arrange piping to allow inspection and service of compressor and other equipment. Install valves and specialties in accessible locations to allow for service and inspection.

S. Install piping with adequate clearance between pipe and adjacent walls and hangers or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full-thickness insulation. Install pipes with proper clearance between the liquid and suction lines.

T. Belowground, install copper tubing in protective watertight flexible PVC conduit. Vent conduit outdoors.

U. Install copper tubing in rigid or flexible conduit in locations where copper tubing will be exposed to mechanical injury.

V. Slope refrigerant piping as follows:
   1. Install horizontal hot-gas discharge piping with a uniform slope downward away from compressor.
   2. Install horizontal suction lines with a uniform slope downward to compressor. slope approximately 1 inch every 20 feet to better facilitate oil return.
   3. Use double-suction riser for maximum compressor efficiencies if load variation is expected.
   4. Install traps and double risers to entrain oil in vertical runs.
   5. Liquid lines may be installed level.

W. Install bypass around moisture-liquid indicators in lines larger than NPS 2.

X. Install unions to allow removal of solenoid valves, pressure-regulating valves, and expansion valves and at connections to compressors and evaporators.

Y. When brazing, remove solenoid-valve coils and sight glasses; also remove valve stems, seats, and packing, and accessible internal parts of refrigerant specialties. Do not apply heat near expansion valve bulb.

Z. Hanger, support, and anchor products are specified in Division 23 Section "Supports and Anchors."

AA. Install the following pipe attachments: Install trapeze or other pipe supports per contract document drawings and details. If details are not shown, provide:
1. Adjustable steel clevis hangers for individual horizontal runs less than 20 feet long.
2. Provide roller hangers and spring hangers for individual horizontal runs 20 feet or longer.
3. Pipe rollers for multiple horizontal runs 20 feet or longer, supported by a trapeze.
4. Spring hangers to support vertical runs.

BB. Support vertical runs at each floor.

3.05 PIPE JOINT CONSTRUCTION

A. Braze joints according to Division 23 Section "Supplementary HVAC Requirements."

B. Braze all copper to-copper joints with Silfos-5 or equal brazing materials. Do not use soft solder.

C. Fill pipe and fittings with an inert gas (nitrogen or carbon dioxide) during brazing to prevent scale formation.

3.06 FIELD QUALITY CONTROL

A. Test and inspect refrigerant piping according to ASME B31.5, Chapter VI.
1. Test refrigerant piping, specialties, and receivers. Isolate compressor, condenser, evaporator, and safety devices from test pressure.
2. Test high- and low-pressure side piping of each system at not less than the lower of the design pressure or the setting of pressure relief device protecting high and low side of system.
    a. System shall maintain test pressure at the manifold gage throughout duration of test.
    b. Test joints and fittings by brushing a small amount of soap and Glycerine solution over joint.
    c. Fill system with nitrogen to raise a test pressure of 150 PSIG or higher as required by authorities having jurisdiction.
    d. Remake leaking joints using new materials and retest until satisfactory results are achieved.

3.07 ADJUSTING

A. Adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.

B. Adjust high- and low-pressure switch settings to avoid short cycling in response to fluctuating suction pressure.

C. Adjust set-point temperature of the conditioned air controllers to the system design temperature.

D. Perform the following adjustments before operating the refrigeration system, according to manufacturer's written instructions:
   1. Open shutoff valves in condenser water circuit.
   2. Check compressor oil level above center of sight glass.
   3. Open compressor suction and discharge valves.
   4. Open refrigerant valves, except bypass valves that are used for other purposes.
   5. Check compressor-motor alignment and lubricate motors and bearings.

3.08 CLEANING

A. For copper tubing other than Type ACR, clean tubing and fittings of the approved materials with trichloroethylene.

B. Replace core of filter-dryer after system has been adjusted and design flow rates and pressures are established.

3.09 SYSTEM CHARGING

A. Charge system using the following procedures:
   1. Install core in filter-dryer after leak test but before evacuation.
   2. Evacuate entire refrigerant system with a vacuum pump to a vacuum of 500 micrometers. If vacuum holds for 12 hours, system is ready for charging.
   3. Break-vacuum with refrigerant gas, allowing pressure to build up to 2 PSIG.
   4. Charge system with a new filter-dryer core in charging line. Provide full-operating charge.

END OF SECTION 23 2300

SECTION 23 3113

METAL DUCTWORK

PART 1 -GENERAL

1.01 SECTION INCLUDES

A. Rectangular and round metal ducts and plenums for heating, ventilating, and air conditioning system from minus 2" to plus 5" Water Gage.

1.02 RELATED SECTIONS

A. Refer to other Division 23 Sections for exterior insulation of metal ductwork; not work of this section.

B. Refer to other Division 23 Sections for ductwork accessories; not work of this section.

C. Refer to other Division 23 Sections for fans and air handling units; not work of this section.

D. Refer to other Division 23 Sections for testing, adjusting, and balancing of metal ductwork systems; not work of this section.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data and installation instructions for metal ductwork materials and products.

B. Record Drawings: At project closeout, submit record drawings of installed metal ductwork and ductwork products, in accordance with requirements of Division 01.

C. Maintenance Data: Submit maintenance data and parts lists for metal ductwork materials and products. Include this data, product data, shop drawings, and record drawings in maintenance manual in accordance with requirements of Division 01.

1.04 QUALITY ASSURANCE

A. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with metal ductwork systems similar to that required for project.

B. Codes and Standards:
1. SMACNA Standards: Comply with SMACNA "HVAC Duct Construction Standards, Metal and Flexible" for fabrication and installation of metal ductwork.
2. ASHRAE Standards: Comply with ASHRAE Handbook, Equipment Volume, Chapter 1 "Duct Construction", for fabrication and installation of metal ductwork.
3. NFPA Compliance: Comply with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems" and NFPA 90B "Standard for the Installation of Warm Air Heating and Air Conditioning Systems".

C. Field Reference Manual: Have available for reference at project field office, copy of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protection: Protect shop-fabricated and factory-fabricated ductwork, accessories and purchased products from damage during shipping, storage, and handling. Prevent end damage and prevent dirt and moisture from entering ducts and fittings.

B. Storage: Where possible, store ductwork inside and protect from weather. Where necessary to store outside, store above grade and enclose with waterproof wrapping.

PART 2 -PRODUCTS

2.01 DUCTWORK MATERIALS

A. Exposed Ductwork Materials: Where ductwork is indicated to be exposed to view in occupied spaces, provide materials which are free from visual imperfections including pitting, seam marks, roller marks, stains and discolorations, and other imperfections, including those which would impair painting.

B. Sheet Metal: Except as otherwise indicated, fabricate ductwork from galvanized sheet steel complying with ASTM A653/A653M, lock forming quality, with G90 zinc coating in accordance with ASTM A653/A653M; and mill phosphatized for exposed locations.

2.02 MISCELLANEOUS DUCTWORK MATERIALS

A. General: Provide miscellaneous materials and products of types and sizes indicated or, where not otherwise indicated, provide type and size required to comply with ductwork system requirements including proper connection of ductwork and equipment.

B. Fittings: Provide radius type fittings fabricated of multiple sections with maximum 18-degree change of direction per section. Unless specifically detailed otherwise, use 45-degree laterals and 45-degree elbows for branch takeoff connections. Where 90-degree branches are indicated, provide conical type tees.

C. Screws and bolts shall be cadmium plated.

D. Duct Liner: Permacote Linacoustic (rectangular), Permacote Spiracoustic (Round), complying with Thermal Insulation Manufacturer's Association (TIMA) AHC-101; of thickness indicated. 1 inch thick; 2inches thick above roofline, unless indicated otherwise. Or approved equal.

E. Duct Liner Adhesive: Comply with ASTM C 916 "Specifications for Adhesives for Duct Thermal Insulation". Adhesive used on the project shall meet the requirements of CalGreen Section 5.504.4.1.

F. Duct Liner Fasteners: Comply with SMACNA HVAC Duct Construction Standards, Article S2.11.

G. Duct Sealant: Non-hardening, non-migrating mastic or liquid elastic sealant, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for sealing joints and seams in ductwork. Sealant used on the project shall meet the requirements of CalGreen Section 5.504.4.1.

H. Duct Cement. Non-hardening migrating mastic or liquid neoprene-based cement, type applicable for fabrication/installation detail, as compounded and recommended by manufacturer specifically for cementing fitting components, or longitudinal seams in ductwork. Cement used on the project shall meet the requirements of CalGreen Section 5.504.4.1.

I. Ductwork Support Materials: Except as otherwise indicated, provide hot-dipped galvanized steel fasteners, anchors, rods, straps, trim and angles for support of ductwork.

J. Flexible ducts: Manufacturer based upon Casco Model Silent Flex II. Equal products by Thermaflex or approved equal. Insulated flexible ductwork shall be a factory fabricated assembly composed of a high carbon spring steel wire with a non-corrosive zinc coating spiral helix permanently bound to a spun-bonded nonwoven nylon interior liner and supporting a fiberglass insulating blanket with a polyethylene jacket vapor barrier. Working pressure: + 1-1/2" W.G. minimum, complying with UL 181; with factory installed metal collar connectors, maximum length 4 feet. Suspend at maximum 2'-0" O.C.

K. Under slab Ducts: For ductwork placed in concrete slabs, or under slabs on grade, fabricate ductwork of one of the following materials:
1. Galvanized Steel.

2.03 SHOP FABRICATED LOW PRESSURE DUCTWORK

A. Shop-fabricate ductwork in 4, 8, 10 or 12-ft lengths, unless otherwise indicated or required to complete runs. Preassemble work in shop to greatest extent possible so as, to minimize field assembly of systems. Disassemble systems only to extent necessary for shipping and handling. Match-mark sections for reassembly and coordinated installation.

B. Shop-fabricate ductwork of gages and reinforcement complying with SMACNA "HVAC Duct Construction Standards". Ducts shall be fabricated of galvanized sheet metal no less than 24 Gauge.

C. Fabricate duct fittings to match adjoining ducts, and to comply with duct requirements as applicable to fittings. Except as otherwise indicated, fabricate elbows with center-line radius equal to associated duct width; and fabricate to include turning vanes in elbows where shorter radius is necessary. Limit angular tapers to 30 degrees for contracting tapers and 20 degrees for expanding tapers.

D. Fabricate ductwork with accessories installed during fabrication to the greatest extent possible. Refer to Division 23 Section "Ductwork Accessories" for accessory requirements.

E. Fabricate ductwork with duct liner in each section of duct where indicated. Laminate liner to internal surfaces of duct in accordance with instructions by manufacturers of lining and adhesive and fasten with mechanical fasteners.

2.04 FACTORY FABRICATED LOW PRESSURE DUCTWORK

A. General: At Installer's option, provide factory-fabricated duct and fittings, in lieu of shop-fabricated duct, and fittings.

B. Material: Galvanized sheet steel complying with ASTM A517, lock forming quality, with ASTM A525, G90 zinc coating, mill phosphatized.

C. Gage: 24-gage minimum for round and oval ducts and fittings, 4" through 24" diameter.

D. Elbows: One-piece construction for 90 degrees and 45-degree elbows 14" and smaller. Provide multiple gore construction for larger diameters with standing seam circumferential joint.

E. Divided Flow Fittings: 90-degree tees, constructed with saddle tap spot welded and bonded to duct fitting body.

F. Manufacturers: Subject to compliance with requirements, provide factory-fabricated ductwork of one of the following or equal:
1. Semco Mfg., Inc.
2. United Sheet Metal Div. United McGill Corp.
3. Or approved equal.

PART 3 -EXECUTION

3.01 INSPECTION

A. General: Examine areas and conditions under which metal ductwork is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF METAL DUCTWORK

A. General: Assemble and install ductwork in accordance with recognized industry practices which will achieve air-tight (5% leakage for systems rated 3" and under; 1% for systems rated over 3") and noiseless (no objectionable noise) systems capable of performing each indicated service. Install each run with minimum number of joints. Align ductwork accurately at connections, within 1/8" misalignment tolerance and with internal surfaces smooth. Support ducts rigidly with suitable ties, braces, hangers and anchors of type, which will hold ducts true-to-shape, and to prevent buckling. Support vertical ducts at every floor.

B. Field Fabrication: Complete fabrication of work at project as necessary to match shop-fabricated work and accommodate installation requirements.

C. Routing: Locate ductwork runs, except as otherwise indicated, vertically and horizontally and avoid diagonal runs wherever possible. Locate runs as indicated by diagrams, details and notations or, if not otherwise indicated, run ductwork in shortest route which does not obstruct useable space or block access for servicing building and its equipment. Hold ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building. Limit clearance to 1/2" where furring is shown for enclosure or concealment of ducts, but allow for insulation thickness, if any.

Where possible, locate insulated ductwork for 1" clearance outside of insulation. Wherever possible in finished and occupied spaces, conceal ductwork from view, by locating in mechanical shafts, hollow wall construction or above suspended ceilings. Do not encase horizontal runs in solid partitions, except as specifically shown. Coordinate layout with suspended ceiling and lighting layouts and similar finished work.

D. Electrical Equipment Spaces: Do not route ductwork through transformer vaults and their electrical equipment spaces and enclosures.

E. Penetrations: Where ducts pass through interior partitions and exterior walls, and are exposed to view, conceal space between construction opening and duct or duct insulation with sheet metal flanges of same gage as duct. Overlap opening on 4 sides by at least 1-1/2". Fasten to duct and substrate.

F. Where ducts pass through fire-rated floors, walls, or partitions, provide fire stopping between duct and substrate.

G. Coordination: Coordinate duct installations with installation of accessories, dampers, coil frames, equipment, controls, and other associated work of ductwork system.

H. Installation: Install metal ductwork in accordance with SMACNA HVAC Duct Construction Standards.

3.03 INSTALLATION OF DUCT LINER

A. General: Install duct liner in accordance with SMACNA HVAC Duct Construction Standards.

3.04 INSTALLATION OF FLEXIBLE DUCT

A. Maximum Length: For any duct run using flexible ductwork, do not exceed 8'-0" extended length.

B. Installation: Install in accordance with Section III of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".

C. Bends in flexible ducts shall have a radius of not less 1.5 times the internal diameters.

3.05 EQUIPMENT CONNECTIONS

A. General: Connect metal ductwork to equipment as indicated; provide flexible connection for each ductwork connection to equipment mounted on vibration isolators, and/or equipment containing rotating machinery. Provide access doors as indicated.

3.06 ADJUSTING AND CLEANING

A. Clean ductwork internally, unit by unit as it is installed, of dust and debris. Clean external surfaces of foreign substances, which might cause corrosive deterioration of metal or, where ductwork is to be painted, might interfere with painting or cause paint deterioration.

B. Temporary closure: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, or the period of rough installation, or during storage on the construction site and until final startup of the heating and cooling equipment, provide temporary closure of duct openings and protection of mechanical equipment during construction. All duct and other related air distribution component openings shall be covered with polyethylene film, tape, plastic, sheet metal or other methods acceptable to the enforcing agency which will prevent entrance of dust and debris.

C. Balancing: Refer to Division 23 Section "Testing, Adjusting and Balancing" for air distribution balancing of metal ductwork; not work of this section. Seal any leaks in ductwork that become apparent in balancing process.

END OF SECTION 23 3113

SECTION 23 3300

DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Types of ductwork accessories required for project include the following:
   1. Dampers.
      a. Low pressure manual dampers.
      b. Control dampers.
      c. Counterbalanced relief dampers.
   2. Fire and smoke dampers.
   3. Turning vanes.
   4. Duct hardware.
   5. Duct access doors.
   6. Flexible connections.

1.02 RELATED SECTIONS

A. Refer to other Division 23 Sections for testing, adjusting, and balancing of ductwork accessories; not included in work of this section.

B. Division 23 Section "Metal Ductwork."

C. Division 23 Section "HVAC Identification."

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for each type of ductwork accessory including dimensions, capacities, and materials of construction; and Installation Instructions.

1.04 QUALITY ASSURANCE

A. Codes and Standards:
   1. SMACNA Compliance: Comply with applicable portions of SMACNA "HVAC Duct Construction Standards, Metal and Flexible".
   2. Industry Standards: Comply with ASHRAE recommendations pertaining to construction of ductwork accessories, except as otherwise indicated.
   3. UL Compliance: Construct, test, and label fire dampers in accordance with UL Standard 555 "Fire Dampers and Ceiling Dampers".
   4. Fire dampers shall bear California State Fire Marshal Listing Number.
   5. NFPA Compliance: Comply with applicable provisions of NFPA 90A "Air Conditioning and Ventilating Systems", pertaining to installation of ductwork accessories.

PART 2 - PRODUCTS

2.01 DAMPERS

A. Manufacturers: Subject to compliance with requirements set forth in constriction documents, provide dampers of one of the following:
   1. Ruskin Manufacturing Co.
   2. Air Balance Co.
   3. Pottorff Company, Inc.

B. Low Pressure Manual Dampers: Provide dampers of single blade type and of multi-blade type, constructed in accordance with SMACNA "HVAC Duct Construction Standards". "Jiffy" type dampers are not acceptable.

2.02 BACKDRAFT DAMPERS

A. General: Provide back-draft dampers of types and sizes indicated. Construct casings of 0.090-thickness aluminum with mitered corners.

B. Blades, 0.025" formed aluminum with extruded vinyl edge seals. Bearings, Zytel. Linkage, 1/8" x 1/8" aluminum tie bars concealed in frame.

C. Counterbalance: Zinc plated bar on blades (except top blade). Adjustable for final setting Mill finish

D. Control Dampers: Refer to Division 23 section "Sequence of Operation" for control dampers; not work of this section.

E. Counterbalanced Relief Dampers: Provide dampers with parallel blades, counterbalanced and factory-set to relieve at indicated static pressure. Construct blades of 16-ga aluminum provide 1/2" diameter ball bearings, 1/2" diameter steel axles spaced on 9" centers. Construct frame of 2" x 1/2" x 1/8" steel channel for face areas 25 sq. ft. and under; 4" x 1-1/2" x 16-ga channel for face areas over 25 sq. ft. Provide galvanized steel finish on frame with aluminum touch-up.

F. Manufacturer: Subject to compliance with requirements, provide dampers of one of the following:
   1. Air Balance, Inc.
   2. Ruskin Mfg. Co.
   3. Pottorff Company, Inc.

2.03 FIRE AND SMOKE DAMPERS

A. California State Fire Marshal approved, designed, and constructed in accordance with NFPA 90A and UL Standard 555 and bear stamp showing compliance.

B. Fire Dampers: Provide fire dampers, of types and sizes indicated. Construct casings of 11-ga galvanized steel. Provide fusible link rated at 160 to 165 degrees F. (71 to 74 degrees C.) (unless otherwise indicated.) Provide damper with positive lock in closed position, and with the following additional features.
   1. Damper Blade Assembly: Curtain type.

C. Manufacturer: Subject to compliance with requirements, provide fire and smoke dampers of one of the following:
   1. Air Balance, Inc.
   2. Ruskin Mfg. Co.
   3. Pottorff Company, Inc.

2.04 TURNING VANES

A. Manufactured Turning Vanes: Provide turning vanes constructed of 1-1/2" wide curved blades set at 3/4" O.C., supported with bars perpendicular to blades set at 2" O.C., and set into side strips suitable for mounting in ductwork.

B. Acoustic Turning Vanes: Provide acoustic turning vanes constructed of airfoil shaped aluminum extrusion with perforated faces and fiberglass fill.

C. Manufacturer: Subject to compliance with requirements, provide turning vanes of one of the following:
   1. Aero Dynen Co.
   2. Airsan Corp.
   3. Anemostat Products Div.; Dynamics Corp. of America
   4. Barber-Colman Co.
   5. Duro Dyne Corp.
   6. Environmental Elements Corp. Subs, Koppers Co., Inc
   7. Hart & Cooley Mfg. Co.
   8. Register & Grille Mfg. Co., Inc.
   9. Souther, Inc.

2.05 DUCT HARDWARE

A. General: Provide duct hardware, manufactured by one manufacturer for all items on project, for the following:
   1. Test Holes: Provide in ductwork at fan inlet and outlet, and elsewhere as indicated, duct test holes, consisting of slot and cover, for instrument tests.
   2. Quadrant Locks: Provide for each damper, quadrant lock device on one end of shaft; and end bearing plate on other end for damper lengths over 12". Provide extended quadrant locks and end extended bearing plates for externally insulated ductwork.

B. Manufacturer: Subject to compliance with requirements, provide duct hardware of one of the following:
   1. Ventfabrics, Inc.
   2. Young Regulator Co.

2.06 DUCT ACCESS DOORS

A. General: Provide duct access doors where required.

B. Construction: Construct of same or greater gage as ductwork served, provide insulated doors for insulated ductwork. Provide flush frames for un-insulated ductwork, extended frames for externally insulated duct. Provide one side hinged and other side with one handle-type latch for doors 12" high and smaller, 2 handle-type latches for larger doors.

C. Manufacturer: Subject to compliance with requirements, provide duct access doors of one of the following:
   1. Air Balance Inc.
   2. Duro Dyne Corp.
   3. Register & Grille Mfg. Co., Inc.
   4. Ruskin Mfg. Co.
   5. Ventfabrics, Inc.
   6. Zurn Industries, Inc.; Air Systems Div.

2.07 FLEXIBLE CONNECTORS

A. General: Provide flexible duct connections wherever ductwork connects to vibration-isolated equipment. Construct flexible connections of neoprene-coated flameproof fabric crimped into duct flanges for attachment to duct and equipment. Make airtight joint. Provide adequate joint flexibility to allow for thermal, axial, transverse, and torsional movement, and also capable of absorbing vibration of connected equipment.

B. Manufacturer: Subject to compliance with requirements, provide flexible connections of one of the following:
   1. American/Elgen Co.; Energy Div
   2. Duro Dyne Corp.
   3. Flexaust (The) Co
   4. Ventfabrics, Inc.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which ductwork accessories will be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION OF DUCTWORK ACCESSORIES

A. Install ductwork accessories in accordance with manufacturer's installation instructions, with applicable portions of details of construction as shown in SMACNA standards, and in accordance with recognized industry practices to ensure that products serve intended function.

B. Install turning vanes in square or rectangular 90-degree elbows in supply and exhaust air systems, and elsewhere as indicated.

C. Install access doors to open against system air pressure, with latches operable from either side, except outside only where duct is too small for person to enter.

D. Coordinate with other work, including ductwork, as necessary to interface installation of ductwork accessories properly with other work.

3.03 FIELD QUALITY CONTROL

A. Operate install ductwork accessories to demonstrate compliance with requirements. Test for air leakage while system is operating. Repair or replace faulty accessories, as required to obtain proper operation and leak proof performance.

3.04 ADJUSTING AND CLEANING

A. Adjusting: Adjust ductwork accessories for proper settings, install fusible links in fire dampers and adjust for proper action.
   1. Label access doors in accordance with Division 23 Section "HVAC Identification".
   2. Final positioning of manual dampers is specified in Division 23 Section "Testing, Adjusting, and Balancing".

B. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.05 EXTRA STOCK

A. Furnish extra fusible links to Owner, one link for every 10 installed of each temperature range; obtain receipt.

END OF SECTION 23 3300

SECTION 23 3423

POWER AND GRAVITY VENTILATORS

PART 1 -GENERAL

1.01 SECTION INCLUDES

A. Types of power and gravity ventilators specified in this section include the following:
   1. Power ventilators.
      a. Centrifugal roof ventilators.
      b. In-Line roof ventilators.
   2. Gravity ventilators.
      a. Hooded gravity ventilators.
   3. Prefabricated roof curbs.

1.02 RELATED SECTIONS

A. Refer to Division 23 Section "Testing, Adjusting, and Balancing" for balancing of power and gravity ventilators; not work of this section.

B. Refer to Division 23 Section "Common Motor Requirements for Mechanical Equipment."

C. Refer to Division 26 Sections for the following work; not included in work of this section:
   1. Power supply wiring from power source to power connection on ventilators. Include starters, disconnects, and required electrical devices, except where specified as furnished, or factory-installed, by manufacturer.

D. Refer to Division 23, Section “Vibration Control for HVAC.”

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical data for power and gravity ventilators, including specifications, capacity ratings, dimensions, weights, materials, accessories furnished, and installation instructions.

B. Fan curve: Submit manufacturer’s fan curve data for power ventilators.
   1. For belt driven equipment, submit graph of fan curve with system curve that indicates intended point of operation. The graph shall also indicate manufacturer’s recommended operating range of fan curve.
   2. For direct driven equipment with speed controller, submit graph of fan curve with system curve that indicates intended point of operation. The graph shall also indicate manufacturer’s recommended operating range of fan curve. On the same graph, also provide fan curves representing maximum operating RPM and minimum operating RPM utilizing manufacturer’s speed controller.
   3. For direct driven equipment, submit graph of fan curve with system curve that indicates intended point of operation. The graph shall also indicate manufacturer’s recommended operating range of fan curve.

C. Shop Drawings: Submit assembly-type shop drawings showing unit dimensions, construction details, methods of assembly of components, and field connection details.

D. Wiring Diagrams: Submit manufacturer's electrical requirements for power supply wiring to power ventilators. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field installed.

E. Maintenance Data: Submit maintenance data and parts list for each type of power and gravity ventilator, accessory, and control. Include this data, product data, shop drawings, and wiring diagrams in maintenance manual; in accordance with requirements of Division 01.

F. Exhaust fan unit equipment manufacturer shall furnish calculations showing the estimated sound power levels for each supply air, return air and unit casing radiation for each exhaust fan unit.

G. The results of the tests shall be certified by the testing agency and submitted to the Architect for approval. The report shall include the manufacturer's designation of the tested unit, a complete description of the testing conditions, the measurement procedure, and the calculated PWL values (dB re. 10^{-12} watts), and calculations showing how the sound power levels were obtained from test data.

1.04 QUALITY ASSURANCE

A. Codes and Standards:
   1. AMCA Compliance: Provide power ventilators, which have been tested and rated in accordance with AMCA standards, and bear AMCA Certified Rating Seal.
   2. UL Compliance: Provide power ventilators, which are designed, manufactured, and tested in accordance with UL 705 "Power Ventilators".
   3. NEMA Compliance: Provide motors and electrical accessories complying with NEMA Standards.

PART 2 -PRODUCTS

2.01 POWER VENTILATORS

A. General: Except as otherwise indicated, provide standard prefabricated power ventilator units of type and size indicated, modified as necessary to comply with requirements and as required for complete installation.

2.02 CENTRIFUGAL ROOF VENTILATORS (EXHAUST AND SUPPLY)

A. Centrifugal Roof Ventilators: Provide centrifugal roof type, curb mounted, power ventilators of type, size, and capacity as scheduled, and as specified herein.

B. Type: Centrifugal fan, direct or belt driven as scheduled. Provide aluminum, or fiberglass weatherproof housings as scheduled. Provide square base to suit roof curb.

C. Motors: Provide permanent split-capacitor type motor for direct driven fans; capacitor-start, induction-run type motor for belt driven fans.

D. Electrical: Provide factory-wired non-fusible type disconnect switch at motor in fan housing. Provide thermal overload protection in fan motor. Provide conduit chase within unit for electrical connection.

E. Bird Screens: Provide removable bird screen, 1/2" mesh 16-Ga. aluminum or brass wire.

F. Dampers: Provide gravity-actuated louvered dampers in curb bases unless noted to provide motorized louvered dampers with linkage in curb base.

G. Manufacturer: Subject to compliance with requirements, provide centrifugal roof ventilators of one of the following:
1. Cook Co., Loren.
2. Greenheck Fan Corp.
3. Or approved equal.

2.03 GRAVITY VENTILATORS

A. General: Except as otherwise indicated, provide standard prefabricated gravity ventilator units of type and size indicated, modified as necessary to comply with requirements, and as required for complete installation.

B. Hooded Gravity Ventilators: Provide gravity ventilators, hooded type, curb mounted, of size, type and capacity as scheduled, and as specified herein.
1. Type: Stationary, natural draft type. Provide weatherproof housings to match power ventilators in materials and finish. Provide square or rectangular base to suit roof curb.
2. Bird Screens: Provide removable bird screens, 1/2" mesh, 16-Ga. aluminum or brass wire.
3. Dampers: Provide gravity-actuated louvered dampers in curb bases.
4. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
   a. Cook Co., Loren.
   b. Greenheck Fan Corp.
   c. Or approved equal.

2.04 PREFABRICATED ROOF CURBS

A. General: Provide manufacturer's standard shop-fabricated units, modified if necessary to comply with requirements.

B. Fabricate structural framing for units of structural quality, aluminum formed to profiles indicated or, if not indicated, to manufacturer's standard profiles for coordination with roofing, insulation, and deck construction. Include 45-degree cant-strips and deck flanges with offsets to accommodate roof insulation. Weld corners and seams to form watertight units.

C. Reinforce continuous runs of over 3'-0" length by inserting welded stiffeners of heavy gage with flanges as required to provide sufficient rigidity and strength to withstand maximum lateral forces in addition to superimposed vertical loads.

D. Sloping Roof Decks: For deck slopes of 1/4" per foot and more, fabricate support units to form level top edge.

E. Gage and Height: Fabricate units of metal gage and to height above roof surface as indicated.
   1. Where gage or height is not indicated, fabricate units of 14-Ga. metal, and nominal height of 14".

F. Insulate units inside structural support wall with rigid glass fiber insulation board of approximately 3-Lb. density and 1-1/2" minimum thickness, except as otherwise indicated.

G. Provide support liners where shown.
   1. Use perforated metal for support liners, with approximately 1000, 3/32" diameter holes per Sq. Ft., to provide sound absorbing surfaces.
   2. Provide sound insulation insert for curbs so indicated. Construct of 1" thick rigid fiberglass panels secured in galvanized steel framework, with rounded edges to minimize airflow resistance.

H. Manufacturer: Subject to compliance with requirements, provide prefabricated roof curbs of the same manufacturer as ventilator.

PART 3 -EXECUTION

3.01 INSPECTION

A. General: Examine areas and conditions under which power and gravity ventilators are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION OF POWER AND GRAVITY VENTILATORS

A. General: Except as otherwise indicated or specified, install power ventilators in accordance with manufacturer's installation instructions and recognized industry practices to ensure that products serve the intended function.

B. Coordinate ventilator work with work of roofing, walls, and ceilings, as necessary for proper interfacing.

C. Ductwork: Refer to Division 23, Section "Metal Ductwork." Connect ducts to ventilators in accordance with manufacturer's installation instructions.

D. Roof Curbs: Furnish roof curbs to roofing Installer for installation.

E. Electrical Wiring: Install electrical devices furnished by manufacturer but not specified to be factory-mounted. Furnish copy of manufacturer's wiring diagram submittal to Electrical Installer.
   1. Verify that electrical wiring installation is in accordance with manufacturer's submittal and installation requirements of Division 26 Sections.
   2. Verify proper rotation direction of fan wheels. Do not proceed with equipment start-up until wiring installation is acceptable to equipment installer.

F. Remove shipping bolts and temporary supports within ventilators. Adjust dampers for free operation.

3.03 FIELD QUALITY CONTROL

A. Testing: After installation of ventilators has been completed, test each ventilator to demonstrate proper operation of unit at performance requirements specified. When possible, field correct malfunctioning units, and then retest to demonstrate compliance. Replace units, which cannot be satisfactorily corrected.

3.04 ADJUSTING AND CLEANING

A. Cleaning: Clean factory-finished surfaces. Repair any marred or scratched surfaces with manufacturer's touch-up paint.

3.05 SPARE PARTS

A. General: Furnish to Owner, with receipt, one spare set of belts for each belt driven power ventilator.

END OF SECTION 23 3423

SECTION 23 3713

AIR OUTLETS AND INLETS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Types of outlets and inlets required for project include the following:
   1. Linear slot diffusers and returns.
   2. Ceiling air diffusers, rectangular, square, round.
   3. Wall registers and grilles.

1.02 RELATED SECTIONS

A. Refer to other Division 23 Sections for ductwork and duct accessories required in conjunction with air outlets and inlets; not work of this section.

B. Refer to other Division 23 Sections for balancing of air outlets and inlets; not work of this section.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data for air outlets and inlets including the following:
   1. Schedule of air outlets and inlets indicating drawing designation, room location, quantity furnished, model number, size, and accessories furnished.
   2. Data sheet for each type of air outlet and inlet, and accessory furnished indicating construction, finish, and mounting details.
   3. Performance data for each type of air outlet and inlet furnished, including aspiration ability, temperature, and velocity traverses; throw and drop; and noise criteria ratings. Indicate selections on data.
   4. ANSI/ASHRAE Standard 70-1991.

B. Shop Drawings: Submit manufacturer's assembly-type shop drawing for each type of air outlet and inlet, indicating materials and methods of assembly of components.

C. Maintenance Data: Submit maintenance data, including cleaning instructions for finishes, and spare parts lists. Include this data, product data, and shop drawings in maintenance manuals; in accordance with requirements of Division 01.

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver air outlets and inlets wrapped in factory-fabricated fiberboard type containers. Identify on outside of container type of outlet or inlet and location to be installed. Avoid crushing or bending and prevent dirt and debris from entering and settling in devices.

B. Store air outlets and inlets in original cartons and protect from weather and construction work traffic. Where possible, store indoors, when necessary to store outdoors, store above grade and enclose with waterproof wrapping.

1.05 QUALITY ASSURANCE

A. Codes and Standards:
   1. ANSI/ASHRAE Compliance: Test and rate air outlets and inlets in certified laboratories under requirements of ANSI/ASHRAE Standard 70-1991.
   2. NFPA Compliance: Install air outlets and inlets in accordance with NFPA 90A "Standard for the Installation of Air Conditioning and Ventilating Systems".

PART 2 - PRODUCTS

2.01 CEILING AIR DIFFUSERS

A. General: Except as otherwise indicated, provide manufacturer's standard ceiling air diffusers where shown; of size, shape, capacity and type indicated; constructed of materials and components as indicated, and as required for complete installation.

B. Performance: Provide ceiling air diffusers that have, as minimum, temperature and velocity traverses, throw and drop, and noise criteria ratings for each size device as listed in manufacturer's current data.

C. Ceiling Compatibility: Provide diffusers with border styles that are compatible with adjacent ceiling systems, and that are specifically manufactured to fit into ceiling module with accurate fit and adequate support. Refer to general construction drawings and specifications for types of ceiling systems, which will contain each type of ceiling air diffuser.

2.02 MANUFACTURER

A. Subject to compliance with requirement diffusers of one of the following:
   1. Krueger Mfg. Co.
   2. Titus Air Distribution Products
   3. Anemostat Air Distribution Products

B. Manufacturers and model numbers are listed and/or scheduled to set a standard of quality. Equivalent manufacturers and models accepted by Architect/Engineer may be used. Equivalents must be for review.
   1. Equivalents: Other manufacturers offering a similar product which is in accordance with the design criteria indicated may be submitted upon architect’s written acceptance prior to bidding. The cost to conduct all tests as may be directed by the architect to demonstrate that the equivalent product can achieve the criteria indicated, including all travel costs, shall be borne by the submitting contractor.

2.03 LINEAR SLOT DIFFUSER AND RETURN

A. General: Provide acoustical ceiling air distribution system. Consisting of ceiling slot air diffusers, base-frames, air chambers and entry collars.

B. Air Distribution Base Frames:
   1. Linear air diffusers base frames shall mechanically lock into the grid system. The base frames shall be extruded aluminum sections. Length shall be 48" unless otherwise noted or required.

2. Provide air distribution base frame with full supply air pattern control air weir gates. When used for return air, these air weir gates act as a return airflow control damper. Close air weir gates where return is not necessary.
3. Base frame shall present a substantially uniform appearance through the air slot when used as supply, returns, or fully closed. All interior portions of the throat, including the vertical stems of the extrusions, shall be painted flat black to prevent unsightly visual deviations. Paint all exposed surfaces baked white enamel. Base frame shall be compatible with type of ceiling where linear slot diffuser is installed.
4. Base frame shall be provided with spacer channels located on the ceiling module. The spacer channel shall act as the support means for the adjustable full pattern control air weir gates, which are provided throughout the entire length of the base frame.
5. The noise criteria of the air distribution base frame shall be expressed in sound power levels (decibels 10-12 watts) in octave bands 2 through 7 with a room attenuation of 10 decibels and shall not exceed noise-criteria of 30. All data shall be based on tests performed in a certifiedlaboratory.
6. Where noted on drawings or as required, blank-off airtight backside of supply air linear slot where duct connection is not made.

C. Supply or Return Air Chambers:
1. Supply or Return air plenum chambers shall be designed, tested, and fabricated by the same manufacturer that furnishes the base frames. Shop fabricated air chambers not acceptable. Provide with damper at inlet to plenum, which is accessible through face of linear diffuser for adjustment.
2. Provide adjustable air pattern controllersthat are accessible through the base frame slot for field adjustment of the spread of the air stream. This will be accomplished without the removal of acoustical tile.
3. Provide a round neck air entry collar sized for maximum average air entry velocity of 750 FPM. A volume damper shall be installed at connection to plenum, which is accessible through face of diffuser for adjustment.
4. Construct supply air chamber from not less than 26-gauge galvanized steel and will be lined with one- quarter inch 2 lb./cu. ft. density thermal acoustical insulating. All surfaces visible through the slot will be painted flat black.
5. Provide spring clip keepers to securely attach the chamber to the base frame when in operation. These spring clips permit releasing of the air chamber for easy relocation.
6. The supply air chamber shall have been tested as composite assembly with the linear base frame for air distribution and noise level performance. The tests shall be conducted in accordance with ANSI/ASHRAE Standard 70-1991.
7. For return air plenums above the ceiling, install Krueger Model DFRH plenum hood on all linear return air bars.

D. Manufacturer: Krueger Model DFL linear slot diffuser.

2.04 SIDEWALL SUPPLY AND RETURN REGISTERS AND GRILLES

A. Supply register - Krueger 1600.

B. Return register - Krueger 5815.

C. Return grille - Krueger 5815.

2.05 CONSTANT AIR VOLUME SYSTEM - CEILING DIFFUSERS (SUPPLY)

A. Concealed Spline - Krueger 1240-F22

B. Glued on Acoustile - Krueger 1240-F22

C. Plaster or Drywall - Krueger 1240-F22

D. 24" x 24" T-Bar - Krueger 1240-F23

Note: For 24" x 48" T-bar ceilings, coordinate with ceiling installer for auxiliary tees as required to create 24" x 24" space.

2.06 CONSTANT AIR VOLUME SYSTEM - CEILING RETURN, EXHAUST AND TRANSFER GRILLES AND REGISTERS

A. Registers shall be provided with opposed blade dampers.

B. Concealed Spline - Krueger EGC5 or EGC5-01.

C. Glued on Acoustile - Krueger EGC5 or EGC5-01.

D. Plaster or drywall - Krueger EGC5 or EGC5-01.

E. 24" x 24" T-bar - Krueger EGC5-F23 or EGC5-01-F23.

Note: For 24" x 48" T-bar ceilings, coordinate with ceiling installer for auxiliary tees as required to provide 24" x 24" space.

F. Transfer Grille - Ceiling - Same as return grilles.

2.07 VARIABLE AIR VOLUME SYSTEM - MODULAR CEILING DIFFUSERS (SUPPLY)

A. Krueger Model 1900SQ and shall have a frame style to interface with the ceiling grid system being used.

B. Manufactured from extruded aluminum. Provided with air pattern control weirs, and an integral deflection rail allowing for one- to four-way direction air flow producing uniform ceiling effect.

C. The air motion in the occupancy zone at maximum cubic feet per minute shall not exceed 50 feet per minute. Inner panel of matching acoustical tile shall provide an airtight joint.

D. Supply, Return and Exhaust Chambers:
1. Designed and fabricated by the manufacturer of the base frames. Field fabricated chambers will not be accepted. Chamber to be supplied with spring clips to attach to the base frame. Constructed from not less than 26-gauge galvanized steel and lined with 1/4" 2 LBS/CU. FT. density thermal insulation. All surfaces visible through the air slot painted flat black.

2. Chamber shall be supplied with a factory installed round entry collar for flex duct connection. Collar shall be sized for maximum average air entry velocity of 750 fpm. Chamber must be tested as a composite assembly with the base frame for air distribution and noise level performance by a certified testing laboratory. If used with side inlet, furnish, and install vertical pressure equalizing baffle.

2.08 VARIABLE AIR VOLUME SYSTEM - MODULAR CEILING RETURN

A. Krueger Model 1900SQ Return diffuser.

B. Base frame from extruded aluminum. Frame shall have fixed weirs creating a continuous one-inch closed slot. Provide opposite blade volume damper.

2.09 VARIABLE AIR VOLUME SYSTEM - TRANSFER GRILLES

A. Krueger Model 1900SQ Return diffuser.

B. Base frame from extruded aluminum. Frame shall have fixed weirs creating a continuous one-inch closed slot. Provide opposite blade volume damper.

2.10 SUPPLY, RETURN AND EXHAUST CONNECTIONS TO METAL LINEAR CEILING

A. Air Factors sheet metal air boot (eight-slot for connecting to back of metal linear ceiling with slot openings with labyrinths, as applicable) for supply, return, and exhaust. Air boot shall lock onto back of ceiling system.

2.11 CIRCULAR CEILING DIFFUSERS

A. Krueger Model RA2 circular diffuser with adjustable inner cone.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine areas and conditions under which air outlets and inlets are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. General: Install air outlets and inlets in accordance with manufacturer's written instructions and in accordance with recognized industry practices to ensure that products serve intended function.

B. Provide 12” high plenum box with 1” acoustical insulation. Refer to installation detail on plans for additional requirements.

C. Coordinate with other work, including ductwork and duct accessories, as necessary to interface installation of air outlets and inlets with other work.

D. Coordinate ceiling air diffusers, registers, and grilles, as indicated on general construction "Reflected Ceiling Plans". Unless otherwise indicated, locate units in center of acoustical ceiling module.

E. Supply outlets to provide the required air throw and spread with no apparent drafts or excessive air movement within space being supplied. Contractor to provide necessary accessories to accomplish satisfactory air distribution.

F. Provide felt, cork or rubber gasket between finish-surface and frame to prevent vibration and assure tight fit. Contractor shall be responsible for the correct location of ductwork and outlets.

G. For filler panel type-outlets the manufacturer shall coordinate his design with the ceiling suspension system being used. The Contractor and manufacturer shall match up sizes of outlets to properly fit in ceiling systems, between concrete or masonry components, between architectural items before fabrication.

H. When installing removable core type outlets, secure to frame with screws.

I. Secure outlets to ceiling suspension systems as required by Division of the State Architect.

END OF SECTION 23 3700

SECTION 23 81 20

ROOFTOP PACKAGED HEAT PUMP

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Section includes package rooftop heating and cooling units.

1.02 RELATED SECTIONS

A. Division 23
   1. Section "Common Motor Requirement for HVAC."
   2. Section "Metal Ductwork."
   3. Section "Testing, Adjusting, and Balancing."

B. Division 26
   1. Section "Electrical Connections for Equipment."

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including rated capacities at scheduled conditions of selected model clearly indicated, dimensions, required clearances, weights, furnished specialties and accessories; and installation and start-up instructions.

B. Shop Drawings:
   1. Submit shop drawings detailing the manufacturer's electrical requirements for power supply wiring for rooftop heating and cooling units. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
   2. Submit shop drawings detailing the mounting, securing, and flashing of the roof curb to the roof structure.
   3. Submit shop drawings detailing method of securing rooftop unit to roof curb to meet seismic restraint requirement.
   4. If an equal unit is being proposed to be used in lieu of the base specified unit, the contractor shall coordinate all differences as hereinafter described and note such differences on the shop drawings and incorporate all changes (if any) required by the structural and electrical engineers to accommodate the equal unit.

C. Operation and Maintenance Data: Submit maintenance data and parts list for each rooftop unit, including "trouble shooting" maintenance guide, servicing guide and preventative maintenance schedule land procedures. Include this data in maintenance manual in accordance with requirements of Division 01.

1.04 QUALITY ASSURANCE

A. Codes and Standards:
   1. Unit meets ASHRAE 90.1 minimum efficiency requirements.
   2. Unit shall be rated in accordance with AHRI Standards 210/240 and 340/360.
   3. Unit shall be designed to conform to ASHRAE 15, 2001.

4. Unit shall be UL-tested and certified in accordance with ANSI Z21.47 Standards and UL-listed and certified under Canadian standards as a total package for safety requirements.
5. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.
6. Unit casing shall be capable of withstanding 500-hour salt spray exposure per ASTM B117 (scribed specimen).
7. Unit casing shall be capable of withstanding Federal Test Method Standard No. 141 (Method 6061) 5000-hour salt spray.
8. Unit shall be designed in accordance with ISO 9001 and shall be manufactured in a facility registered by ISO 9001.
9. Roof curb shall be designed to conform to NRCA Standards.
10. Unit shall be subjected to a completely automated run test on the assembly line. The data for each unit will be stored at the factory and must be available upon request.
11. Unit shall be designed in accordance with UL Standard 1995, including tested to withstand rain.
12. Unit shall be constructed to prevent intrusion of snow and tested to prevent snow intrusion into the control box up to 40 MPH.
13. Unit shake tested to assurance level 1, ASTM D4169 to ensure shipping reliability.
14. High-Efficient Motors listed shall meet Section 313 of the Energy Independence and Security Act of 2007 (EISA 2007).
15. Unit shall meet requirements of CCR Title 24.
16. Unit shall be EER or SEER rated in accordance with ARI Standard 210-81 and California Administrative Title 24.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Handle rooftop units and components per manufacturer’s recommendations and carefully to prevent damage. Replace damaged rooftop units or components with new.

B. Store rooftop units and components in clean dry place, off the ground and protect from weather, water, and physical damage. Unit shall only be stored or positioned in the upright position.

C. Rig rooftop units to comply with manufacturer's rigging and installation instructions for unloading rooftop units and moving them to final location.

1.06 SCHEDULING AND SEQUENCING

A. Coordinate installation of roof mounting curb with roof structure.

B. Coordinate roof-opening locations for mechanical and electrical connections.

1.09 SPECIAL WARRANTY

A. Warranty on Compressor (and Heat Exchanger): Provide written warranty, signed by manufacturer, agreeing to replace/repair, within warranty period, compressors (and heat exchangers) with inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform as required; provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period. Replacement is limited to component replacement only and does not include labor for removal and reinstallation.
   1. Warranty Period: 4-year extension from date of basic 1-year warranty, See Division 01.

1.10 MAINTENANCE

A. Extra Materials: Furnish to Owner, with receipt, the following spare parts for each rooftop heating and cooling unit:
   1. One set of matched fan belts for each belt-driven fan.

PART 2 - PRODUCTS

2.01 ROOFTOP UNITS (GENERAL)

A. General Description: Outdoor, rooftop mounted, electrically controlled, heating and cooling unit utilizing a hermetic scroll compressor(s) for cooling duty and heat pump for heating duty. Factory assembled, single piece heating and cooling rooftop unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, and special features required prior to field startup.

B. Unit shall be installed in accordance with the manufacturer’s instructions.

C. Unit must be installed in compliance with local, state, and federal codes.

D. Subject to compliance with the requirements project documents provide packaged rooftop air conditioning unit of one of the following manufacturers:
   1. Carrier Corporation (Basis of Design).
   2. Trane.
   3. York.

E. Units as manufactured by Carrier are used as the basis of design and their capacities, weights, dimensions, and mechanical, structural, and electrical characteristics, compatibility with existing roof curbs and existing ductwork connection point are scheduled on the drawings and contract documents. Use of alternate units named in this spec requires owner approval. Contractor shall include such approval in their bid documents. By submitting Alternate equipment named in this specification, contractor shall bear all additional cost and responsibility associated with all additional electrical, mechanical, structural, Title-24 energy calculations. Contractor shall be responsible for resubmitting and obtaining DSA approval for all such changes. Contractor shall provide As-built drawing based on the Alternate equipment information at the project closeout.

F. Carrier units are used as the basis of design and their efficiencies are the bases of energy calculations for Title-24 compliance. Contractor submitting units by other manufacturers named in this specification as alternate shall provide the required Title-24 calculations demonstrating compliance. This effort shall be at no cost to the owner, and all required calculations shall be submitted within 14 calendar days after the award of contract. Job will be awarded on basis of specified product. Alternates must comply with the performance and features as specified within these specifications and indicated on the design documents. Any, and all additional cost due to submission of alternate units for redesign and/or increase in construction cost of other trades and/or re-submittal fee to DSA and authorities having jurisdiction shall be borne by the contractor.

2.03 OPERATING CHARACTERISTICS

A. Unit shall be capable of starting and running at 125°F. (52°C.) ambient outdoor temperature, meeting maximum load criteria of AHRI Standard 210/240 or 340/360 at ± 10% voltage.

B. Compressor with standard controls shall be capable of operation down to 30°F. (-1°C.), ambient outdoor temperatures. Accessory Low Ambient controls are available if mechanically cooling at ambient temperatures below 30°F. (-1°C.).

C. Unit shall be capable of simultaneous heating duty and defrost cycle operation when using accessory electric heaters.

D. Unit shall discharge supply air vertically or horizontally as shown on contract drawings.

E. Unit shall be factory configured for vertical supply & return configurations.

F. Unit shall be field convertible from vertical to horizontal configuration.

G. Unit shall be capable of mixed operation: vertical supply with horizontal return or horizontal supply with vertical return.

H. Electrical Requirements.
   1. Main power supply voltage, phase, and frequency must match those required by the manufacturer.

2.04 CONTROLS

A. Control Module: Unit-mounted digital panel for interlock with the energy management system for heating, cooling, and fan operation. Include the following features (Refer to construction document drawings for additional requirements):
   1. Low Ambient Lockout Control: Prevents cooling-cycle operation below 40 deg. F. outdoor air temperature.
   2. Temperature-Limit Control: Prevents occupant from exceeding preset setup temperature.
   3. Building Automation System Interface: Allows remote on-off control with setback temperature control.

2.05 UNIT CABINET

A. Unit cabinet shall be constructed of galvanized steel and shall be bonderized and coated with a pre-painted baked enamel finish on all externally exposed surfaces.

B. Unit cabinet exterior paint shall be, film thickness, (dry) 0.003 inches minimum, gloss (per ASTM D523, 60°F.): 60, Hardness: H-2H Pencil hardness.

C. Evaporator fan compartment interior cabinet insulation shall conform to AHRI Standards 210/240 or 340/360 minimum exterior sweat criteria. Interior surfaces shall be insulated with a minimum 1/2-in. thick, 1 1/2 Lb. density, flexible fiberglass insulation, neoprene coated on the air side. Aluminum foil-faced fiberglass insulation shall be used in the heat compartment. Insulation and adhesive shall meet NFPA 90A requirements for flame spread and smoke generation.

D. Base of unit shall have a minimum of three locations for thru-the-base electrical connections (factory-installed or field-installed), standard.

E. Base Rail
   1. Unit shall have base rails on a minimum of 2 sides.
   2. Holes shall be provided in the base rails for rigging shackles to facilitate maneuvering and overhead rigging.
   3. Holes shall be provided in the base rail for moving the rooftop by fork truck.
   4. Base rail shall be a minimum of 16-gauge thickness.

F. Condensate pan and connections:
   1. Shall be a sloped condensate drain pan made of a non-corrosive material.
   2. Shall comply with ASHRAE Standard 62.
   3. Shall use a 3/4-in. -14 NPT drain connection, possible either through the bottom or end of the drain pan. Connection shall be made per manufacturer's recommendations.

G. Top panel:
   1. Shall be a single piece on all 04 to 09 models. Two-piece on size 12 models.
   2. shall be removable for coil removal.

H. Electrical Connections
   1. All unit power wiring shall enter unit cabinet at a single, factory prepared, knock-out location.
   2. Thru-the-base capability.
      a. Standard unit shall have a thru-the-base electrical location(s) using a raised, embossed portion of the unit base-pan.
      b. Optional, factory approved, watertight connection method must be used for thru-the-base electrical connections.
      c. No base-pan penetration, other than those authorized by the manufacturer, is permitted.

I. Component access panels (standard).
   1. Cabinet panels shall be easily removable for servicing.
   2. Unit shall have one factory-installed, tool-less, removable, filter access panel.
   3. Panels covering control box, indoor fan, indoor fan motor, gas components (where applicable), and compressors shall have molded composite handles.
   4. Handles shall be UV modified, composite, permanently attached, and recessed into the panel.

5. Screws on the vertical portion of all removable access panels shall engage into heat resistant, molded composite collars.
6. Collars shall be removable and easily replaceable using manufacturer recommended parts.

2.06 COILS

A. Standard Aluminum/Copper Coils: on all models.
   1. Standard evaporator and condenser coils shall have aluminum lanced plate fins mechanically bonded to seamless internally grooved copper tubes with all joints brazed.
   2. Evaporator coils shall be leak tested to 150 PSIG. Pressure tested to 450 PSIG and qualified to UL 1995 burst test at 1775 PSIG.
   3. Condenser coils shall be leak tested to 150 PSIG. Pressure tested to 650 PSIG and qualified to UL 1995 burst test at 1980 PSIG.

B. Optional Pre-coated aluminum fin condenser coils: on all models.
   1. Shall have a durable epoxy-phenolic coating to provide protection in mildly corrosive coastal environments.
   2. Coating shall be applied to the aluminum fin stock prior to the fin stamping process to create an inert barrier between the aluminum fin and copper tube.
   3. Epoxy-phenolic barrier shall minimize galvanic action between dissimilar metals.

C. Optional Copper-fin evaporator and condenser coils: on all models.
   1. Shall be constructed of copper fins mechanically bonded to copper tubes and copper tube sheets.
   2. Galvanized steel tube sheets shall not be acceptable.
   3. A polymer strip shall prevent coil assembly from contacting the sheet metal coil pan to minimize potential for galvanic corrosion between coil and pan.

D. Optional E-coated aluminum-fin evaporator and condenser coils: on all models.
   1. Shall have a flexible epoxy polymer coating uniformly applied to all coil surface areas without material bridging between fins.
   2. Coating process shall ensure complete coil encapsulation of tubes, fins, and headers.
   3. Color shall be high gloss black with gloss per ASTM D523-89.
   4. Uniform dry film thickness from 0.8 to 1.2 mil on all surface areas including fin edges.
   5. Superior hardness characteristics of 2H per ASTM D3363-92A and cross hatch adhesion of 4B-5B per ASTM D3359-93.
   6. Impact resistance shall be up to 160 in.-lb (ASTM D2794-93).
   7. Humidity and water immersion resistance shall be up to minimum 1000 and 250 hours respectively (ASTM D2247-92 and ASTM D870-92).
   8. Corrosion durability shall be confirmed through testing to be no less than 1000 hours salt spray per ASTM B117-90.

2.08 BI-POLAR IONIZATION

A. Each piece of air conditioning unit, so designated on the plans, details, equipment schedules and/or specifications shall contain a plasma ion generator, and the required transformer with bipolar ionization output as noted below.

B. Effectively killing microorganisms downstream of the bipolar ionization equipment (mold, bacteria, virus, etc.).

C. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.

D. Reducing space static charges and space particle counts

E. All manufacturers shall provide documentation by an independent NELEC accredited laboratory that proves the product has minimum kill rates for the following pathogens given the allotted time and in a space condition as noted below. Manufacturers not providing the equivalent space kill rates shall not be acceptable.

1.	MS2 Bacteriophage (COVID):	99.0% in 10 minutes or less
2.	MRSA:	99.5% in 60 minutes or less
3.	E. Coli:	99.4% in 30 minutes or less
4.	H1N1:	86.6% in 60 minutes or less
5.	H1N5:	99.0% in 60 minutes or less
6.	Staphylococcus Aureus	91.5% in 60 minutes or less
7.	Aspergillus Niger:	97.1% in 60 minutes or less
8.	Candida Albicans:	36.0% in 30 minutes or less
9.	Pseudomonas Aeruginosa	99.9% in 60 minutes or less
10.	Cladosporium	97.7% in 60 minutes or less
11.	Dichobotrys Abundans	90.0% in 60 minutes or less
12.	Penicillium	95.0% in 60 minutes or less
13.	Bacillus Subtilis var Niger	89.3% in 60 minutes or less

F. The bipolar ionization system shall operate in such a manner that equal amounts of positive and negative ions are produced. Single pole ion devices shall not be acceptable.

G. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration, or dangerous conditions to the air purification system.

H. Ionization Equipment Requirements:
   1. Each plasma generator with bipolar ionization output shall include the required number of electrodes and power generators sized to the air handling equipment capacity.
   2. Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating.
   3. Ionization output when tested in the occupied space shall be between 800 to 1200 ions/cm3.
   4. Manufacturer shall demonstrate that no voltage potential exists due to exposed electrical components in the duct system or plenum. Exposed needles protruding into the air steam will not be accepted.

I. RTU Installation:
   1. Ion generators for DX Packaged Rooftop Units shall be brush type needlepoint units.
   2. similar, to Plasma Air PA600/660 series is designed to be mounted at the fan inlet.
   3. The unit shall be rated to treat up to 2,400 CFM or 6 tons nominal capacity. For airflows greater than 2,400 CFM, multiple units shall be utilized.
   4. The PA600/660 housing is made from ABS plastic, contains an LED ionization output indicating LED, and an in-line 1 Amp fuse.
   5. The unit shall contain two (2) mounting feet and shall be configured so the needles are oriented perpendicular to the flow of air entering the fan wheel.
   6. Plasma Air 660 series include integral dry contacts which indicate ionizer functionality to a Building Automation System (BAS).

J. Certifications:
   1. Bipolar ionization units shall be tested and listed by either UL or ETL according to UL Standard 867 – Electrostatic Air Cleaners and/or UL 2998 - Environmental Claim Validation Procedure (ECVP) for Zero Ozone Emissions from Air Cleaners.

K. Electrical Requirements:
   1. Ion generators shall contain a built-in power supply and operate on 24V AC and shall connect to the fan and common terminals of the air handling unit served. Ion generators requiring a loose 24V, 120V or 230V transformer or power supply shall not be accepted.
   2. Wiring, conduit, and junction boxes shall be furnished and installed by the electrical contractor within housing plenums and shall be UL and NEC NFPA 70 approved.

L. Bipolar Ionization Control Requirements:
   1. All plasma ion generators shall include internal short circuit protection, overload protection, and automatic fault reset. Manual fuse replacement shall not be accepted.
   2. Plasma ion generator shall include an external BMS interface to indicate ion generator status and alarm.

M. BMS Controls: RTU manufacturer shall provide a BACnet MS/TP Communication Interface.

2.09 REFRIGERANT COMPONENTS

A. Refrigerant circuit shall include the following control, safety, and maintenance features:
   1. Thermostatic Expansion Valve (TXV) shall help provide optimum performance across the entire operating range. Shall contain removable power element to allow change out of power element and bulb, without removing the valve body.
   2. Refrigerant filter drier on each refrigerant circuit.
   3. Service gauge connections on suction and discharge lines.
   4. Pressure gauge access through a specially designed access port in the top panel of the unit.
   5. Suction line accumulator to provide protection in all operating modes from cooling, heating and reverse cycle switching, standard on each refrigerant circuit.

B. There shall be gauge line access port in the top of the rooftop, covered by a black, removable plug.
   1. The plug shall be easy to remove and replace.
   2. When the plug is removed, the gauge access port shall enable maintenance personnel to route their pressure gauge lines.
   3. This gauge access port shall facilitate correct and accurate condenser pressure readings by enabling the reading with the compressor access panel on.
   4. The plug shall be made of a leak proof, UV-resistant, composite material.

C. Compressors
   1. Unit shall use one fully hermetic, scroll compressor for each independent refrigeration circuit.
   2. Models shall be available with single compressor designs on 04-07 models, plus additional 2 compressor (stage) models from 08-12 sizes.
   3. Compressor motors shall be cooled by refrigerant gas passing through motor windings.
   4. Compressors shall be internally protected from high discharge temperature conditions.
   5. Compressors shall be protected from an over-temperature and over-amperage conditions by an internal, motor overload device.
   6. Compressor shall be factory mounted on rubber grommets.
   7. Compressor motors shall have internal line break thermal, current overload and high-pressure differential protection.
   8. Crankcase heaters shall be utilized on all models to protect compressor with specific refrigerant charge.
   9. Compressors shall have a 5-year warranty.

D. Filter Section
   1. Filters access is specified in the unit cabinet section of this specification.
   2. Filters shall be held in place by a pivoting filter tray, facilitating easy removal and installation.
   3. Shall consist of factory-installed, low velocity, throw-away 2-in. thick fiberglass filters.
   4. Filter media shall provide minimum efficiency reporting value of MERV 8.
   5. Filters shall be standard, commercially available sizes.
   6. Only one size filter per unit is allowed.

2.10 EVAPORATOR FAN AND MOTOR

A. Evaporator fan motor:
   1. Shall have permanently lubricated bearings.
   2. Shall have inherent automatic-reset thermal overload protection or circuit breaker.
   3. Shall have a maximum continuous bhp rating for continuous duty operation; no safety factors above that rating shall be required.

B. Electric Drive (Direct Drive) X13 – 5 Speed/Torque Evaporator Fan:
   1. Multi speed motor with easy quick adjustment settings.
   2. Blower fan shall be double inlet type with forward curved blades.
   3. Shall be constructed from steel with a corrosion resistant finish and dynamically balanced.
   4. Standard on all 04-06 models.

C. Belt-driven Evaporator Fan:
   1. Belt drive shall include an adjustable pitch motor pulley.
   2. Shall use sealed, permanently lubricated ball-bearing type.
   3. Blower fan shall be double inlet type with forward curved blades.
   4. Shall be constructed from steel with a corrosion resistant finish and dynamically balanced.
   5. Standard on all 07-12 size models, optional on all 04-06 3-phase models.

2.11 CONDENSER FANS AND MOTORS

A. Condenser fan motors:
   1. Shall be a totally enclosed motor.
   2. Shall use permanently lubricated bearings.
   3. Shall have inherent thermal overload protection with an automatic reset feature.
   4. Shall use a shaft down design on all sizes.

B. Condenser Fans:
   1. Shall be a direct driven propeller type fan.
   2. Shall have aluminum blades riveted to corrosion resistant steel spiders and shall be dynamically balanced.

2.12 SAFETIES

A. Compressor overtemperature, overcurrent.

B. Loss of charge switch.
   1. Units with 2 compressors shall have different sized connectors for the circuit 1 and circuit 2 loss of charge switches. They shall physically prevent the cross-wiring of the safety switches between circuits 1 and 2.
   2. Loss of charge switch shall use different color wire than the high-pressure switch. The purpose is to assist the installer and service technician to correctly wire and or troubleshoot the rooftop unit.

C. High pressure switch.
   1. Units with 2 compressors shall have different sized connectors for the circuit 1 and circuit 2 high pressure switches. They shall physically prevent the cross-wiring of the safety switches between circuits 1 and 2.
   2. High pressure switch shall use different color wire than the low-pressure switch. The purpose is to assist the installer and service technician to correctly wire and or troubleshoot the rooftop unit.

D. Freeze protection thermostat, evaporator coil.

E. Automatic reset, motor thermal overload protector.

2.13 ELECTRONIC CONTROL

A. Shall be complete with self-contained low voltage control circuit protected by a resettable circuit breaker on the 24-V transformer side. Transformer shall have 75VA capability.

B. Shall utilize color-coded wiring.

C. Shall include a central control terminal board to conveniently, and safely provide connection points for vital control functions such as: smoke detectors, phase monitor, economizer, thermostat, DDC control options, loss of charge, freeze switch, high pressure switches.

D. Unit shall include a minimum of one 8-pin screw terminal connection board for connection of control wiring.

E. Shall include integrated defrost system to prevent excessive frost accumulation during heating duty, and shall be controlled as follows:
   1. Defrost shall be initiated on the basis-of time and coil temperature.
   2. A 30, 60, 90, 120-minute timer shall activate the defrost cycle only if the coil temperature is low enough to indicate a heavy frost condition.
   3. Defrost cycle shall terminate when defrost thermostat is satisfied and shall have a positive termination time of 10 minutes.

F. Defrost system shall also include:
   1. Defrost Cycle Indicator LED.
   2. Dip-switch selectable defrost time between 30, 60, 90 and 120 minutes. Factory set at 30 minutes.
   3. Molded plug connection to insure proper connection.

2.14 ROOF CURB

A. General: Roof Curb shall be of down-shot arrangement and shall be of an approved manufacturer as indicated on the drawings and specification section 23 0548 and shall include an insulated panel under compressor section to prevent condensation forming on the bottom. Dimensions shall be provided to allow for each duct location and connection to roof curb prior to unit placement. Roof curb shall be a minimum of 14 in. high, except otherwise noted on drawings. Curb design shall comply with National Roofing Contractors Association requirements. Roof curb must be a manufactured pitched roof curb when applicable. If the manufacturer of the roof curb cannot provide a pitched roof curb due to the excessive slope of the roof, provide a structural leveling platform, then install a level roof curb at no additional cost to the owner. Coordinate this effort with work of all other trades involved.

B. Isolation Roof Curb Type: Roof Curbs shall be of Prefabricated Isolation Curb type. Unit manufacturer shall furnish spring isolation curbs specifically designed for the air conditioning units. Isolation curb isolators must be pre-approved O.S.H.P.D. (HCAi) pre-approval number must be included with the submittal. O.S.H.P.D. (HCAi) approval numbers must be included with the submittal. Numbers subject to approval will not constitute pre-approval. Springs must be a minimum of 2" deflection with seismic restraint. Curb shall have access doors for easy inspection and adjustment of each spring without dismantling any portion of the unit or curb assembly. Isolation curb must include a vandal-proof, galvanized steel counter-flashing skirt to assure long-term air and water seal integrity. Exposed rubber skirt seals are not acceptable. Curb and flashing shall be fully welded. Field assembled and bolted construction not acceptable. Seismic attached (hold-down) clips with certified calculations by a registered California Structural Engineer shall be furnished with the isolation curb.

Installation prior to submittal approval by mechanical engineer shall be subject to removal without any cost or obligation to the Owner. The contractor shall not install any unit without written approval.

C. Roof curb must be a manufactured pitched roof curb when applicable. It the manufacturer of the roof curb cannot provide a pitched roof curb due to the excessive slope of the roof, provide a structural leveling platform at no additional cost to the owner, then install a level roof curb. Coordinate this effort with work of all other trades involved.

2.15 POWER EXHAUST AND ECONOMIZER

A. Power exhaust shall have a modulating centrifugal blower provided with variable frequency drive (VFD). Economizer control (Down-shot) shall include return air (R.A.) and outdoor air filter and hood, and fully modulating electric control system with O.A. thermostat and mixed air thermostat. Economizer control shall be capable of introducing up to 100% outdoor air. Power Exhaust shall be capable of relieving 100% of system air. The control changeover from mechanical cooling to economizer operation shall be fully automatic through an adjustable integrated control sensing pre-assigned outside air requirements. Economizer shall be integrated type capable of simultaneous compressor and economizer operation for maximum benefit of outdoor air. Economizer shall utilize low leakage, opposing blade, gear driven dampers with UL approved gears.

B. Provide economizer control for all units unless specifically indicated otherwise. Economizer shall incorporate a full-sized barometric relief that has the same face area as the outside air inlet. The relief shall be sized to relieve up to 100% relief air.

2.16 THERMOSTAT SHALL:

A. Have capability to energize 2 different stages of cooling, and 2 different stages of heating, manual and automatic changeover, fan control and integrated time delay protection.

B. Include capability for occupancy scheduling.

2.17 MANUFACTURERS

A. Subject to compliance with the requirements project documents provide packaged rooftop air conditioning unit of one of the following manufacturer's:
   1. Carrier Corporation (Basis of Design).
   2. Trane.
   3. York.

B. Carrier Corporation units are used as the basis of design and their efficiencies are the bases of energy calculations for Title-24 compliance. Contractor submitting units by other manufacturers named in this specification as alternate shall provide the required Title-24 calculations demonstrating compliance. This effort shall be at no cost to the owner, and all required calculations shall be submitted within 14 calendar days after the award of contract.

Job will be awarded on basis of specified product. Alternates must comply with the performance and features as specified within these specifications and indicated on the design documents. Any, and all additional cost due to submission of alternate units for redesign and/or increase in construction cost of other trades and/or re-submittal fee to City authorities shall be bonded by the contractor.

2.18 CONTROLS

A. Control Module: Unit-mounted digital panel for interlock with the energy management system for heating, cooling, and fan operation. Include all the following features:
   1. All requirements set forth in Control Drawings.
   2. Low Ambient Lockout Control: Prevents cooling-cycle operation below 40 deg. F. outdoor air temperature.
   3. Temperature-Limit Control: Prevents occupant from exceeding preset setup temperature.
   4. Building Automation System Interface: Allows remote on-off control with setback temperature control.

B. Remote Control: Standard unit-mounted controls with remote-mounted, low-voltage adjustable thermostat with heat anticipator, heat-off-cool-auto switch, and on-auto fan switch.

2.19 CAPACITIES AND CHARACTERISTICS

A. Outdoor Air-Intake Rate: Unit outdoor air-intake rates shall be per equipment schedules on contract document drawings.

B. Cooling Capacity: Unit cooling capacities shall be per equipment schedules on contract document drawings.

C. Energy-Efficiency Ratio: Minimum unit Energy-Efficiency (EER) or Seasonal Energy Efficiency (SEER) Ratios shall be per equipment schedule on contract document drawings.

2.20 BI-POLAR IONIZATION

A. Each piece of air handling equipment, so designated on the plans, details, equipment schedules and/or specifications shall contain a plasma ion generator with bipolar ionization output as noted below.

B. Effectively killing microorganisms downstream of the bipolar ionization equipment (mold, bacteria, virus, etc.).

C. Controlling gas phase contaminants generated from human occupants, building structure, furnishings and outside air contaminants.

D. Reducing space static charges and space particle counts.

E. All manufacturers shall provide documentation by an independent NELEC accredited laboratory that proves the product has minimum kill rates for the following pathogens given the allotted time and in a space condition as noted below. Manufacturers not providing the equivalent space kill rates shall not be acceptable.
   1. MS2 Bacteriophage (COVID): 99.0% in 10 minutes or less

2.	MRSA:	99.5% in 60 minutes or less
3.	E. Coli:	99.4% in 30 minutes or less
4.	H1N1:	86.6% in 60 minutes or less
5.	H1N5:	99.0% in 60 minutes or less
6.	Staphylococcus Aureus	91.5% in 60 minutes or less
7.	Aspergillus Niger:	97.1% in 60 minutes or less
8.	Candida Albicans:	36.0% in 30 minutes or less
9.	Pseudomonas Aeruginosa	99.9% in 60 minutes or less
10.	Cladosporium	97.7% in 60 minutes or less
11.	Dichobotrys Abundans	90.0% in 60 minutes or less
12.	Penicillium	95.0% in 60 minutes or less
13.	Bacillus Subtilis var Niger	89.3% in 60 minutes or less

F. The bipolar ionization system shall operate in such a manner that equal amounts of positive and negative ions are produced. Single pole ion devices shall not be acceptable.

G. Humidity: Plasma Generators shall not require preheat protection when the relative humidity of the entering air exceeds 85%. Relative humidity from 0 - 100%, condensing, shall not cause damage, deterioration, or dangerous conditions to the air purification system.

H. Ionization Equipment Requirements:
1. Each plasma generator with bipolar ionization output shall include the required number of electrodes and power generators sized to the air handling equipment capacity.
2. Electrodes shall be energized when the main unit disconnect is turned on and the fan is operating.
3. Ionization output when tested in the occupied space shall be between 800 to 1200 ions/cm3.
4. Manufacturer shall demonstrate that no voltage potential exists due to exposed electrical components in the duct system or plenum. Exposed needles protruding into the air steam will not be accepted.

I. RTU Installation:
1. Ion generators for DX Packaged Rooftop Units shall be brush type needlepoint units similar-to Plasma Air PA600/660 series is designed to be mounted at the fan inlet.
2. The unit shall be rated to treat up to 2,400 CFM or 6 tons nominal capacity. For airflows greater than 2,400 CFM, multiple units shall be utilized.
3. The PA600/660 housing is made from ABS plastic, contains an LED ionization output indicating LED, and an in-line 1 Amp fuse.
4. The unit shall contain two (2) mounting feet and shall be configured so the needles are oriented perpendicular to the flow of air entering the fan wheel.
5. Plasma Air 660 series include integral dry contacts which indicate ionizer functionality to a Building Automation System (BAS).

J. Certifications:
   1. Bipolar ionization units shall be tested and listed by either UL or ETL according to UL Standard 867 – Electrostatic Air Cleaners and/or UL 2998 - Environmental Claim Validation Procedure (ECVP) for Zero Ozone Emissions from Air Cleaners.

K. Electrical Requirements:
   1. Ion generators shall contain a built-in power supply and operate on 24V AC and shall connect to the fan and common terminals of the air handling unit served. Ion generators requiring a loose 24V, 120V or 230V transformer or power supply shall not be accepted.
   2. Wiring, conduit, and junction boxes shall be furnished and installed by the electrical contractor within housing plenums and shall be UL and NEC NFPA 70 approved.

L. Bipolar Ionization Control Requirements:
   1. All plasma ion generators shall include internal short circuit protection, overload protection, and automatic fault reset. Manual fuse replacement shall not be accepted.
   2. Plasma ion generator shall include an external BMS interface to indicate ion generator status and alarm.

M. BMS Controls: RTU manufacturer shall provide a BACnet MS/TP Communication Interface.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which rooftop units are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

A. General: Install rooftop units in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Support: Install and secure roof curb to roof structure, in accordance with National Roofing Contractors Association (NRCA) installation recommendations and ship drawings. Install and secure rooftop units on curbs and coordinate roof penetrations and flashing.
   1. Provide substructure as required to set curbs plumb and level.

C. Electrical Connections: Refer to Section "Electrical Connections for Equipment" for final connections to equipment and installation of loose shipped electrical components.

D. Unit protection: At ends of ducts which are not connected to equipment or air distribution devices at time of ductwork installation, or the period of rough installation, or during storage on the construction site and until final startup of the heating and cooling equipment, provide temporary closure of duct openings and protection of mechanical equipment during construction.

All duct and other related air distribution component openings shall be covered with polyethylene film, tape, plastic, sheet metal or other methods acceptable to the enforcing agency which will prevent entrance of dust and debris.

3.03 DEMONSTRATION

A. Start-Up Services:
   1. Provide the services of a factory-authorized service representative to start-up rooftop units, in accordance with manufacturer's written start-up instructions. Test controls and demonstrate compliance with requirements.
   2. Replace damaged or malfunctioning controls and equipment. Provide written start-up report for each unit.

B. Operating and Maintenance Training:
   1. Provide two (2), four-hour training classes by manufacturer's service representative to instruct Owner's personnel on how to operate and maintain the rooftop unit.
   2. Video Tape each class and provide three (3) digital copy of each class to the Owner at the end of each class.
   3. Training provided by manufacturer's service representative to instruct Owner's personnel in operation and maintenance of rooftop units shall include start-up and shutdown, servicing and preventative maintenance schedule and procedures, and trouble-shooting procedures plus procedures for obtaining repair parts and technical assistance. Review operating and maintenance data contained in the Operating and Maintenance Manuals specified in Division 01.

END OF SECTION

SECTION 23 8126

SPLIT AIR CONDITIONING SYSTEM

PART 1 -GENERAL

1.01 SECTION INCLUDES

A. Split DX cooling only and heat pump system with indoor split DX fan coil and outdoor cooling/condensing unit.

1.02 RELATED SECTIONS

A. Related sections include but are not limited to the following:
   1. Division 23
      a. Section "Common Work Results for HVAC."
      b. Section "Common Motor Requirements for HVAC Equipment."
      c. Section "Testing, Adjusting and Balancing."
      d. Section "Power and Gravity Ventilators."
   2. Division 26
      a. Section Electrical Connections for Equipment.

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical product data, including rated capacities of selected model clearly indicated, dimensions, required clearances, weights, furnished specialties and accessories; and installation and start-up instructions.

B. Shop Drawings:
   1. Submit shop drawings detailing the manufacturer's electrical requirements for power supply wiring for rooftop cooling/condensing and DX fan coil units. Submit manufacturer's ladder-type wiring diagrams for interlock and control wiring. Clearly differentiate between portions of wiring that are factory-installed and portions to be field-installed.
   2. Submit shop drawings detailing the mounting, securing, and flashing of the outdoor unit to redwood sleepers and sleepers to the roof structure. Indicate coordination requirements with roof membrane system.

C. Operation and Maintenance Data: Submit maintenance data and parts list for each split cooling system, including "trouble-shooting", maintenance guide, servicing guide and preventative maintenance schedule and procedures. Include this data in maintenance manual in accordance with requirements of Division 01.

1.04 QUALITY ASSURANCE

A. Codes and Standards:
   1. Refrigerating system construction of split cooling system shall be in accordance with ASHRAE 15 "Safety Code for Mechanical Refrigeration".
   2. Seasonal Energy Efficiency Ratio (SEER) of split cooling system shall be equal to or greater than prescribed by Title 24 California Administrative Code "Building Energy Efficiency Standards".

3. Split cooling system shall be designed, manufactured, and tested in accordance with UL requirements.

1.05 DELIVERY, STORAGE AND HANDLING

A. Handle split cooling system and components carefully to prevent damage. Replace damaged rooftop units or components with new.

B. Store split cooling system and components in clean dry place, off the ground, and protect from weather, water, and physical damage.

C. Rig outdoor units to comply with manufacturer's rigging and installation instructions for unloading outdoor units and moving them to final location.

1.06 SCHEDULING AND SEQUENCING

A. Coordinate installation of outdoor unit redwood sleepers with roof structure.

B. Coordinate roof-opening locations for mechanical and electrical connections.

1.07 SPECIAL WARRANTY

A. Warranty on Compressor: Provide written warranty, agreeing to replace/repair, including all parts and labor within warranty period, compressors with inadequate and defective materials and workmanship, including leakage, breakage, improper assembly, or failure to perform a required provided manufacturer's instructions for handling, installing, protecting, and maintaining units have been adhered to during warranty period.

B. Warranty period shall be for a period of one year from the agreed start of the District's beneficial use.

C. Extended warranty period. Provide written warranty signed by manufacturer, agreeing to replace components parts only, for an additional four (4) years for all hermetically sealed compressors.

1.08 MAINTENANCE

A. Extra Materials: Furnish to District, with receipt, the following spare parts for each split cooling system:
   1. One set of new filters for each unit set.

PART 2 -PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Provide product of one of the following manufacturers:
   1. Carrier Corp.
   2. Mitsubishi.
   3. Trane.

2.02 SPLIT COOLING SYSTEM (GENERAL)

A. Split cooling only and heat pump system shall be factory assembled and tested, consist of an indoor, wall mounted direct expansion fan coil unit and an outdoor roof mounted, air cooled unit with a hermetic compressor, an air-cooled coil, up-blast propeller type blow-through condenser fans, accumulator, holding refrigerant charge, and control box.

2.03 INDOOR UNIT

A. General: Indoor, direct-expansion, wall-mounted or ceiling-mounted fan coil. Unit shall be complete with coil, fan, fan motor, piping connectors, electrical controls, microprocessor control system, integral temperature sensing, and a holding charge of R-410A refrigerant. Unit shall be furnished with integral wall-mounting or ceiling-mounting bracket.

B. Unit Cabinet: Cabinet discharge and inlet grilles shall be attractively styled, high-impact polystyrene.

C. Fan: Shall be tangential blower type with air intake at the upper front face of the unit and discharge at the bottom front. Automatic motor-driven horizontal air sweep shall be provided standard.

D. Coil: Shall be copper tube with aluminum fins and galvanized steel tube sheets. Fins will be bonded to the tubes by mechanical expansion. A drip pan under the coil shall have a drain connection for hose attachment to remove condensate.

E. Motors: Shall be permanently lubricated with inherent overload protection. Fan motors shall be multi-speed.

F. Controls: Shall consist of a microprocessor-based control system that shall control space temperature, determine optimum fan speed, and run self-diagnostics. The unit shall have:
   1. An automatic restart after power failure at the same operating conditions as at failure.
   2. A timer-function to provide a minimum 15-hour timer cycle for system on or off.
   3. Temperature-sensing controls and a high discharge temperature shut down.
   4. Wired control or wireless infrared control to enter set points and operating controls (required accessory).
   5. Filter status indication after 250 hours of indoor fan operation.
   6. Test mode button to run self-diagnostics and aid in troubleshooting.

G. Filters: Unit shall have filter track with factory-supplied cleanable filter.

2.04 OUTDOOR UNIT

A. General: Factory assembled, single piece, air-cooled outdoor unit. Contained within the unit enclosure shall be all factory wiring, piping, controls, compressor, and holding charge of R-410A refrigerant.

B. Unit Cabinet:
   1. Unit cabinet shall be constructed of galvanized steel, bonderized and coated with a baked enamel finish.

2. Unit access panels shall be removable with minimal screws and shall provide full access to the compressor, fan, and control components.
3. Compressor compartment shall be isolated and have an acoustic lining to assure quiet operation.

C. Fans:
1. Condenser fans shall be direct-drive propeller type, discharging air horizontally, and blowing air through the condenser coil.
2. Condenser fan motors shall be totally enclosed, Single-Phase motors with class B insulation and permanently lubricated ball bearings. Motor shall be protected by internal thermal overload protection.
3. Shaft shall have inherent corrosion resistance.
4. Fan blades shall be corrosion resistant and shall be statically and dynamically balanced.
5. Condenser fan openings shall be equipped with PVC grille cover and screen protection grille.

D. Compressor:
1. Compressor shall be fully hermetic reciprocating or scroll type.
2. Compressor shall be equipped with oil system, operating oil charge, and motor. Internal overloads shall protect the compressor from over temperature and current. Scroll compressors shall also have high discharge gas temperature protection.
3. Motor shall be NEMA rated class F, suitable for operation in a refrigerant atmosphere.
4. Reciprocating compressors shall be equipped with crankcase heaters to minimize liquid refrigeration accumulation in compressor during shut down and to prevent refrigerant dilution of oil.
5. Compressor assembly shall be installed on rubber vibration isolators and shall have internal spring isolation.

E. Condenser Coil: Shall be constructed of aluminum fins mechanically bonded to internally enhanced, seamless copper tubes that are cleaned, dehydrated, and sealed.

F. Refrigeration Components: Refrigerant circuit components shall include external liquid line service valve with service port, suction line service valve with service gage connection port, service port connections on compressor suction and discharge lines with Schrader-type fittings, 4-Way valve on heat pumps, accumulator, filter drier, pressure relief, and a holding charge of refrigerant.

G. Controls and Safeties: Operating controls and safeties shall be factory selected, assembled, and tested. The minimum control function shall include:
1. Controls:
   a. Time delay restart to prevent compressor short cycling.
   b. Automatic restart on power failure.
   c. Three-pole contactors on 3-Phase units.
   d. Safety lockout.
   e. High and low-pressure switches.
   f. Automatic fan motor protection.
   g. Start capacitor and relay only on Single-Phase units.

h. When heat pump units are matched with high wall and ceiling suspended units, defrost control shall be based on demand determined by the outdoor air temperature and the coil temperature.

2. Safeties:
   a. High temperature protection.
   b. System diagnostics.
   c. Compressor motor current and temperature overload protection.
   d. High-pressure relief.
   e. Condenser fan failure protection.

H. Electrical Requirements:
   1. Unit electrical power shall be a single point connection.
   2. Unit control voltage to the indoor fan coil shall be 24V.

PART 3 -EXECUTION

3.01 EXAMINATION

A. Examine areas and conditions under which split cooling system is to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

3.02 INSTALLATION

A. General: Install split cooling system in accordance with manufacturer's installation instructions. Install units plumb and level, firmly anchored in locations indicated, and maintain manufacturer's recommended clearances.

B. Support: Install and secure redwood sleepers to roof structure, in accordance with National Roofing Contractors Association (NRCA) installation recommendations and shop drawings.

C. Electrical Connections: Refer to Division 26 Electrical Connections for Equipment for final connections to equipment and installation of loose-shipped electrical components.

3.03 DEMONSTRATION

A. Provide the services of a qualified service representative to start-up split cooling system in accordance with manufacturer's written start-up instructions. Test controls and demonstrate compliance with requirements. Replace damaged or malfunctioning controls and equipment.

END OF SECTION 23 8126

SECTION 26 0500

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements applicable to all Division 26 Sections. Also refer to Division 1 - General Requirements. This section is also applicable to Interior Communications Pathways Section 27 0528. This section is also applicable to Fire Alarm and Detection Systems Section 28 3100.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.02 REFERENCES

A. **NFPA 70 - National Electrical Code (NEC)**CEC California Electrical Code

B. CCR California Code of Regulation

C. CBC California Building Code

D. CFC California Fire Code

E. CMC California Mechanical Code

F. CPC California Plumbing Code

G. California Title 24 - Building Energy Efficiency Standards

1.03 SCOPE OF WORK

A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Electrical Systems.

B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make the portion of the Electrical Work a finished and working system.

C. Separate contracts will be awarded for the following work.

D. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.

E. Separate contracts will be awarded for the following work. The division of work listed below is for the contractors' convenience and lists a normal breakdown of the work. Please refer to the Construction Manager's scope statements for complete scope of work description.

F. Description of Systems shall be as follows:

1. Electrical power system to and including luminaires, equipment, motors, devices, etc.
2. Electrical power service system from the Utility Company to and including service entrance equipment, distribution and metering.
3. Grounding system.
4. Fire alarm system.
5. Furnish and install firestopping systems for penetrations of fire-rated construction associated with this Contractor's work.

G. Work Not Included:

1. Telecommunications cabling will be byDivision 27, in raceways and conduits furnished and installed as part of the Electrical work.
2. Temperature control wiring for plumbing and HVAC equipment (unless otherwise indicated) will be by other Contractors.

1.04 DIVISION OF WORK BETWEEN MECHANICAL, ELECTRICAL, AND CONTROL CONTRACTORS

A. Division of work is the responsibility of the Prime Contractor. Any scope of work described at any location on the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described on the contract documents on bid day. The following division of responsibility is a guideline based on typical industry practice.

B. Definitions:

1. "Mechanical Contractors" refers to the Contractors listed in Division 21/22/23 of this Specification.
2. "Technology Contractors" refers to the Contractors furnishing and installing systems listed in Division 27/28 of this Specification.
3. Motor Power Wiring: The single phase or 3 phase wiring extending from the power source (transformer, panelboard, feeder circuits, etc.) through disconnect switches and motor controllers to, and including the connections to the terminals of the motor.
4. Motor Control Wiring: The wiring associated with the remote operation of the magnetic coils of magnetic motor starters or relays, or the wiring that permits direct cycling of motors by means of devices in series with the motor power wiring. In the latter case, the devices are usually single phase, have "Manual-Off-Auto" provisions, and are usually connected into the motor power wiring through a manual motor starter.
5. Control devices such as start-stop push buttons, thermostats, pressure switches, flow switches, relays, etc., generally represent the types of equipment associated with motor control wiring.

6. Motor control wiring is single phase and usually 120 volts. In some instances, the voltage will be the same as the motor power wiring. When the motor power wiring exceeds 120 volts, a control transformer is usually used to give a control voltage of 120 volts.
7. Temperature Control Wiring: The wiring associated with the operation of a motorized damper, solenoid valve or motorized valve, etc., either modulating or two-position, as opposed to wiring that directly powers or controls a motor used to drive equipment such as fans, pumps, etc. This wiring will be from a 120-volt source and may continue as 120 volt, or be reduced in voltage (24 volt), in which case a control transformer shall be furnished as part of the temperature control wiring.
8. Control Motor: An electric device used to operate dampers, valves, etc. It may be two-position or modulating. Conventional characteristics of such a motor are 24 volts, 60 cycles, 1 phase, although other voltages may be encountered.
9. Low Voltage Technology Wiring: The wiring associated with the technology systems, used for analog or digital signals between equipment.
10. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation or mounting of telecommunications/technology information outlets.

C. General:

1. The purpose of these Specifications is to outline the Electrical and Mechanical Contractors' responsibilities related to electrical work required for items such as temperature controls, mechanical equipment, fans, chillers, compressors, etc. The exact wiring requirements for much of the equipment cannot be determined until the systems have been selected and submittals approved. Therefore, the electrical drawings show only known wiring related to such items. All wiring not shown on the electrical drawings, but required for mechanical systems, is the responsibility of the Mechanical Contractor.
2. Where the drawings require the Electrical Contractor to wire between equipment furnished by the Mechanical Contractor, such wiring shall terminate at terminals provided in the equipment. The Mechanical Contractor shall furnish complete wiring diagrams and supervision to the Electrical Contractor and designate the terminal numbers for correct wiring.
3. Control low (24V) and control line (120V) voltage wiring, conduit, and related switches and relays required for the automatic control and/or interlock of motors and equipment, including final connection, are to be furnished and installed under Divisions 21, 22 and 23. Materials and installation to conform to Class 1 or 2 requirements, California Electrical Code Article 725.
4. The Electrical Contractor shall establish electrical utility elevations prior to fabrication and installation. The Electrical Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:

    a. Luminaires.
    b. Gravity flow piping, including steam and condensate.
    c. Electrical bus duct.
    d. Sheet metal.
    e. Cable trays, including access space.
    f. Other piping.
    g. Conduits and wireway.

D. Mechanical Contractor's Responsibility:

1. Assumes responsibility for internal wiring of all equipment furnished by the Mechanical Contractor.
2. Assumes all responsibility for miscellaneous items furnished by the Mechanical Contractor that require wiring but are not shown on the electrical drawings or specified in the Electrical Specification. If items such as relays, flow switches, or interlocks are required to make the mechanical system function correctly or are required by the manufacturer, they are the responsibility of the Mechanical Contractor.
3. Assumes all responsibility for Temperature Control wiring, if the Temperature Control Contractor is a Subcontractor to the Mechanical Contractor.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Temperature Control Contractor's or Subcontractor's Responsibility:

1. Wiring of all devices needed to make the Temperature Control System functional.
2. Verifying any control wiring on the electrical drawings as being by the Electrical Contractor. All wiring required for the Control System, but not shown on the electrical drawings, is the responsibility of the Temperature Control Contractor or Subcontractor.
3. Coordinating equipment locations (such as PE's, EP's, relays, transformers, etc.) with the Electrical Contractor, where wiring of the equipment is by the Electrical Contractor.

F. Electrical Contractor's Responsibility:

1. Furnishes and installs all combination starters, manual starters and disconnect devices shown on the Electrical Drawings or indicated to be by the Electrical Contractor in the Mechanical Drawings or Specifications.
2. Installs and wires all remote-control devices furnished by the Mechanical Contractor or Temperature Control Contractor when so noted on the Electrical Drawings.
3. Furnishes and installs motor control and temperature control wiring, when noted on the drawings.
4. Furnishes, installs, and connects all relays, etc., for automatic shutdown of certain mechanical equipment (supply fans, exhaust fans, etc.) upon actuation of the Fire Alarm System.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

G. General (Electrical/Technology):

1. "Electrical Contractor" as referred to herein shall be responsible for scope listed in Division 27/28 of this specification when the "Suggested Matrix of Scope Responsibility" indicated work shall be furnished and installed by the EC. Refer to the Contract Documents for this "Suggested Matrix of Scope Responsibility".

2. The purpose of these Specifications is to outline the Electrical and Technology Contractor's work responsibilities as related to Telecommunications Rough-in, conduit, cable tray, power wiring and Low Voltage Technology Wiring.
3. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals approved. Therefore, only known wiring, conduits, raceways and electrical power related to such items is shown on the Technology drawings. Other wiring, conduits, raceways, junction boxes and electrical power not shown on the Technology Drawings but required for operation of the systems is the responsibility of the Technology Contractor and included in said Contractor's bid.
4. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of Technology systems, the final installation shall not be until a coordination meeting between the Electrical Contractor and the Technology Contractor has convened to determine the exact location and requirements of the installation.
5. Where the Electrical Contractor is required to install cable tray that will contain Low Voltage Technology Wiring, installation shall not begin prior to a coordination review of the cable tray shop drawings by the Technology Contractor.

H. Technology Contractor's Responsibility:

1. Assumes all responsibility for the low voltage technology wiring of all systems, including cable support where open cable is specified.
2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being furnished and installed by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility".
3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).
4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of technology equipment which is required to be bonded to the telecommunications ground bar.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.05 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

    a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.

b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
d. Maintenance clearances and code-required dedicated space shall be included.
e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.

    a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.

3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor

    a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

    a. Scale of drawings:

        1) General plans: 1/4 Inch = 1 '-0" (minimum).
        2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
        3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
        4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1 '-0" (minimum).
        5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
b. Potential layout changes shall be made to avoid additional access panels.
c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign-off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.06 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing/Bid Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guides, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Architect/Engineer any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Architect/Engineer will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers as determined by the Architect/Engineer are acceptable.
2. All Contractors and subcontractors shall employ only workmen who are skilled in their trades. At all times, the number of apprentices at the job site shall be less than or equal to the number of journeymen at the job site.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the State of CA Codes, Laws, Ordinances and other regulations having jurisdiction.

2. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
3. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
4. All changes to the system made after the letting of the contract to comply with codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
5. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
6. If there are no local codes having jurisdiction, the current issue of the National Electrical Code shall be followed.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by State, Municipal, and other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be listed by Underwriter's Laboratories, Inc. or a nationally recognized testing organization.
8. Pay all telephone company charges related to the service or change in service.

E. Examination of Drawings:

1. The drawings for the electrical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of raceways to best fit the layout of the job. Conduit entry points for electrical equipment including, but not limited to, panelboards, switchboards, switchgear and unit substations, shall be determined by the Contractor unless noted in the contract documents.
3. Scaling of the drawings will not be sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either shown on the drawings or called for in the specifications, it shall be included in this contract.

7. The Contractor shall determine quantities and quality of material and equipment required from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater and better-quality number shall govern.
8. Where used in electrical documents the word "furnish" shall mean supply for use, the word "install" shall mean connect up complete and ready for operation, and the word "provide" shall mean to supply for use and connect up complete and ready for operation.
9. Any item listed as furnished shall also be installed unless otherwise noted.
10. Any item listed as installed shall also be furnished unless otherwise noted.

F. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any conduit, conductors, wireways, bus duct, fittings, etc.

1.07 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item	Coordination Drawing
26 05 03	Through Penetration Firestopping	

Referenced Specification Section	Submittal Item	Coordination Drawing
26 05 13	Wire and Cable	
26 05 26	Grounding and Bonding	
26 05 33	Conduit and Boxes	+> 1.5"
26 05 48	Seismic Requirements for Equipment and Supports	
26 05 53	Electrical Identification	
26 09 33	Lighting Control System	
26 22 00	Dry Type Transformers	Yes
26 24 16	Panelboards	Yes
26 27 16	Cabinets and Enclosures	Yes
26 27 26	Wiring Devices	Ceiling mount
26 27 29	Electric Vehicle Charging Station	
26 28 13	Fuses	
26 28 16	Disconnect Switches	Yes
26 31 00	Solar Photovoltaic Systems	Yes
26 43 00	Surge Protection Devices	
26 51 19	LED Lighting	Yes
28 31 00	Fire Alarm and Detection Systems	Yes
Drawings	Photocells, Timeclocks, Relays	

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

    a. Date
    b. Project title and number
    c. Contractor's name and address
    d. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
    e. Description of items submitted and relevant specification number
    f. Notations of deviations from the contract documents
    g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

    a. Date
    b. Project title and number
    c. Architect/Engineer
    d. Contractor and subcontractors' names and addresses
    e. Supplier and manufacturer's names and addresses
    f. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
    g. Description of item submitted (using project nomenclature) and relevant specification number
    h. Notations of deviations from the contract documents
    i. Other pertinent data
    j. Provide space for Contractor's review stamps

3. Composition:

    a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
    b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
    c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:

    a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
    b. Unstamped submittals will be rejected.
    c. The Contractor's review shall include, but not be limited to, verification of the following:

        1) Only approved manufacturers are used.
        2) Addenda items have been incorporated.
        3) Catalog numbers and options match those specified.
        4) Performance data matches that specified.
        5) Electrical characteristics and loads match those specified.
        6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
        7) Dimensions and service clearances are suitable for the intended location.
        8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
        9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

    d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
    e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:

    a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
    b. The Contractor shall clearly indicate the size, finish, material, etc.
    c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
    d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.

    a. Allow at least two weeks for Architect¢¢s/Engineer's review and processing of each submittal, excluding mailing.

16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer¢¢s opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.

4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. Submittal file name: 26 XX XX.description.YYYYMMDD
    b. Transmittal file name: 26 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.08 SCHEDULE OF VALUES

A. The requirements herein are in addition to the provisions of Division 1.

B. Format:

1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
2. Submit in Excel format.
3. Support values given with substantiating data.

C. Preparation:

1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
2. Break down all costs into:

    a. Material: Delivered cost of product with taxes paid.
    b. Labor: Labor cost, excluding overhead and profit.

3. Itemize the cost for each of the following:

    a. Overhead and profit.
    b. Bonds.
    c. Insurance.
    d. General Requirements: Itemize all requirements.

4. For each line item having an installed cost of more than $5,000, break down costs to list major products or operations under each item. At a minimum, provide material and labor cost line items for the following:

    a. Each piece of equipment requiring shop drawings. Use the equipment nomenclature (SB-1, PANEL P-1, etc.) on the Schedule of Values.
    b. Each type of small unitary equipment (e.g., FDS, FCS, CS, etc.). Multiple units of the same type can be listed together provided quantities are also listed so unit costs can be determined.

c. Each conduit system (medium voltage, normal, emergency, low voltage systems, etc.). In addition, for larger projects breakdown the material and labor for each conduit system based on geography (building, floor, and/or wing).
d. Fire alarm broken down into material and labor for the following:

1) Engineering
2) Controllers, devices, sensors, etc.
3) Conduit
4) Wiring
5) Programming
6) Commissioning

e. Site utilities (5' beyond building)
f. Seismic design
g. Testing
h. Commissioning
i. Record drawings
j. Punchlist and closeout

D. Update Schedule of Values when:

1. Indicated by Architect/Engineer.
2. Change of subcontractor or supplier occurs.
3. Change of product or equipment occurs.

1.09 CHANGE ORDERS

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.

B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.

C. Change order work shall not proceed until authorized.

1.10 PRODUCT DELIVERY, STORAGE, HANDLING and MAINTENANCE

A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.

B. Keep all materials clean, dry and free from damaging environments.

C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Electrical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.11 NETWORK / INTERNET CONNECTED EQUIPMENT

A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

B. The following network connected equipment shall be equipped with restricted access protocols:

1. Adjustable trip overcurrent protection devices
2. Power monitoring and control
3. Electrical controls
4. Lighting control system
5. Variable frequency drives
6. Package engine generator and remote annunciator
7. Transfer switch and remote annunciator
8. Static uninterruptible power supply (UPS)
9. Fire alarm and automatic detection

1.12 WARRANTY

A. Provide one-year warranty for all fixtures, equipment, materials, and workmanship.

B. The warranty period for all work in this specification Division shall commence on the date of Substantial Completion or successful system performance whichever occurs later. The warranty may also commence if a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization of the Owner. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements extend to correction, without cost to the Owner, of all work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage due to defects or nonconformance with contract documents excluding repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.13 INSURANCE

A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.14 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality.

B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.

D. Voluntary add or deduct prices for alternate materials may be listed on the bid form. These items will not be used in determining the low bidder. This Contractor assumes all costs incurred as a result of using the offered material or equipment on the Contractors part or on the part of other Contractors whose work is affected.

E. All material substitutions requested after the final addendum must be listed as voluntary changes on the bid form.

1.15 PROJECT COMMISSIONING

A. The Contractor shall work with the Commissioning Agent (CxA) as described in Section 01 91 00 and provide all services as described in the Commissioning Plan.

PART 2 PRODUCTS

2.01 GENERAL

A. All items of material having a similar function (e.g., safety switches, panelboards, switchboards, contactors, motor starters, dry type transformers) shall be of the same manufacturer unless specifically stated otherwise on drawings or elsewhere in specifications.

PART 3 EXECUTION

3.01 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.02 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811.
2. The Contractor shall do all excavating, filling, backfilling, compacting, and restoration in connection with the work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. If excavations are carried in error below indicated levels, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer shall be placed in such excess excavations under the foundation. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workmen.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. If satisfactory bearing soil is not found at the indicated levels, immediately notify the Architect/Engineer or their representative, and do no further work until the Architect/Engineer or their representative gives further instructions.

9. Excavation shall be performed in all ground conditions, including rock, if encountered. Bidders shall visit the premises and determine the soil conditions by actual observations, borings, or other means. The cost of all such inspections, borings, etc., shall be borne by the bidder.
10. If a trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
11. Mechanical excavation of the trench to line and grade of the conduit or to the bottom level of masonry cradles or encasements is permitted, unless otherwise indicated on the electrical drawings.
12. Mechanical excavation of the trench to line and grade where direct burial cables are to be installed is permitted provided the excavation is made to a depth to permit installation of the cable on a fine sand bed at least 3 inches deep.

C. Dewatering:

1. Furnish, install, operate and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, conduit, feeders, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Review all Bid Documents for all trades on the project to determine obstructions indicated. Take great care in making installations near underground obstructions.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

1. No rubbish or waste material is permitted for fill or backfill.
2. Provide all necessary sand and/or CA6 for backfilling.
3. Native soil materials may be used as backfill if approved by the Geotechnical Engineer.
4. Dispose of the excess excavated earth as directed.
5. Backfill materials (native soil material, sand, and/or CA6) shall be suitable for required compaction, clean and free of perishable materials, frozen earth, debris, earth with a high void content, and stones greater than 4 inches in diameter. Water is not permitted to rise in unbackfilled trenches.
6. Backfill all trenches and excavations immediately after installing of conduit, or removing forms, unless other protection is directed.
7. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Spread fill and backfill materials in 6" uniform horizontal layers with each layer compacted separately to required density.
8. For conduits that are not concrete encased, lay all conduits on a compacted bed of sand at least 3" deep. Backfill around conduits with sand, in 6" layers and compact each layer.
9. Conduits that are concrete encased or in a ductbank, conduit spacers, and cradles shall be installed on a bed of compacted CA-6 gravel. Refer to conduit section for backfilling and ductbank requirements.

10. Backfill with native soil material (if approved) or sand up to grade for all conduits under slabs or paved areas. All other conduits shall have sand backfill to 6" above the top of the conduit.
11. Place all backfill above the sand in uniform layers not exceeding 6" deep. Place then carefully and uniformly tamp each layer to eliminate lateral or vertical displacement.
12. Where the fill and backfill will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density as determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content as determined by AASHTO T-99 or ASTM D-698 test.
13. After backfilling of trenches, no superficial loads shall be placed on the exposed surface of the backfill until a period of 48 hours has elapsed.

F. Surface Restoration:

1. Where trenches are cut through graded, planted or landscaped areas, the areas shall be restored to the original condition. Replace all planting and landscaping features removed or damaged to its original condition. At least 6" of topsoil shall be applied where disturbed areas are to be seeded or sodded. All lawn areas shall be sodded unless seeding is called out in the drawings or specifications.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition. Broken edges shall be saw cut and repaired as directed by Architect/Engineer.

3.03 ARCHITECT/ENGINEER OBSERVATION OF WORK

A. The contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

1. Placing fill over underground and underslab utilities.
2. Covering exterior walls, interior partitions and chases.
3. Installing hard or suspended ceilings and soffits.

B. The Architect/Engineer will review the installation and provide a written report noting deficiencies requiring correction. The contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation:

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:

   a. All junction boxes are closed and identified in accordance with Section 26 0553 Electrical Identification.
   b. Luminaires, including ceiling-mounted exit and emergency lights, are installed and operational.
   c. Luminaire whips are supported above the ceiling.
   d. Conduit identification is installed in accordance with Section 26 0553 Electrical Identification.

e. Luminaires are suspended independently of the ceiling system when required by these contract documents.
f. All wall penetrations have been sealed.

2. To prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to seven days elapsing, the Architect/Engineer may not recommend further payments to the contractor until full access has been provided.

3.04 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 1.

B. IDPH Pre-Occupancy Requirements:

1. Each Contractor must submit all forms and certifications required by IDPH relating to their work at 85% completion of the project or when directed by the Owner/Architect/Engineer.

C. Final Jobsite Observation:

1. To prevent the Final Jobsite Observation from occurring too early, the Contractor shall review the completion status of the project and certify that the job is ready for the final jobsite observation.
2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review. The Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
3. It is understood that if the Architect/Engineer finds the job not ready for the final observation and additional trips and observations are required to bring the project to completion, the cost of the additional time and expenses incurred by the Architect/Engineer will be deducted from the Contractor's final payment.
4. Contractor shall notify Architect/Engineer 48 hours prior to installation of ceilings or lay-in ceiling tiles.

D. The following must be submitted before Architect/Engineer recommends final payment:

1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including marked-up drawings and specifications.
3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of this Contractor and shall be signed by the Owner's representatives.
4. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and submit receipt to Architect/Engineer.
5. Inspection and testing report by the fire alarm system manufacturer.
6. Start-up reports on all equipment requiring a factory installation or start-up.

E. Circuit Directories:

1. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

3.05 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copies of all factory inspections and/or equipment startup reports.
5. Copies of warranties.
6. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
7. Dimensional drawings of equipment.
8. Detailed parts lists with lists of suppliers.
9. Operating procedures for each system.
10. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
11. Repair procedures for major components.
12. Replacement parts and service material requirements for each system and the frequency of service required.
13. Instruction books, cards, and manuals furnished with the equipment.
14. Include record drawings of the one-line diagrams for each major system. The graphic for each piece of equipment shown on the one-line diagram shall be an active link to its associated Operation & Maintenance data.

15. Copies of all panel schedules in electronic Microsoft Excel spreadsheet (.xlsx) file. Each panelboard shall be a separate tab in the workbook.

3.06 INSTRUCTING THE OWNER'S REPRESENTATIVE

A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of the complete systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. Contractor shall make a DVD video recording of instructions to the Owner while explaining the system so additional personnel may view the instructions at a later date. The video recording shall be the property of the Owner.

D. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

E. The instructions shall include:

1. Maintenance of equipment.
2. Start-up procedures for all major equipment.
3. Description of emergency system operation.
4. Insert.

F. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can be present if desired.

G. Minimum hours of instruction time for each item and/or system shall be as indicated in each individual specification section.

H. Operating Instructions:

1. Contractor is responsible for all instructions to the Owner's representatives for the electrical and specialized systems.
2. If the Contractor does not have staff that can adequately provide the required instructions, the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.07 RECORD DOCUMENTS

A. The following paragraphs supplement Division 1 requirements.

B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

C. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should this Contractor fail to complete Record Documents as required by this contract, this Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.

D. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

F. Record actual routing of conduits exceeding 2 inches.

3.08 ADJUST AND CLEAN

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.

B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc. from all equipment.

C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.09 SPECIAL REQUIREMENTS

A. Coordinate the installation of all equipment, controls, devices, etc., with other trades to maintain clear access area for servicing.

B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement, and orientation of equipment with the Owner's representative prior to setting equipment.

C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's representative will result in removal and reinstallation of the equipment at the Contractor's expense.

D. Raceway and Cable Routing Restrictions: Raceways and cable are restricted from being routed in the following locations, unless serving the space or permitted by the authority having jurisdiction.

1. Elevator machine rooms and hoistways.
2. Exit enclosures.
3. Other areas restricted by code.
4. Technology, data, server rooms.
5. Fire pump and sprinkler rooms.
6. Normal power in emergency power equipment rooms: Limited to feeders and branch circuits serving the emergency power equipment located in the room.

7. Emergency power in normal power equipment rooms: Limited to feeders and branch circuits serving the normal power equipment located in the room.

E. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:

1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
2. South Coast Air Quality Management District Rule 1168 - Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
3. South Coast Air Quality Management District Rule SCAQMD 1113 - Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

3.10 INDOOR AIR QUALITY (IAQ) MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

A. Within the Limits of Construction:

1. The Electrical Contractor shall coordinate all work with the contractor responsible for IAQ.
2. The means, methods and materials used by the Electrical Contractor shall be coordinated with the contractor responsible for IAQ and shall comply with the IAQ requirements set forth in Division 1 and Division 21/22/23 of these specifications.

B. Outside the Limits of Construction:

1. IAQ shall be the responsibility of the electrical contractor for work that is required outside the limits of construction.
2. The Electrical Contractor is responsible for the IAQ set forth in Division 1 and Division 21/22/23 of these specifications.
3. The Electrical Contractor shall review and coordinate all IAQ plans and procedures with the owner's IAQ representative.

C. Contractors shall make all reasonable efforts to prevent construction activities from affecting the air quality of the occupied areas of the building or outdoor areas near the building. These measures shall include, but not be limited to:

1. General Contractor shall erect and maintain dust barriers throughout the construction work. These barriers shall be reasonably airtight and shall prevent entry into the construction zone by unauthorized persons. Reasonably airtight means construction equivalent to full-height temporary or permanent walls with joints taped or sealed, and shafts and other penetrations sealed as well as possible. Fire resistant polyethylene is acceptable; if flame spread/smoke developed ratings are demonstrated to conform to the applicable building codes and licensing acts.
2. The Contractor shall continuously maintain the construction zone under a negative pressure of at least 0.01" w.g. minimum relative to all adjacent areas of the building.

a. Exhaust fans used for this purpose shall filter air and discharge it outdoors or to the least populated area adjacent to the construction work using negative air machines designed specifically for this purpose. All filtration for air recirculated back into the building shall be HEPA (99.97% DOP efficiency) for work adjacent to healthcare or elderly facilities. If no work is adjacent to these areas, 95% filtration is acceptable. Filtering air discharged to outdoors shall be accomplished with 30% filters.
b. If air is discharged outdoors, maintain all required distances to doors, windows, air intakes, etc.
c. If high levels of Volatile Organic Compounds (VOC's) or odors are released, activated carbon or equivalent filtration shall also be employed. Exhaust shall not discharge near doors, air intakes, pedestrians, gathering areas, or operable windows.
d. Adjusting existing air handling equipment to assist in pressure control is acceptable, if approved by the Owner and the authority having jurisdiction.
e. Seal return, exhaust, and supply air openings in or near the construction zone that serve existing air handling systems, and rebalance the systems for proper operation. If this is impractical, add filters at the intakes of sufficient cross sectional area to minimize the pressure drop and avoid the need for rebalancing.
f. Maintain pressure control one hour before and after all construction periods, and 24 hours per day in healthcare or elderly facilities.

3. All contractors shall endeavor to minimize the amount of contaminants generated during construction. Methods to be employed shall include, but not be limited to:

    a. Minimizing the amount of dust generated.
    b. Reducing solvent fumes and VOC emissions.
    c. Maintain good housekeeping practices, including sweeping and periodic dust and debris removal. There should be no visible haze in the air.

4. Request that the Owner designate an IAQ representative.
5. Review and receive approval from the Owner's IAQ representative for all IAQ-related construction activities and negative pressure containment plans.
6. Inform the IAQ representative of all conditions that could adversely impact IAQ, including operations that will produce higher than normal dust production or odors.
7. Schedule activities that may cause IAQ conditions that are not acceptable to the Owner's IAQ representative during unoccupied periods.
8. Request copies of and follow all Owner's IAQ and infection control policies.
9. Unless no other access is possible, the entrance to construction site shall not be through the existing facility.
10. To minimize growth of infectious organisms, do not permit damp areas in or near the construction area to remain for over 24 hours.
11. In addition to the criteria above, provide measures as recommended in the SMACNA "IAQ Guidelines for Occupied Buildings under Construction".

3.11 SYSTEM STARTING AND ADJUSTING

A. The electrical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes all calibration and adjustment of electrical controls, balancing of loads, troubleshooting and verification of software, and final adjustments that may be needed.

B. Complete all manufacturer-recommended startup procedures and checklists to verify proper equipment operation and does not pose a danger to personnel or property.

C. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls, and alarms.

D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.12 FIELD QUALITY CONTROL

A. General:

1. Conduct all tests required during and after construction. Submit test results in NETA format, or equivalent form, that shows the test equipment used, calibration date, tester's name, ambient test conditions, humidity, conductor length, and results corrected to 40°C.
2. Supply necessary instruments, meters, etc., for the tests. Supply competent technicians with training in the proper testing techniques.
3. All cables and wires shall be tested for shorts and grounds following installation and connection to devices. Replace shorted or grounded wires and cables.
4. Any wiring device, electrical apparatus or luminaire, if grounded or shorted on any integral "live" part, shall have all defective parts or materials replaced.
5. Test cable insulation of service and panel feeder conductors for proper insulation values. Tests shall include the cable, all splices, and all terminations. Each conductor shall be tested and shall test free of short circuits and grounds and have an insulation value not less than Electrical Code Standards. Take readings between conductors, and between conductors and ground.
6. If the results obtained in the tests are not satisfactory, make adjustments, replacements, and changes as needed. Then repeat the tests, and make additional tests, as the Architect/Engineer or authority having jurisdiction deems necessary.

B. Ground Resistance:

1. Conduct service ground resistance tests using an approved manufactured ground resistance meter. Submit to the Architect/Engineer a proposed test procedure including type of equipment to be used. (The conventional ohmmeter is not an acceptable device.)
2. Make ground resistance measurements during normal dry weather and not less than 48 hours after a rain. Ground resistance values shall be verified by the Architect/Engineer at the time the readings are taken.
3. If the ground resistance value obtained is more than the value set forth in Section 26 0526, the following shall be done to obtain the value given:

    a. Verify that all connections in the service ground system are secure.
    b. Increase the depth to which ground rods are driven by adding section lengths to the rods and retest. If the resistance is still excessive increase the depth by adding an additional rod section and retest.
    c. If the resistance is still excessive, furnish and install additional ground rods, spaced not less than 20 feet from other ground rods unless otherwise noted on plans, and connect into the ground electrode system. Retest.
    d. Review results with the Architect/Engineer.

4. Before final payment is made to the Contractor submit a written report to the Architect/Engineer including the following:

    a. Date of test.
    b. Number of hours since the last rain.
    c. Soil condition at the time of the test in the ground electrode location. That is: dry, wet, moist, sand, clay, etc.
    d. Diagram of the test set-up showing distances between test equipment, ground electrode, auxiliary electrodes, etc.
    e. Make, model, and calibration date of test equipment.
    f. Tabulation of measurements taken and calculations made.

C. Ground-Fault Equipment Performance Testing:

1. Test: Perform ground-fault performance testing when system is installed. The test process shall use primary current injection per manufacturer instruction and procedures. Perform test for the following:

    a. Service disconnects
    b. Solid state molded case circuit breakers and solid-state insulated case circuit breakers equipped with ground fault protection.
    c. Fusible switches with ground fault relay protection.
    d. Outside branch circuits and feeders.
    e. Code required.

2. Report: Provide copy of test result report with Operation and Maintenance manuals. Provide report to Authority Having Jurisdiction when requested.

D. Arc Energy Reduction Equipment Performance Testing:

1. Test: Perform arc energy protection performance testing when system is installed. The test process shall use primary current injection or approved method per manufacturer instructions and procedures. Perform test for the following:

a. All arc energy reduction systems installed.

2. Report: Provide copy of test result report with Operation and Maintenance manuals. Provide report to Authority Having Jurisdiction when requested.

E. Other Equipment:

1. Give other equipment furnished and installed by the Contractor all standard tests normally made to assure that the equipment is electrically sound, all connections properly made, phase rotation correct, fuses and thermal elements suitable for protection against overloads, voltage complies with equipment nameplate rating, and full load amperes are within equipment rating.

F. If any test results are not satisfactory, make adjustments, replacements and changes as needed and repeat the tests and make additional tests as the Architect/Engineer or authority having jurisdiction deem necessary.

G. Contractor shall thermographic study all electrical gear, switchboard, panelboards, etc. at the end of construction to identify any unusual conditions/heating within the equipment. Coordinate with Owner/Architect/Engineer to have an Owner/Architect/Engineer representative present during testing.

H. Report shall include color printouts, in binder, of pictures taken to use as a baseline reading after building is occupied.

I. Upon completion of the project, the Contractor shall provide amperage readings for all panelboards and switchboards and turn the results over to the Owner for "benchmark" amperages.

3.13 UTILITY REBATE

A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.

B. Contractor must submit notification of any value engineering or product substitution that will affect the utility rebate amount prior to approval.

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations of fire-rated construction fire sealed in accordance with specifications.
2. Electrical panels have typed circuit identification.
3. Smoke and fire/smoke dampers are wired and have been tested.
4. Per Section 26 0500, cable insulation test results have been submitted.
6. Per Section 26 0500, ground resistance test results have been submitted.
7. Operation and Maintenance manuals have been submitted as per Section 26 0500.
8. Bound copies of approved shop drawings have been submitted as per Section 26 0500.
9. Report of instruction of Owner's representative has been submitted as per Section 26 0500.
10. Fire alarm inspection and testing report has been submitted as per Sections 26 05 00 and 28 31 00.
11. Start-up reports from factory representative have been submitted as per Section 26 0500.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION 26 0500

SECTION 26 0503

THROUGH PENETRATION FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Through-Penetration Firestopping.

1.02 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section.

B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.03 REFERENCES

A. UL 263 - Fire Tests of Building Construction and Materials

B. UL 723 - Surface Burning Characteristics of Building Materials

C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops

D. UL 2079 - Tests for Fire Resistance of Building Joint Systems

E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)

F. Intertek / Warnock Hersey - Directory of Listed Products

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops

I. The Building Officials and Code Administrators National Building Code

J. Uniform Building Code

K. Wisconsin Administrative Code

L. International Building Code

M. NFPA 5000 - Building Construction Safety Code

N. CBC California Building Code

1.04 SUBMITTALS

A. Submit under provisions of Division 1

B. Submit Firestopping Installers Certification for all installers on the project.

C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Interek / Warnock Hersey Assembly number.

D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
4. F ratings for each firestop system.

E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

F. Submit VOC rating of firestopping material in g/L (less water) with documentation that it meets the limits set forth in SCAQMD Rule 1168.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.

B. Install material prior to expiration of product shelf life.

1.06 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

2. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 cfm/sq.ft. at both ambient temperature and 400°F.

C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

F. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:

1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
2. South Coast Air Quality Management District Rule 1168 - Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
3. South Coast Air Quality Management District Rule SCAQMD 1113 - Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

1.07 MEETINGS

A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the Construction Manager, General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.

1. Review foreseeable methods related to firestopping work.
2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

1.08 WARRANTY

A. Provide one year warranty on parts and labor.

B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.

1. 3M; Fire Protection Products Division
2. Hilti, Inc.
3. RectorSeal Corporation, Metacaulk

2.02 THROUGH PENETRATION FIRESTOP SYSTEMS

A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.

B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.

C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.

D. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.

E. Provide firestopping systems allowing continuous insulation for all insulated pipes.

F. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

Penetrating Item	UL System No.
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999

Penetrating Item	UL System No.
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

1. Non-Combustible Framed Walls - 1 or 2 Hour Rated:

   a. F Rating = Wall Rating
   b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

2. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated:

   a. F Rating = Wall/Floor Rating
   b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

G. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

H. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.

C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.

D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.02 INSTALLATION

A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.

B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.

C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.03 CLEANING AND PROTECTING

A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.04 IDENTIFICATION

A. Provide and install labels adjacent to each firestopping location. Label shall be provided by the firestop system supplier and contain the following information in a contrasting color:

1. The words "Warning - Through Penetration Firestop System - Do Not Disturb. Notify Building Management of Any Damage."
2. Firestop System Supplier; UL or listed by Intertek / Warnock Hersey system number; date installed; contractor name and phone number; manufacturer's representative name, address, and phone number.

3.05 INSPECTION

A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.

B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.

C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.

D. The contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the contractor's expense.

END OF SECTION 26 0503

SECTION 26 0513

WIRE AND CABLE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Building wire

1.02 RELATED WORK

A. Section 26 0553 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.03 REFERENCES

A. ASTM B800-05 - Standard Specification for 8000 Series Aluminum Alloy Wire Electrical Purposes-Annealed and Intermediate Tempered.

B. ASTM B801-07 - Standard Specification for Concentric-Lay-Stranded Conductors of 8000 Series Aluminum Alloy for Subsequent Covering or Insulation

C. NEMA WC 70 - Power Cables Rated 2,000V or Less for the Distribution of Electrical Energy

D. NFPA 70 - National Electrical Code (NEC)CEC California Electrical Codeed Wires and Cables

E. UL 854 - Service-Entrance Cables

F. UL 1581 - Standard for Electrical Wires, Cables, and Flexible Cords

G. UL 2196 - Fire Resistive, Fire Resistant and Circuit Integrity Cables

H. California Division of State Architect (DSA) Interpretation of Regulations

1.04 SUBMITTALS

A. Submit manufacturer's installation instructions.

PART 2 PRODUCTS

2.01 BUILDING WIRE

A. Feeders and Branch Circuits 8 AWG and larger: Copper, stranded conductor, 600-volt insulation, THHN/THWN or XHHW-2.

B. Feeders and Branch Circuits 8 AWG and larger in Underground Conduit: Copper, stranded conductor, 600-volt insulation, THWN or XHHW-2.

C. Feeders and Branch Circuits 10 THWN orAWG and Smaller: Copper, solid or stranded conductor, 600-volt insulation, THHN/THWN, unless otherwise noted on the drawings. Aluminum, compact stranded conductor is not acceptable for feeder and branch circuits

D. Aluminum conductors are not to be used .

E. Each 120 and 277-volt branch circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for wire derating.

PART 3 EXECUTION

3.01 WIRE AND CABLE INSTALLATION SCHEDULE

A. Above Accessible Ceilings:

1. Building wire shall be installed in raceway.
2. Metal clad cable, Type MC, 1/2" size with minimum #12 conductors and ground, shall be allowed for flexible whips to individual luminaires on non-essential circuits. The flexible whips shall be between 18" to 72" in length per Electrical Code.

B. All Other Locations: Building wire in raceway.

C. Above Grade: All conductors installed above grade shall be type "THHN".

D. Underground or In Slab: All conductors shall be type "THWN".

3.02 CONTRACTOR CHANGES

A. The basis of design is copper conductors installed in raceway based on ambient temperature of 30°C, CEC California Electrical Code edition Table 310.15(B)(16). and fire pump feeder , CEC California Electrical Code Table B310.15(B)(2)(7).

B. The Contractor shall be responsible for derating and sizing conductors and conduits to equal or exceed the ampacity of the basis of design circuits, if he/she chooses to use methods or materials other than the basis of design.

C. Underground electrical duct ampacity rating shall be in accordance with NEC Table 310.16 (2011 - 2017 edition 310.15(B)(16)) or calculated in accordance with Annex B Application Information for Ampacity Calculation. The calculations and a sketch of the proposed installation shall be submitted prior to any conduit being installed.

D. Conductor length(s) listed on plans and schedules. The drawings are diagrammatic with intent to convey the components of the electrical distribution system. Conductor length(s) when listed on plans and schedules are for engineering calculation purposes. Conductor length(s) shall NOT be used for bidding purposes.

E. Record drawing shall include the calculations and sketches.

3.03 GENERAL WIRING METHODS

A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.

B. Use no wire smaller than 18 AWG for low voltage control wiring below 100 volts.

C. Use 10 AWG conductor for 20 ampere, 120-volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277-volt branch circuit home runs longer than 200 feet.

D. Use no wire smaller than 8 AWG for outdoor lighting circuits.

E. The ampacity of multiple conductors in one conduit shall be derated per the Electrical Code. In no case shall more than 4 conductors be installed in one conduit to such loads as motors larger than 1/4 HP, panelboards, motor control centers, etc.

F. Where installing parallel feeders, place an equal number of conductors for each phase of a circuit in same raceway or cable.

G. Splice only in junction or outlet boxes.

H. Neatly train and lace wiring inside boxes, equipment, and panelboards.

I. Make conductor lengths for parallel circuits equal.

J. All conductors shall be continuous in conduit from last outlet to their termination.

K. Terminate all spare conductors on terminal blocks, and label the spare conductors.

L. Cables or wires shall not be laid out on the ground before pulling.

M. Cables or wires shall not be dragged over earth or paving.

N. Care shall be taken so as not to subject the cable or wire to high mechanical stresses that would cause damage to the wire and cable.

O. At least six (6)-inch loops or ends shall be left at each outlet for installation connection of luminaires or other devices.

P. All wires in outlet boxes not connected to fixtures or other devices shall be rolled up, spliced if continuity of circuit is required, and insulated.

3.04 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires. Do not use wire pulling lubricant for isolated (ungrounded) power system wiring.

B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

C. Pulling shall be continuous without unnecessary stops and starts with wire or cable only partially through raceway.

D. Where reels of cable or wire are used, they shall be set up on jacks close to the point where the wire or cable enters the conduit or duct so that the cable or wire may be unreeled and run into the conduit or duct with a minimum of change in the direction of the bend.

E. Conductors shall not be pulled through conduits until plastering or masonry work is completed and conduits are free from moisture. Care shall be taken so that long pulls of wire or pulls around several bends are not made where the wire may be permanently stretched and the insulation damaged.

F. Only nylon rope shall be permitted to pull cables into conduit and ducts.

G. Completely and thoroughly swab raceway system before installing conductors.

H. Conductor Supports in Vertical Raceways:

1. Support conductors in vertical raceways in accordance with the Electrical Code Spacing of Conductors Supports.
2. Supports shall be of insulated wedge type (OZ Gedney Type S, or equal) and installed in a tapered insulated bushing fitting or a metal woven mesh with a support ring that fits inside conduit fitting installed in an accessible junction box (Hubbell Kellems support grip or equal).

3.05 CABLE INSTALLATION

A. Provide protection for exposed cables where subject to damage.

B. Use suitable cable fittings and connectors.

C. Run all open cable parallel or perpendicular to walls, ceilings, and exposed structural members. Follow the routing as illustrated on the drawings as closely as possible. Cable routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatical, unless noted otherwise. The correct routing, when shown diagrammatically, shall be chosen by the Contractor based on information in the contract documents; in accordance with the manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", recognized industry standards; and coordinated with other contractors.

D. Open cable shall be supported by the appropriate size J-hooks or other means if called for on the drawings. Wire and cable from different systems shall not be installed in the same J-hook. J-hooks shall be sized with 20% spare capacity. J-hooks shall provide proper bend radius support for data cable and fiber cables.

E. Open cable installed above suspended ceilings shall not rest on the suspended ceiling construction, nor utilize the ceiling support system for wire and cable support.

F. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet. All J-hooks shall be installed where completely accessible and not blocked by piping, ductwork, inaccessible ceilings, etc. J-hooks shall be independently rigidly attached to a structural element. J-hooks shall be installed to provide 2" horizontal separation and 6" vertical separation between systems.

G. Open cable shall only be installed where specifically shown on the drawings, or permitted in these specifications.

3.06 WIRING CONNECTIONS AND TERMINATIONS

A. Splice and tap only in accessible junction boxes.

B. Use solderless, tin-plated copper, compression terminals (lugs) applied with circumferential crimp for conductor terminations, 8 AWG and larger.

C. Use solderless, tin-plated, compression terminals (lugs) applied with indenter crimp for copper conductor terminations, 10 AWG and smaller.

D. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.

E. Use compression connectors applied with circumferential crimp for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor. Cold shrink connector insulator with 1kV rating shall be used in damp and wet locations.

F. Thoroughly clean wires before installing lugs and connectors.

G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

H. Phase Sequence: All apparatus shall be connected to operate in the phase sequence A-B-C representing the time sequence in which the phase conductors so identified reach positive maximum voltage.

I. As a general rule, applicable to switches, circuit breakers, starters, panelboards, switchgear and the like, the connections to phase conductors are intended thus:

1. Facing the front and operating side of the equipment, the phase identification shall be:

    a. Left to Right - A-B-C
    b. Top to Bottom - A-B-C

J. Connection revisions as required to achieve correct rotation of motors shall be made at the load terminals of the starters or disconnect switches.

K. Use antioxidant joint compound on all aluminum conductor terminations. Apply antioxidant joint compound per manufacturer's recommendations.

3.07 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 1.

B. Building Wire and Power Cable Testing: Perform an insulation-resistance test on each conductor with respect to ground and adjacent conductors. Test shall be made by means of a low-resistance ohmmeter, such as a "Megger". The applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. The test duration shall be one minute. Insulation resistance must be greater than 100 mega-ohm for 600 volt and 25 mega-ohm for 300 volt rated cables per NETA Acceptance Testing Standard. Verify uniform resistance of parallel conductors.

C. MI cable shall have the insulation resistance of each cable tested with a 500-volt dc megohmeter prior to energizing the cables. Tabulate resistance values and submit to Architect/Engineer for acceptance.

D. Inspect wire and cable for physical damage and proper connection.

E. Torque test conductor connections and terminations to manufacturer's recommended values.

F. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

G. Provide documentation of the manufacturer's recommended lug torque value for Documentation indicating that the torque wrench has been calibrated not more than 30 days prior to tightening of lugs shall be provided.

H. Protection of wire and cable from foreign materials:

1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any wire or cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid, or compound that could come in contact with the cable, cable jacket, or cable termination components.

I. Overspray of paint on any wire or cable will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed.

END OF SECTION 26 0513

SECTION 26 0526

GROUNDING AND BONDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Equipment grounding system

B. Bonding system

C. Grounding electrode system

1.02 QUALITY ASSURANCE

A. Testing Agency Qualifications: Testing agency as defined by OSHA in 29 CFR 1910.7 or a member company of the International Electrical Testing Association and that is acceptable to authorities having jurisdiction.

B. Testing Agency's Field Supervisor: Person currently certified by the International Electrical Testing Association to supervise on-site testing specified in Part 3.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in Electrical Code, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

D. Comply with UL 467 Grounding and Bonding Equipment.

E. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

F. Comply with Electrical Code; for overhead-line construction and medium-voltage underground construction, comply with IEEE/ANSI C2 National Electrical Safety Code (NESC).

1.03 REFERENCES

A. NFPA 70 - National Electrical Code (NEC)

B. CEC California Electrical Code

1.04 SUBMITTALS

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

B. Indicate layout of ground field, location of system grounding electrode connections, and routing of grounding electrode conductor and ground ring.

1.05 SUMMARY

A. This section includes grounding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

PART 2 PRODUCTS

2.01 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 26 Section 26 0513 "Wire and Cable".

B. Material: Copper.

C. Equipment Grounding Conductors: Insulated. Refer to Section 26 0553 for insulation color.

D. Grounding Electrode Conductors: Stranded cable.

E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

F. Copper Bonding Conductors: As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch in diameter.
2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.02 CONNECTOR PRODUCTS

A. Comply with UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

C. Substation connectors shall comply with IEEE 837 listed for use for specific types, sizes, and combinations of conductors and connected items.

2.03 GROUNDING ELECTRODES

A. Ground Rods Copper-clad steel.

PART 3 EXECUTION

3.01 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically non-continuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Structural Steel Connection: Exothermic-welded connections to structural steel. Coordinate with structure to provide physical protection.

F. Underground Connections: Exothermic-welded connections. Use for underground connections, except those at test wells.

G. Connections at back boxes, junction boxes, pull boxes, and equipment terminations: The equipment grounding conductor(s) associated with all circuits in the box shall be connected together and to the box using a suitable grounding screw. The removal of the respective receptacle, luminaire, or other device served by the box shall not interrupt the grounding continuity. The connection to the non-metallic boxes shall be made to any metallic fitting or device requiring grounding.

H. Tighten screws and bolts for grounding and bonding 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.

I. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.02 INSTALLATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage. Each grounding conductor that passes through a below grade wall must be provided with a waterstop.

C. Grounding electrode conductor (GEC) shall be protected from physical damage by rigid polyvinyl chloride conduit (PVC) in exposed locations.

D. In raceways, use insulated equipment grounding conductors.

E. Underground Grounding Conductors: Usetinned copper conductor, No. 2/0 AWG minimum. Bury at least 24 inches below grade or bury 12 inches above duct bank when installed as part of the duct bank.

3.03 EQUIPMENT GROUNDING SYSTEM

A. Comply with Electrical Code, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by Electrical Code are indicated.

B. Install equipment grounding conductors in all feeders and circuits. Terminate each end on a grounding lug or bus.

C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by Electrical Code:

1. Lighting and receptacle circuits. Terminate each end on a grounding lug or bus.
2. Single-phase and three-phase motor and appliance branch circuits.
3. Flexible raceway runs, including FMC and LFMC.
4. Armored and metal-clad cable runs.

D. Computer Outlet Circuits: Install insulated equipment grounding conductor in branch-circuit runs from computer-area power panels or power-distribution units.

E. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

3.04 BONDING SYSTEM

A. At building expansion joints, provide flexible bonding jumpers to connect to columns or beams on each side of the expansion joint.

B. Isolated Equipment Enclosure: For designated equipment supplied by a branch circuit or feeder, isolate equipment enclosure from supply raceway with a nonmetallic raceway fitting listed for the purpose. Install fitting where raceway enters enclosure, and install a separate equipment bonding conductor.

C. Exterior Metallic Pull and Junction Box Covers, Metallic Hand Rails: Bond to grounding system using flexible grounding conductors.

D. Equipment Circuits: Install a bonding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, dampers, and heaters. Bond conductor to each unit and to air duct. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps or copper conductor sized equal to the equipment grounding conductor.

E. Bond metal ducts of dust collectors, particulate conveying, fume hoods, and other hazardous materials to the equipment grounding conductors of associated pumps, fans, or blowers. Use braided-type bonding straps. Provide braided bare copper bonding conductor in nonmetallic dust collector ductwork to each equipment inlet location, and bond to equipment.

F. Water Heater, Heat-Tracing, Metal Well Casing, and Heating Cables: Install a separate equipment grounding conductor to each electric water heater, heat-tracing, and anti-frost heating cable. Bond conductor to heater units, piping, well casing, connected equipment, and components.

G. Connect bonding conductors to metal water pipe using a suitable ground clamp. Make connections to flanged piping at street side of flange. Provide bonding jumper around water meter.

H. Signal and Communication Systems: For telephone, alarm, voice and data, and other communication systems, provide No. 6 AWG minimum insulated bonding conductor in raceway from grounding electrode system to each service location, terminal cabinet, wiring closet, and central equipment location. Leave 10 feet of slack conductor at terminal board.

I. Telecom Service and Central Equipment Locations and Wiring Closets: Terminate grounding conductor on a 1/4-by-2-by-12-inch grounding bar.

J. Industrial Control Panels, Terminal Cabinets, and Similar Installation: Terminate bonding conductor on cabinet grounding terminal. Provide an equipment grounding conductor and bond adjacent and associated control panels together.

K. Equipment Ground Conductor Continuity: All spliced equipment grounding conductors in junction boxes, cabinets, and distribution equipment shall be connected together and bonded to the metal enclosure.

L. Remote control, signaling, and fire alarm circuits shall be bonded in accordance with the most recent version of the National Electric Code.

3.05 GROUNDING ELECTRODE SYSTEM

A. Ground Ring (Counterpoise):

1. Ground the steel framework of the building with a driven ground rod at the base of every corner column and at intermediate exterior columns at average distances not more than 60 feet apart. Provide a grounding conductor, electrically connected to each ground rod and to each steel column, extending around the perimeter of the building. Use tinned-copper conductor not less than No. 2 AWG for ground ring and for tap to building steel. Bury conductor not less than 30 inches below grade, 24 inches from building foundation, and 18 inches outside of roof drip line.

B. Supplementary Grounding Electrode: Use driven ground rod on exterior of building.

C. Ground Rods: Install at least two rods spaced at least 20 feet from each other and located at least the same distance from other grounding electrodes.

1. Drive ground rods until tops are 12 inches below finished floor or final grade, unless otherwise indicated.
2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.

D. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters, filtering devices, and similar equipment. Connect to pipe with grounding clamp connectors.

E. Natural Gas Service Piping: Bond to natural gas main service with grounding clamp connectors. Bonding conductor shall be connected to the main service ground bar. Provide grounding jumpers around all breaks in metallic continuity.

F. Natural Gas Equipment Piping: Bond each aboveground portion of natural gas metallic piping system at each equipment location with grounding clamp connectors. Bonding shall be performed after any flexible attachment nearest the equipment. The equipment grounding conductors may serve as the bonding means.

G. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.

3.06 EQUIPOTENTIAL (MULTI-POINT) GROUNDING SYSTEM

A. Provide an equipotential grounding system in the following locations:

1. Class I Div 1 and Div 2 locations as required in Electrical Code.
2. Swimming pool, fountains, and similar locations as required in Electrical Code.
3. Critical patient care and special care areas as indicated on drawings.

B. The non-current-carrying metal parts of equipment, raceways and other enclosures shall be bonded to the grounding system.

3.07 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

A. Manholes and Handholes: Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.

B. Connections to Manhole Components: Connect exposed-metal parts, such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields as recommended by manufacturer of splicing and termination kits.

C. Pad-Mounted Transformers and Switches: Install two ground rods and counterpoise circling pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Use tinned-copper conductor not less than No. 2 AWG for counterpoise and for taps to equipment ground pad. Bury counterpoise not less than 18 inches below grade and 6 inches from the foundation. The pad rebar shall be attached to the counterpoise conductor at the four corners.

3.08 FIELD QUALITY CONTROL

A. Inspect grounding and bonding system conductors and connections for tightness and proper installation.

1. Measure ground resistance from system neutral connection at service entrance to convenient ground reference points using suitable ground testing equipment. Resistance shall not exceed 5 ohms.
2. Testing: Owner will engage a qualified testing agency to perform the following field quality-control testing:
3. Testing: Engage a qualified testing agency to perform the following field quality-control testing:
4. Testing: Perform the following field quality-control testing:

    a. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.
    b. 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. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE 81.

c. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

1) Equipment Rated 500 kVA and Less: 10 ohms.
2) Equipment Rated 500 to 1000 kVA: 5 ohms.
3) Equipment Rated More Than 1000 kVA: 3 ohms.
4) Substations and Pad-Mounted Switching Equipment: 5 ohms.
5) Manhole Grounds: 10 ohms.

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

3.09 GRADING AND PLANTING

A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Division 2. Maintain restored surfaces. Restore disturbed paving.

END OF SECTION 26 0526

SECTION 26 0527

SUPPORTING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Conduit and Equipment Supports

B. Fastening Hardware

1.02 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

1.03 COORDINATION

A. Coordinate size, shape and location of concrete pads with section on Cast-in-Place Concrete or Concrete Topping.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Allied Support Systems

B. Cooper B-Line

C. Erico, Inc.

D. Hilti

2.02 MATERIAL

A. Support Channel: Hot-dip galvanized; painted steel for interior/dry locations. All field cut ends shall be touched up with matching finish to inhibit rusting.

B. Hardware: Corrosion resistant.

Model	Service	Element Material	Temperature Range
S	Standard (Stainless)	EPDM	-40°F to 250°F
T	Fire Seals (1 hour)	Silicone	-67°F to 400°F
FS	Fire Seals (3 hours)	Silicone	-67°F to 400°F
OS	Oil Resistant / Stainless	Nitrile	-40°F to 210°F

PART 3 EXECUTION

3.01 INSTALLATION

A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors in concrete and beam clamps on structural steel.

B. Trapeze support installation: Cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.

C. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchor on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.

D. Do not fasten supports to ceiling systems, piping, ductwork, mechanical equipment, or conduit, unless otherwise noted.

E. Do not use powder-actuated anchors without specific permission.

F. Do not drill structural steel members.

G. Fabricate supports from structural steel or steel channel, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

H. In wet locations and on all building floors below exterior earth grade install free-standing electrical equipment on concrete pads.

I. Install cabinets and panelboards with minimum of four anchors. Provide horizontal backing/support framing in stud walls for rigid mounting. Provide steel channel supports to stand surface-mounted panelboard or cabinet one inch off wall.

J. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

K. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

L. Refer to Section 26 0533 for special conduit supporting requirements.

3.02 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.

B. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

END OF SECTION 26 0527

SECTION 26 0533

CONDUIT AND BOXES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Rigid metallic conduit and fittings (RMC)

B. Intermediate metallic conduit and fittings (IMC)

C. Electrical metallic tubing and fittings (EMT)

D. Flexible metallic conduit and fittings (FMC)

E. Liquidtight flexible metallic conduit and fittings (LFMC)

F. Rigid polyvinyl chloride conduit and fittings (PVC)

G. Wall and ceiling outlet boxes

H. Pull and junction boxes

I. Handholes

J. Accessories

1.02 RELATED WORK

A. Section 26 0553 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.03 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated
2. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated and Fittings
3. ANSI C80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing
4. ANSI C80.6 - Intermediate Metal Conduit, Zinc Coated
5. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports
6. ANSI/NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports

B. Federal Specifications (FS):

1. A-A-50553A - Fittings for Conduit, Metal, Rigid, (Thick-Wall and Thin-Wall (EMT) Type
2. A-A-55810 - Specification for Flexible Metal Conduit

C. NECA "Standards of Installation"

D. National Electrical Manufacturers Association (NEMA):

1. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
2. RN 1 - Polyvinyl chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit, Rigid Aluminum Conduit, and Intermediate Metal Conduit
3. TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit
4. TC 9 - Fittings for PVC Plastic Utilities Duct for Underground Installation

E. NFPA 70 - National Electrical Code (NEC)

F. CEC California Electrical Code

G. Underwriters Laboratories (UL): Applicable Listings

1. UL 1 - Flexible Metal Conduit
2. UL 6 - Rigid Metal Conduit
3. UL 360 - Liquid Tight Flexible Steel Conduit
4. UL514-B - Conduit Tubing and Cable Fittings
5. UL651-A - Type EB and a PVC Conduit and HDPE Conduit
6. UL651-B - Continuous Length HDPE Conduit
7. UL746A - Standard for Polymeric Materials - Short Term Property Evaluations
8. UL797 - Electrical Metal Tubing
9. UL1242 - Intermediate Metal Conduit

H. American Standard of Testing and Materials (ASTM):

1. ASTM D 570 - Standard Test Method for Water Absorption of Plastics
2. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics
3. ASTM D 648 - Standard Test Method for Deflection Temperature of Plastics under Flexural Load in the Edge Wise Position
4. ASTM D 2412 - Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading
5. ASTM D 2447 - Standard Specification for Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
6. ASTM D 3350 - Standard Specification for Polyethylene Plastic Pipe and Fittings Material

I. Definitions:

1. Fittings: Conduit connection or coupling.
2. Body: Enlarged fittings with opening allowing access to the conductors for pulling purposes only.
3. Mechanical Spaces: Enclosed areas, usually kept separated from the general public, where the primary use is to house service equipment and to route services. These spaces generally have exposed structures, bare concrete and non-architecturally emphasized finishes.

4. Finished Spaces: Enclosed areas where the primary use is to house personnel and the general public. These spaces generally have architecturally emphasized finishes, ceilings and/or floors.
5. Concealed: Not visible by the general public. Often indicates a location either above the ceiling, in the walls, in or beneath the floor slab, in column coverings, or in the ceiling construction.
6. Above Grade: Not directly in contact with the earth. For example, an interior wall located at an elevation below the finished grade shall be considered above grade but a wall retaining earth shall be considered below grade.
7. Slab: Horizontal pour of concrete used for a floor or sub-floor.

PART 2 PRODUCTS

2.01 RIGID METALLIC CONDUIT (RMC) AND FITTINGS

A. Manufacturers:

1. Allied
2. LTV
3. Steelduct
4. Calbond Calpipe

B. Manufacturers of RMC Conduit Fittings:

1. Appleton Electric
2. O-Z/Gedney Co.
3. Electroline

C. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted.

D. Fittings and Conduit Bodies:

1. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
2. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
3. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.

2.02 INTERMEDIATE METALLIC CONDUIT (IMC) AND FITTINGS

A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted.

B. Manufacturers:

1. Allied
2. LTV
3. Steelduct
4. O-Z Gedney

C. Fittings and Conduit Bodies:

1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.
2. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. High impact phenolic threaded type bushings are not acceptable.
3. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.

2.03 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

A. Minimum Size Electrical Metallic Tubing: 3/4 inch, unless otherwise noted.

B. Manufacturers of EMT Conduit:

1. Allied
2. Calbond Calpipe
3. LTV
4. Steelduct

C. Fittings and Conduit Bodies:

1. 2" Diameter or Smaller: Compression type of steel designed for their specific application.
2. 1/2" and 3/4" Conduit: Push-on connectors and couplers with locking ring and washer of zinc plated steel, listed for use in dry locations.
3. Larger than 2": Compression type of steel designed for their specific application.
4. Manufacturers of EMT Conduit Fittings:

    a. Appleton Electric
    b. O-Z/Gedney Co.
    c. Electroline
    d. Midwest
    e. Thomas & Betts
    f. or approved equal.

2.04 FLEXIBLE METALLIC CONDUIT (FMC) AND FITTINGS

A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted. Lighting branch circuit wiring to an individual luminaire may be a manufactured, UL listed 3/8" flexible metal conduit and fittings with #14 AWG THHN conductors and an insulated ground wire. Maximum length of 3/8" FMC shall be six (6) feet.

B. Manufacturers:

1. American Flex
2. Alflex
3. Electri-Flex Co
4. or approved equal.

C. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel. Provide a separate equipment grounding conductor when used for equipment where flexibility is required.

D. Fittings and Conduit Bodies:

1. Threadless hinged clamp type, galvanized zinc coated cadmium plated malleable cast iron or screw-in type, die-cast zinc.
2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
3. Manufacturers:

    a. O-Z/Gedney Co.
    b. Thomas & Betts
    c. Appleton Electric
    d. Electroline

2.05 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC) AND FITTINGS

A. Manufacturers:

1. Anaconda Type UA
2. Electri-Flex Type LA
3. Alflex
4. or approved equal.

B. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel and an extruded PVC cover.

C. Fittings and Conduit Bodies:

1. Watertight, compression type, galvanized zinc coated cadmium plated malleable cast iron, UL listed.
2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
3. Manufacturers:

    a. Appleton Electric
    b. O-Z/Gedney Co.
    c. Electroline
    d. Thomas & Betts

2.06 RIGID NON-METALLIC CONDUIT (PVC) AND FITTINGS

A. Minimum Size Rigid Smooth-Wall Nonmetallic Conduit: 3/4 inch, unless otherwise noted.

B. Acceptable Manufacturers:

1. Carlon (Lamson & Sessions) Type 40

C. Construction: Schedule 40 and Schedule 80 rigid polyvinyl chloride (PVC), UL labeled for 90°C.

D. Fittings and Conduit Bodies: NEMA TC 3; sleeve type suitable for and manufactured especially for use with the conduit by the conduit manufacturer.

E. Plastic cement for joining conduit and fittings shall be provided as recommended by the manufacturer.

ASTM Test	Description	Values HDPE
D-1505	Density g/CM 3	less than 0.941
D-1238	Melt Index, g/10 min Condition E	greater than 0.55 grams/10 min.
D-638	Tensile Strength at yield (psi)	3000 min.
D-1693	Environmental Stress Crack Resistance Condition B, F 20	96 hrs.
D-790	Flexural Modulus, MPa (psi)	less than 80,000
D-746	Brittleness Temperature	-75°C Max

2.07 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, 16 gauge (approximately 0.0625 inches), with 1/2-inch male fixture studs where required.

B. Outlet boxes for luminaires to be not less than 1-1/2" deep, deeper if required by the number of wires or construction. The box shall be coordinated with surface luminaires to conceal the box from view or provide a finished trim plate.

C. Switch outlet boxes for local light control switches, dimmers and occupancy sensors shall be 4 inches square by 2-1/8 inches deep, with raised cover to fit flush with finish wall line. Multiple gang switch outlets shall consist of the required number of gang boxes appropriate to the quantity of switches comprising the gang. Where walls are plastered, provide a plaster raised cover. Where switch outlet boxes occur in exposed concrete block walls, boxes shall be installed in the block cavity with a raised square edge tile cover of sufficient depth to extend out to face of block or masonry boxes.

D. Outlet boxes for telephone substations in walls and columns shall be 4 inches square and 2-1/8 inches deep with single gang raised cover to fit flush with finished wall line equipped with flush telephone plate.

E. Wall or column receptacle outlet boxes shall be 4 inches square with raised cover to fit flush with finished wall line. Boxes in concrete block walls shall be installed the same as for switch boxes in block walls.

2.08 JB; PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: ANSI/NEMA OS 1; galvanized steel.

B. Sheet metal boxes larger than 12 inches in any dimension that contain terminations or components: Continuous hinged enclosure with 1/4 turn latch and white back panel for mounting terminal blocks and electrical components.

C. Flanged type boxes shall be used where installed flush in wall.

2.09 HANDHOLES

A. HH-##; Handhole, cast iron, hot dipped galvanized with checkered cover sidewalk weatherproof box, flat neoprene cover gasket. Stainless steel screw hardware. Mounted flush in concrete. 12"W, 18"L, 12"D or dimensions as shown on plans.

1. Manufacturers:

a. Appleton Electric WYT Series, WYT 181212
b. OZ Gedney YT Series
c. Crouse Hinds WJBF Series

B. HH-##; Handhole, concrete traffic box and galvanized steel checkered cover. Stainless steel hardware. Bolted cover and box rated for H/20 vehicular traffic. Reinforced concrete slab for bottom. 11"W, 18"L, 24"D or dimensions as shown on plans.

1. Manufacturer:

a. Oldcastle Precast B1017 Box

2.10 ACCESSORIES

A. Fire Rated Moldable Pads: UL #9700, moldable sheet putty at required thickness on all five sides of back boxes. Kinetics Noise Control - IsoBacker Pad, SpecSeal - SSP Putty and Pads, 3M #MPP-4S or equal.

B. Sound Barrier Insulation Pads: Mastic, non-hardening, sheet material, minimum 1/8" thickness applied to all five sides of back boxes. Kinetics Noise Control - SealTight Backer Pad, L.H. DOTTIE Co., #68 or equal.

PART 3 EXECUTION

3.01 CONDUIT INSTALLATION SCHEDULE AND SIZING

A. In the event the location of conduit installation represents conflicting installation requirements as specified in the following schedule, a clarification shall be obtained from the Architect/Engineer. If this Contractor is unable to obtain a clarification as outlined above, concealed rigid galvanized steel conduit installed per these specifications and the Electrical Code shall be required.

B. Installation Schedule: Refer to drawings.

C. Size conduit as shown on the drawings and specifications. Where not indicated in the contract documents, conduit size shall be according to the Electrical Code. Conduit and conductor sizing shall be coordinated to limit conductor fill to less than 40%, maintain conductor ampere capacity as required by the Electrical Code (to include enlarged conductors due to temperature and quantity derating values) and to prevent excessive voltage drop and pulling tension due to long conduit/conductor lengths.

D. Minimum Conduit Size (Unless Noted Otherwise):

1. Above Grade: 3/4 inch. (The use of 1/2 inch would be allowed for installation conduit to individual light switches, individual receptacles and individual fixture whips from junction box.)
2. Below Grade 5' or less from Building Foundation: 3/4 inch.

E. Conduit Embedded in Slabs above Grade:

1. Embedded installation NOT allowed in elevated slabs with metal composite decks nor structural pour in place slabs less than 6 inches in depth unless specifically noted or shown on drawings otherwise.
2. Maximum size 1-1/4 inch for conduits crossing each other.

F. Conduit sizes shall change only at the entrance or exit to a junction box, unless specifically noted on the drawings.

3.02 CONDUIT ARRANGEMENT

A. In general, conduit shall be installed concealed in walls, in finished spaces and where possible or practical, or as noted otherwise. Conduit shall be installed parallel or perpendicular to walls, ceilings, and exposed structural members. In unfinished spaces, mechanical and utility areas, conduit may run either concealed or exposed as conditions dictate and as practical unless noted otherwise on drawings. Installation shall maintain headroom in exposed vicinities of pedestrian or vehicular traffic.

B. Exposed conduit on exterior walls or above roof will not be allowed without prior written approval of Architect/Engineer. A drawing of the proposed routing and a photo of the location shall be submitted 14 days prior to start of conduit rough-in. Routing shall be shown on coordination drawings.

C. Conduit arrangement in elevated slabs (restricted to applications specifically noted or shown on drawings):

1. Conduit size shall not exceed one-third of the structural slab thickness. Place conduit between the top and bottom reinforcing with a minimum of 3" concrete cover.
2. Parallel conduits shall be spaced at least 8 inches apart. Exception: Within 18 inches of commonly served floor boxes, junction boxes, or similar floor devices. Arrange conduits parallel or perpendicular to building lines and walls.

D. Conduit shall not share the same cell as structural reinforcement in masonry walls.

E. Conduit runs shall be routed as shown on large scale drawings. Conduit routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatic, unless noted otherwise. The correct routing, when shown diagrammatically shall be chosen by the Contractor based on information in the contract documents, in accordance with manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", in accordance with recognized industry standards, and coordinated with other contractors.

F. Contractor shall adapt Contractor's work to the job conditions and make such changes as required and permitted by the Architect/Engineer, such as moving to clear beams and joists, adjusting at columns, avoiding interference with windows, etc., to permit the proper installation of other mechanical and/or electrical equipment.

G. Contractor shall cooperate with all contractors on the project. Contractor shall obtain details of other contractor's work to ensure fit and avoid conflict. Any expense due to the failure of This Contractor to do so shall be paid for in full by Contractor. The other trades involved as directed by the Architect/Engineer shall perform the repair of work damaged as a result of neglect or error by This Contractor. The resultant costs shall be borne by This Contractor.

3.03 CONDUIT SUPPORT

A. Conduit runs installed above a suspended ceiling shall be properly supported. In no case shall conduit rest on the suspended ceiling construction, nor utilize ceiling support system for conduit support.

1. Support wire used to independently support raceway and wiring systems above suspending ceilings shall be supported on both ends, minimum 12 gauge suspended ceiling support wire, and distinguishable from ceiling support systems by color (field paint), tagging, or equivalent means.

B. Conduit shall not be supported from ductwork, water, sprinkler piping, or other non-structural members, unless approved by the Architect/Engineer. All supports shall be from structural slabs, walls, structural members, and bar joists, and coordinated with all other applicable contractors, unless noted otherwise.

C. Conduit shall be held in place by the correct size of galvanized one-hole conduit clamps, two-hole conduit straps, patented support devices, clamp back conduit hangers, or by other means if called for on the drawings.

D. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

E. Spring-steel conduit clips specifically designed for supporting single conduits or tubing may be used in lieu of malleable-iron hangers for 1-1/2" and smaller raceways serving lighting and receptacle branch circuits above accessible ceilings and for securing raceways to slotted channel and angle supports.

F. Group conduits in parallel runs where practical and use conduit racks or trapeze hangers constructed of steel channel, suspended with threaded solid rods or wall mounted from metal channels with conduit straps or clamps. Provide space in each rack or trapeze for 25% additional conduits.

G. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Supports for metallic conduit shall be no greater than 10 feet. A smaller interval may be used if necessitated by building construction, but in no event shall support spans exceed the Electrical Code requirements. Conduit shall be securely fastened within 3 feet of each outlet box, junction box, device box, cabinet, or fitting.

J. Supports of flexible conduit shall be within 12 inches of each outlet box, junction box, device box, cabinet, or fitting and at intervals not to exceed 4.5 feet.

K. Supports for non-metallic conduit shall be at sufficiently close intervals to eliminate any sag in the conduit. The manufacturer's recommendations shall be followed, but in no event shall support spans exceed the Electrical Code requirements.

L. Where conduit is to be installed in poured concrete floors or walls, provide concrete-tight conduit inserts securely fastened to forms to prevent conduit misplacement.

M. Finish:

1. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
2. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

3.04 CONDUIT INSTALLATION

A. Conduit Connections:

1. Shorter than standard conduit lengths shall be cut square using industry standards. The ends of all conduits cut shall be reamed or otherwise finished to remove all rough edges.
2. Metallic conduit connections in slab on grade installation shall be sealed and one coat of rust inhibitor primer applied after the connection is made.
3. Where conduits with tapered threads cannot be coupled with standard couplings, then approved split or Erickson couplings shall be used. Running threads will not be permitted.
4. Install expansion/deflection joints where conduit crosses structure expansion/seismic joints.

B. Conduit terminations for all low voltage wiring shall have nylon bushings installed on each end of every conduit run.

C. Conduit Bends:

1. Use a hydraulic one-shot conduit bender or factory elbows for bends in conduit 2" in size or larger. All steel conduit bending shall be done cold; no heating of steel conduit shall be permitted.
2. All bends of rigid polyvinyl chloride conduit (PVC) shall be made with the manufacturer's approved bending equipment. The use of spot heating devices will not be permitted (i.e. blow torches).
3. A run of conduit shall not contain more than the equivalent of four (4) quarter bends (360°), including those bends located immediately at the outlet or body.
4. Telecommunications conduits shall have no more than two (2) 90-degree bends between pull points and contain no continuous sections longer than 100 feet. Insert pull points or pull boxes for conduits exceeding 100 feet in length.

    a. A third bend is acceptable if:

        1) The total run is not longer than (33) feet.
        2) The conduit size is increased to the next trade size.

5. Telecommunications pull boxes shall not be used in lieu of a bend. Align conduits that enter the pull box from opposite ends with each other. Pull box size shall be twelve (12) times the diameter of the largest conduit. Slip sleeves or gutters can be used in place of a pull box.
6. Telecommunications Conduit(s): Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of less than 2", maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter 2" or greater, maintain a bend radius of at least 10 times the internal diameter.
7. Rigid polyvinyl chloride conduit (PVC) runs longer than 100 feet or runs which have more than two 90° equivalent bends (regardless of length) shall use rigid metal or RTRC factory elbows for bends.
8. Use conduit bodies to make sharp changes in direction (i.e. around beams).

D. Conduit Placement:

1. Conduit shall be mechanically continuous from source of current to all outlets. Conduit shall be electrically continuous from source of current to all outlets, unless a properly sized grounding conductor is routed within the conduit. All metallic conduits shall be bonded per the Electrical Code.
2. Route exposed conduit and conduit above suspended ceilings (accessible or not) parallel/perpendicular to the building structural lines, and as close to building structure as possible. Wherever possible, route horizontal conduit runs above water and steam piping.
3. Route conduit through roof openings provided for piping and ductwork where possible. If not provided or routing through provided openings is not possible, route through roof jack with pitch pocket. Coordinate roof penetrations with other trades.
4. Conduits, raceway, and boxes shall not be installed in concealed locations in metal deck roofing or less than 1.5" below bottom of roof decking.

5. Avoid moisture traps where possible. Where unavoidable, provide a junction box with drain fitting at conduit low point.
6. All conduits through walls shall be grouted or sealed into openings. Where conduit penetrates firewalls and floors, seal with a UL listed sealant. Seal penetrations with intumescent caulk, putty, or sheet installed per manufacturer's recommendations. All materials used to seal penetrations of firewalls and floors shall be tested and certified as a system per ASTM E814 Standard for fire tests or through-penetration fire stops as manufactured by 3M or approved equal
7. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL OPENINGS REQUIRED IN MASONRY OR EXTERIOR WALLS UNDER THIS DIVISION. A QUALIFIED MASON AT THE EXPENSE OF THIS CONTRACTOR SHALL REPAIR ALL OPENINGS TO MATCH EXISTING CONDITIONS.
8. Seal interior of conduit at exterior entries, air handling units, coolers/freezers, etc., and where the temperature differential can potentially be greater than 20°F, to prevent moisture penetration. Seal shall be placed where conduit enters warm space. Conduit seal fitting shall be a drain/seal, with sealing compound, identified for use with cable and raceway system, equal to O-Z/Gedney type EYD.
9. Horizontal conduit routing through slabs above grade

    a. Conduits, if run in concrete structure, shall be in middle one-third of slab thickness, and leave at least 3" min. concrete cover. Conduits shall run parallel to each other and spaced at least 8" apart centerline to centerline. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement. Maximum conduit outside diameter 1".
    b. No conduits are allowed in concrete on metal deck unless expressly approved in writing by the Structural Engineer.
    c. No conduits are allowed to be routed horizontally through slabs above grade.

10. Do not route conduits across each other in slabs on grade.
11. Rigid polyvinyl chloride conduit (PVC) shall be installed when material surface temperatures and ambient temperature are greater than 40°F.
12. Where rigid polyvinyl chloride conduit (PVC) is used below grade, in a slab, below a slab, etc., a transition to rigid galvanized steel or PVC-coated steel conduit shall be installed before conduit exits earth. The metallic conduit shall extend a minimum of 6" into the surface concealing the non-metallic conduit.
13. Contractor shall provide suitable mechanical protection around all conduits stubbed out from floors, walls or ceilings during construction to prevent bending or damaging of stubs due to carelessness with construction equipment.
14. Contractor shall provide a polypropylene pull cord with 2000 lbs. tensile strength in each empty conduit (indoor and outdoor), except in sleeves and nipples.
15. Telecommunications conduits that protrude through the structural floor shall be installed 1 to 3" above finished floor (AFF).
16. Telecommunications conduits that enter into Telecommunications rooms below the finished ceiling shall terminate a minimum of 4" below ceiling and as close to the wall as possible.
17. Telecommunications conduits that are below grade and enter into a building shall terminate a minimum of 4" above finished floor (AFF) and as close to the wall as possible.

3.05 CONDUIT TERMINATIONS

A. Where conduit bonding is indicated or required in the contract documents, the bushings shall be a grounding type sized for the conduit and ground bonding conductor as manufactured by O-Z/Gedney, Appleton, Thomas & Betts, Burndy, Regal, Orbit Industries or approved equal.

B. Conduits with termination fittings shall be threaded for one (1) lock nut on the outside and one (1) lock nut and bushing on the inside of each box.

C. Where conduits terminate in boxes with knockouts, they shall be secured to the boxes with lock nuts and provided with approved screw type tinned iron bushings or fittings with plastic inserts.

D. Where conduits terminate in boxes, fittings, or bodies with threaded openings, they shall be tightly screwed against the shoulder portion of the threaded openings.

E. Conduit terminations to all motors shall be made with flexible metallic conduit (FMC), unless noted otherwise. Final connections to roof exhaust fans, or other exterior motors and motors in damp or wet locations shall be made with liquidtight flexible metallic conduit (LFMC). Motors in hazardous areas, as defined in the Electrical Code, shall be connected using flexible conduit rated for the environment. Flexible conduit shall not exceed 6' in length. Route equipment ground conductors from circuit ground to motor ground terminal through flexible conduit.

F. Rigid polyvinyl chloride conduit (PVC) shall be terminated using fittings and bodies produced by the manufacturer of the conduit, unless noted otherwise. Prepare conduit as per manufacturer's recommendations before joining. All joints shall be solvent welded by applying full even coat of plastic cement to the entire areas that will be joined. Turn the conduit at least a quarter to one half turn in the fitting and let the joint cure for 1-hour minimum or as per the manufacturer's recommendations.

G. All conduit ends shall be sealed with plastic immediately after installation to prevent the entrance of any foreign matter during construction. The seals shall be removed and the conduits blown clear of all foreign matter prior to any wires or pull cords being installed.

3.06 RIGID POLYVINYL CHLORIDE CONDUIT (PVC) OVERHEAD CONDUIT INSTALLATION

A. Conduit shall be installed away from high temperature piping and equipment.

B. Conduit shall be installed to prevent exposure to ultraviolet radiation.

C. Proper allowances shall be made for expansion and/or contraction of the conduit during installation.

D. Expansion fittings shall be installed in any 100' continuous run of conduit and at each 100' thereafter.

E. Supports shall be made from non-corroding materials and spacing shall not be greater than the listing in the Electrical Code, but also shall not exceed the manufacturer's recommendations depending on the expected surface temperature.

3.07 UNDERGROUND CONDUIT INSTALLATION

A. Conduit Connections:

1. Conduit joints in a multiple conduit run shall be staggered at least one foot apart.

B. Conduit Bends (Lateral):

1. Conduits shall have long sweep radius elbows instead of standard elbows wherever special bends are indicated and noted on the drawings, or as required by the manufacturer of the equipment or system being served.
2. Telecommunications conduit bend radius shall be six times the diameter for conduits under 2" and ten times the diameter for conduits over 2". Where long cable runs are involved, sidewall pressures may require larger radius bends. Coordinate with Architect/Engineer prior to conduit installation to determine bend radius.

C. Conduit Elbows (vertical):

1. Minimum metal or RTRC elbow radiuses shall be 30 inches for primary conduits (greater than 600V) and 18 inches for secondary conduits (less than 600V). Increase radius, as required, based on pulling tension calculation requirements.

D. Expansion Fittings at Finished Grade: Provide underground raceways with an expansion fitting after emerging from finished grade and exterior equipment pads. Field locate the expansion fitting above and within 24 inches of finished grade. Raceways extending less than 12 inches above finished grade, transitioning to LFMC within 12 inches of finished grade, and interior concrete building slabs do not require an expansion fitting unless required by code.

E. Conduit Placement:

1. Conduit runs shall be pitched a minimum of 4" per 100 feet to drain toward the terminations. Duct runs shall be installed deeper than the minimum wherever required to avoid any conflicts with existing or new piping, tunnels, etc.
2. For parallel runs, use suitable separators and chairs installed not greater than 4' on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement or backfilling.
3. Where concrete is required, the materials for concreting shall be thoroughly mixed to a minimum f'c = 2500 and immediately placed in the trench around the conduits. No concrete that has been allowed to partially set shall be used.
4. Before the Contractor pulls any cables into the conduit, Contractor shall have a mandrel 1/4" smaller than the conduit inside diameter pulled through each conduit and if any concrete or obstructions are found, the Contractor shall remove them and clear the conduit. Spare conduit shall also be cleared of all obstructions.

5. Conduit terminations in manholes, masonry pull boxes, or masonry walls shall be with malleable iron end bell fittings.
6. All spare conduits not terminated in a covered enclosure shall have its terminations plugged as described above.
7. Ductbanks and conduit shall be installed a minimum of 24" below finished grade, unless otherwise noted on the drawings or elsewhere in these specifications.
8. All non-metallic conduit installed underground outside of a slab shall be rigid.

F. Horizontal Directional Drilling:

1. Entire drill path shall be accurately surveyed, with entry and exit stakes placed and coordinated with other contractors. If using a magnetic guidance system, entire drill path shall be surveyed for any surface geo-magnetic variations or anomalies.
2. Any utility locates within 20 feet of the bore path shall have the exact location physically verified by hand digging or vacuum excavation. Restore inspection holes to original condition after verification.

G. Raceway Seal:

1. Where a raceway enters a building or structure, it shall be sealed with a sealing bushing or duct seal to prevent the entry of liquids or gases. Seal must be compatible with conductors and raceway system. Spare or unused raceway shall also be sealed.
2. All telecommunications conduits and innerducts, including those containing cables, shall be plugged at the building and vault with "JackMoon" or equivalent duct seal, capable of withstanding a 10-foot head of water (5 PSI).
3. Duct Seal Alternative Option: Inflatable duct seal system. Capable of withstanding a 10-foot head of water (5 PSEI).

    a. Manufacturers:

        1) Raychem Rayflate Duct Sealing Systems RDSS
        2) Approved equal

3.08 BOX INSTALLATION SCHEDULE

A. Galvanized steel boxes may be used in:

1. Concealed interior locations above ceilings and in hollow studded partitions.
2. Exposed interior locations in mechanical rooms and in rooms without ceilings; higher than 8' above the highest platform level.
3. Direct contact with concrete except slab on grade.
4. Recessed in stud wall of kitchens and laundries.

3.09 COORDINATION OF BOX LOCATIONS

A. Provide electrical boxes as shown on the drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

B. Electrical box locations shown on the Contract Drawings are approximate, unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.

C. Locate and install boxes to allow access. Avoid interferences with ductwork, piping, structure, equipment, etc. Recessed luminaires shall not be used as access to outlet, pull, and junction boxes. Where installation is inaccessible, provide access doors. Coordinate locations and sizes of required access doors with the Architect/Engineer and General Contractor.

D. Locate and install to maintain headroom and to present a neat appearance.

E. Coordinate locations with Heating Contractor to avoid baseboard radiation cabinets.

3.10 OUTLET BOX INSTALLATION

A. Do not install boxes back-to-back in walls.

1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.
2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.

B. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.

C. The Contractor shall anchor switch and outlet box to wall construction so that it is flush with the finished masonry, paneling, drywall, plaster, etc. The Contractor shall check the boxes as the finish wall surface is being installed to assure that the box is flush. (Provide plaster rings as necessary.)

D. Mount at heights shown or noted on the drawings or as generally accepted if not specifically noted.

E. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.

F. Provide knockout closures for unused openings.

G. Support boxes independently of conduit.

H. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

I. Install boxes in walls without damaging wall insulation.

J. Coordinate mounting heights and locations of outlets mounted above counters, benches, backsplashes, and below baseboard radiation.

K. Position outlets to locate luminaires as shown on reflected ceiling drawings.

L. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioned to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.

M. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

N. Provide cast outlet boxes in exterior locations and wet locations, and where exposed rigid or intermediate conduit is used.

3.11 PULL AND JUNCTION BOX INSTALLATION

A. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.

B. Support pull and junction boxes independent of conduit.

C. Do not install boxes back-to-back in walls.

1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.
2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.

D. Install sound insulation pads on all five sides of the back of all boxes in sound-rated wall assemblies. Sound-rated wall assemblies are defined as partition types carrying a Sound Transmission Class (STC) rating.

3.12 EXPOSED BOX INSTALLATION

A. Boxes shall be secured to the building structure with proper size screws, bolts, hanger rods, or structural steel elements.

B. On brick, block and concrete walls or ceilings, exposed boxes shall be supported with no less than two (2) Ackerman-Johnson, Paine, Phillips, or approved equal screw anchors or expansion shields and round head machine screws. Cast boxes shall not be drilled.

C. On steel structures, exposed boxes shall be supported to the steel member by drilling and tapping the member and fastening the boxes by means of round head machine screws.

D. Boxes may be supported on steel members by APPROVED beam clamps if conduit is supported by beam clamps.

E. Boxes shall be fastened to wood structures by means of a minimum of two (2) wood screws adequately large and long to properly support. (Quantity depends on size of box.)

F. Wood, plastic, or fiber plugs shall not be used for fastenings.

G. Explosive devices shall not be used unless specifically allowed.

END OF SECTION 26 0533

SECTION 26 0548

SEISMIC REQUIREMENTS FOR EQUIPMENT AND SUPPORTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Seismic Requirements.

1.02 QUALITY ASSURANCE

A. General:

1. The contractor shall retain a specialty consultant or equipment manufacturer to develop a seismic restraint and support system and perform seismic calculations in accordance with these specifications, state, and local codes.
2. Items used for seismic restraint of equipment and systems shall be specifically manufactured for seismic restraint.
3. These requirements are beyond those listed in Section 26 0527 of these specifications. Where a conflict arises between the seismic requirements of this section and any other section, the Architect/Engineer shall be immediately notified for direction to proceed.

B. Manufacturer:

1. System Supports/Restraints: Company specializing in the manufacture of products specified in this Section.
2. Equipment: Each company providing equipment that must meet seismic requirements shall provide certification included in project submittals the equipment supplied for the project meets or exceeds the seismic requirements of the project.

C. Testing Agency: An independent testing agency, acceptable to Authorities Having Jurisdiction, with experience and capability to conduct the testing indicated.

D. Installer: Company specializing in performing the work of this Section.

1.03 REFERENCES

A. International Building Code, 2000

B. California Building Code (CBC)

C. California Division of State Architect (DSA) Interpretation of Regulations

D. ASHRAE - A Practical Guide to Seismic Restraint.

E. ASCE 7-02, Chapter 9.

F. ASCE 7-05, Chapter 13.

G. ASCE 7-10, Chapter 13.

H. ASCE 7-16, Chapter 13.

1.04 TESTING AND INSPECTION

A. Special Inspection and Testing shall be done in accordance with Chapter 17 of the InternationalBuilding Code.

B. The O**wner**shall employ a Special Inspection Agency to perform the duties and responsibilities specified in Section 1704 and 1705.

C. Work performed on the premises of a fabricator approved by the building official need not be tested and inspected. The fabricator shall submit a certificate of compliance that the work has been performed in accordance with the approved plans and specifications to the building official and the Architect and Engineer of Record.

D. The Special Inspection Agency shall furnish inspection reports to the building official, the Owner, the Architect, the Engineer of Record, and the General Contractor. The reports shall be completed and furnished within 48 hours of inspected work. A final signed report stating whether the work requiring special inspection was, to the best of the Special Inspection Agency's knowledge, in conformance with the approved plans and specifications shall be submitted.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, protect and handle products to site. Accept material on site in factory containers and packing. Inspect for damage. Protect from damage and contamination by maintaining factory packaging until installation. Follow manufacturer's instructions for storage.

1.06 DESIGN REQUIREMENTS

A. This project is subject to the seismic bracing requirements of the International Building Code, 2000 edition.

B. This project is subject to the seismic bracing requirements of California Building Code, Division of State Architect (DSA) Interpretation of Regulations.

C. Equipment shall meet California Building Code and ASCE 7 seismic qualification requirements in concurrence with ICC ES AC156 Acceptance Criteria for Seismic Qualification by Shake-Table Testing of Nonstructural Components and Systems.

D. All seismic anchorage and bracing shall comply with the St. Louis County Rules & Regulations on Anchorage & Sway Bracing - Mechanical, Electrical & Plumbing (MEP) System Components.

E. All seismic anchorage and bracing shall comply with FM Global Property Loss Prevention Data Sheet 1-11, Fire Following Earthquakes.

1.07 COORDINATION

A. Coordinate layout and installation of seismic bracing with building structural systems and architectural features, and with mechanical, fire-protection, electrical and other building features in the vicinity.

B. Coordinate concrete bases with building structural system.

1.08 WARRANTY

A. Provide one-year warranty on parts and labor for manufacturer defects and installation workmanship.

PART 2 PRODUCTS

2.01 SUPPLIERS

A. Following is a partial list of manufacturer/supplier contact information for seismic restraints:

1. B-Line Systems, Inc. (800) 851-7415, www.b-line.com.
2. Unistrut Corporation http://www.unistrut.us/
3. Kinetics Noise Control (877) 457-2695, www.kineticsnoise.com.
4. Mason Industries, Inc. www.mason-ind.com.
5. Loos & Co., Inc. (800) 321-5667, www.loosnaples.com.

2.02 SEISMIC DESIGN CRITERIA

A. This section describes the requirements for seismic restraint of systems and equipment related to continued operation of the facility after a design seismic event.

B. Definitions:

1. Stay in Place:

   a. All systems and equipment shall be anchored and restrained such that the anchoring system is intended not to fail and equipment and/or system components will not fall.

2. Remain Operational:

   a. Requirements for "Stay in Place" listed above shall be met.
   b. The following systems and associated equipment are intended not to fail externally or internally and are intended to continue operation following a seismic event:

      1) Fire Alarm

2.03 SEISMIC BRACING AND SUPPORT OF SYSTEMS AND COMPONENTS

A. General:

1. Seismic restraint designer shall coordinate all attachments with the Structural Engineer of Record; refer to submittal requirements.
2. The seismic restraint design shall be based on actual equipment data obtained from manufacturer's submittals or the manufacturer. The equipment manufacturer shall verify and provide written certification the attachment points on the equipment can accept the combination of seismic, weight, and other imposed loads.
3. Design analysis shall include calculated dead loads, static seismic loads, and capacity of materials utilized for the connection of the equipment or system to the structure.
4. Analysis shall detail anchoring methods, bolt diameter, embedment, and weld length.
5. All seismic restraint devices shall be designed to accept without failure the forces calculated per the applicable building code.
6. All seismic restraints and combination isolator/restraints shall have verification of their seismic capabilities witnessed by an independent testing agency.

B. Housekeeping Pads:

1. Reinforced housekeeping pads shall be provided to handle shear, tension, and compression forces with proper reinforcement, doweling, and attachments connecting the pad to the structural slab.

2.04 SEISMIC RESTRAINT AND CONSTRUCTION OF EQUIPMENT

A. Equipment supplied for the project shall be designed to meet the requirements of lateral forces calculated using the applicable code and method described above.

B. The following is a partial list of equipment that shall be restrained and that shall be constructed to meet seismic forces described in this section:

1. Switchboards, Distribution Panelboards, Panelboards, Load Centers
2. Transformers
3. Disconnect Switches
4. Interior Luminaires
5. Emergency Luminaires and Exit Signs
6. Fire Alarm Panel, Initiating and Notification Appliances
7. Area of Rescue Assistance

2.05 MATERIALS

A. Use the following materials for restraints:

1. Indoor Dry Locations: Steel, zinc plated.
2. Outdoors and Damp Locations: Galvanized steel.

2.06 ANCHORAGE AND STRUCTURAL ATTACHMENT COMPONENTS

A. Strength: Defined in reports by ICC Evaluation Service or another agency acceptable to authorities having jurisdiction.

1. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.

B. Concrete Inserts: Steel-channel type.

C. Through Bolts: Structural type, hex head, high strength. Comply with ASTM F3125, Grade A 325.

D. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.

E. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.

2.07 SEISMIC BRACING COMPONENTS

A. Slotted Steel Channel: 1-5/8-by-1-5/8-inch cross section, formed from 0.1046-inchthick steel, with 9/16-by-7/8-inch slots at a maximum of 2 inches o.c. in webs, and flange edges turned toward web.

1. Materials for Channel: ASTM A 1011, GR 33.
2. Materials for Fittings and Accessories: ASTM A 635, ASTM A 576, or ASTM A 36.
3. Fittings and Accessories: Products of the same manufacturer as channels and designed for use with that product.
4. Finish: Baked, rust-inhibiting, acrylic-enamel paint applied after cleaning and phosphate treatment, unless otherwise indicated.

B. Channel-Type Bracing Assemblies: Slotted steel channel, with adjustable hinged steel brackets and bolts.

C. Cable-Type Bracing Assemblies: Zinc-coated, high-strength steel wire rope cable attached to steel thimbles, brackets, and bolts designed for cable service.

1. Arrange units for attachment to the braced component at one end and to the structure at the other end.
2. Wire Rope Cable: Comply with ASTM A 603. Use 49- or 133-strand cable with a minimum strength of 2 times the calculated maximum seismic force to be resisted.

D. Hanger Rod Stiffeners: Slotted steel channels with internally bolted connections to hanger rod.

PART 3 EXECUTION

3.01 INSTALLATION

A. Refer to the applicable code sections and Authority Having Jurisdiction for the exact seismic restraint requirements of conduit, equipment, etc.

B. Layout of transverse and longitudinal bracing shall follow recommendations of approved design standards listed in Part 1 of this specification section.

C. All rigid floor mounted equipment shall have a resilient media between the equipment mounting hole and the anchor bolt in concrete.

D. All seismic restraint systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.

E. Installation of seismic restraints shall not cause any change in position of equipment lighting or conduits resulting in stresses or misalignment.

F. No rigid connections between equipment and the building structure shall be made that degrade the noise and vibration-isolation system specified.

G. Do not install any equipment or conduit that makes rigid connections with the building unless isolation is not specified.

H. Coordinate work with all other trades to avoid rigid contact with the building. Any conflicts with other trades that will result in rigid contact with equipment or conduit due to inadequate space or other unforeseen conditions shall be brought to the Architect/Engineer's attention prior to specific equipment selection.

I. Prior to installation, bring to the Architect/Engineer's attention any discrepancies between the specifications and the field conditions, or changes required due to specific equipment selection.

J. Bracing may occur from flanges of structural beams, upper truss cords of bar joists, cast in place inserts, or International Code Council approved seismic anchors for installation in concrete.

K. Cable restraints shall be installed slightly slack to avoid short-circuiting the isolated suspended equipment or conduit.

L. Cable assemblies shall be installed taut on non-isolated systems. Solid braces may be used in place of cables on rigidly attached systems only.

M. Do not install cables over sharp corners.

N. Brace support rods when necessary to accept compressive loads. Welding of compression braces to the vertical support rods is not acceptable.

O. Provide reinforced clevis bolts when required.

P. The vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not acceptable.

Q. Post-Installed anchors shall be provided to meet seismic requirements.

R. Vertical conduit risers flexibly supported to accommodate thermal motion and/or conduit vibration shall be guided to maintain conduit stability and provide horizontal seismic restraint.

S. Seismic restraints shall be mechanically attached to the system. Looping restraints around the system is not acceptable.

T. Conduit crossing building seismic or expansion joints, passing from building to building, or supported from different portions of the building shall be installed to allow differential support displacements without damaging the conduit, equipment connections, or support connections. Conduit offsets, loops, anchors, and guides shall be installed as required to provide required motion capability and limit motion of adjacent conduit.

U. Do not brace a system to two different structures such as a wall and a ceiling.

V. Provide appropriately sized openings in walls, floors, and ceilings for anticipated seismic movement. Provide fire seal systems in fire-rated walls.

W. Positively attach all roof-mounted equipment to roof curbs. Positively attach all roof curbs to building structure.

X. Exposed seismic supports in occupied areas shall be guarded or covered to protect occupants.

3.02 SEISMIC RESTRAINT EXCLUSIONS

A. Refer to the applicable code sections and Authority Having Jurisdiction for allowable exclusions.

END OF SECTION 26 0548

SECTION 26 0553

ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Adhesive Markings and Field Labels

B. Nameplates and Signs

C. Product Colors

1.02 REFERENCES

A. NFPA 70E - National Electrical Safety Code

B. NFPA 70 - National Electrical Code (NEC)

C. CEC California Electrical Code

D. ANSI A13.1 - Standard for Pipe Identification

E. ANSI Z535.4 - Standard for Product Safety Signs and Labels

1.03 QUALITY ASSURANCE

A. Electrical identification products shall be suitable for the environment installed. Identification labels damaged by the environment due to ultraviolet light fading, damp or wet conditions, physical damage, corrosion, or other conditions shall be replaced with labels suitable for the environment.

1.04 SUBMITTALS

A. General: Submit the following in accordance with Division 1 Specification Sections and under provisions of Section 26 0500.

1. Product Data for each type of product specified.
2. Schedule of nomenclature to be used for identification signs and labels for each piece of equipment including, but not limited to, the following equipment types as specified in Division 26.
3. Samples of each color, lettering style and other graphic representation required for identification materials including samples of labels and signs.
4. Identification required in this section shall apply to equipment furnished in Division 26 and any other applicable Divisions including Division 21/22/23.

PART 2 PRODUCTS

2.01 ADHESIVE MARKINGS AND FIELD LABELS

A. Adhesive Marking Labels for Raceway: Pre-printed, flexible, self-adhesive vinyl labels with legend indicating voltage and service (Emergency, Lighting, Power, HVAC, Communications, Control, Fire).

1. Label Size as follows:

a. Raceways: Kroy or Brother labels 1-inch high by 12-inches long (minimum).

2. Color: As specified for various systems.

B. Colored Adhesive Marking Tape for banding Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width.

C. Pretensioned Flexible Wraparound Colored Plastic Sleeves for Cable Identification: flexible acrylic bands sized to suit the cable diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the cable.

D. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.

E. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from -40°F to 185°F (-40°C to 85°C), type 2/2S or type 21/21S based on application. Provide ties in specified colors when used for color coding. Cable ties shall be listed and identified for the application, securement, and support.

F. Underground Plastic Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inches wide by 4 mil thick, printed legend indicating type of underground line, manufactured for direct burial service. Tape shall contain a continuous metallic wire to allow location with a metal detector.

G. Aluminum, Wraparound Marker Bands: 1-inch width, 0.014 (5mm) inch thick aluminum bands with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.

H. Brass or Aluminum Tags: 2" (50mm) by 2" (50mm) by .05-inch metal tags with stamped legend, punched for fastener.

I. Indoor/Outdoor Number and Letters: Outdoor grade vinyl label with acrylic adhesive designed for permanent application in severe indoor and outdoor environments.

J. Text Sizes:

1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.

a. Font: Normal 721 Swiss Bold
b. Adhesive Labels: 3/16 inch minimum text height

c. Vinyl / Plastic Laminate Labels: 3/4" inch minimum text height

2.02 NAMEPLATES AND SIGNS

A. Engraved, Plastic-Laminated Labels, Signs and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8 inch thick for larger sizes. Labels shall be punched for mechanical fasteners.

B. Text Sizes:

1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.

a. Text Height: 3/8 inch minimum

C. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.

D. Fasteners for Plastic-Laminated Signs; Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

2.03 PRODUCT COLORS

A. Adhesive Markings and Field Labels:

1. All Labels: Black letters on white face
2. Normal Power and General Labels: Black letters on white face
3. Fire Alarm: Red letters on white face

B. Nameplates and Signs:

1. NORMAL POWER: Black letters on white face

C. Box Covers:

1. Box covers shall be painted to correspond with system type as follows:

a. Normal Power and General: Silver

b. Fire Alarm System: Red

2. Box cover colors shall match conduit colors listed above.

PART 3 EXECUTION

3.01 INSTALLATION

A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as approved in submittals and as required by code.

B. Exposed Ceilings and Finished Spaces: The project includes exposed ceilings in finished spaces. The installation of colored raceways and labeling may not be aesthetically desirable in finished spaces. The contractor shall coordinate identification requirements in exposed ceilings of finished spaces with the A/E prior to installation and ordering of materials.

C. Electrical System Color Chart: This Contractor shall furnish and install framed 8" x 12" charts of the color-coded identification scheme used for the electrical system in all electrical rooms and next to the main fire alarm panel.

D. Install identification devices in accordance with manufacturer's written instruction and requirements of Electrical Code.

E. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work. All mounting surfaces shall be cleaned and degreased prior to identification installation.

F. Circuit Identification: Tag or label conductors as follows:

1. Multiple Power or Lighting Circuits in Same Enclosure: Where multiple branch circuits are terminated or spliced in a box or enclosure, label each conductor with source and circuit number.
2. Multiple Control Wiring and Communication/Signal Circuits in Same Enclosure: For control and communications/signal wiring, use wire/cable marking tape at terminations in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tape.
3. Match identification markings with designations used in panelboards shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.

G. Apply Danger, Warning, Caution and instruction signs as follows:

1. Install Danger, Warning, Caution or instruction signs where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
2. 'Danger' indicates a hazardous situation which, if not avoided, will result in death or serious injury. ANSI standard red background, white letters.
3. 'Warning' indicates a hazardous situation which, if not avoided, could result in death or serious injury. ANSI standard orange background, black letters.
4. 'Caution' indicates a hazardous situation which, if not avoided, may result in minor or moderate injury. ANSI standard yellow background, black letters.
5. Emergency Operating Signs: Install, where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect, engraved laminate signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.

H. Apply circuit/control/item designation labels of engraved plastic laminate for pushbuttons, pilot lights, alarm/signal components, and similar items, except where labeling is specified elsewhere.

I. Install labels parallel to equipment lines at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

J. Install ARC FLASH WARNING signs on all power distribution equipment per Section 26 0573.

K. Install ARC FLASH WARNING signs on all switchboards, switchgear, distribution panels, branch panelboards, industrial control panels, and motor control centers.

1. Sample Label:

   ! WARNING
   ARC FLASH AND SHOCK HAZARD
   APPROPRIATE PPE REQUIRED
   FAILURE TO COMPLY CAN RESULT IN DEATH OR INJURY
   REFER TO NFPA 70E

L. Circuits with more than 600V: Identify raceway and cable with "DANGER-HIGH VOLTAGE" in black letters 2 (50mm) inches high on orange background at 10'-0 foot intervals.

1. Entire floor area directly above conduits running beneath and within 12 inches of a basement or ground floor that is in contact with earth or is framed above unexcavated space.
2. Wall surfaces directly external to conduits concealed within wall.
3. All accessible surfaces of concrete envelope around conduits in vertical shafts, exposed in building, or concealed above suspended ceilings.

M. Selective Coordination Label: Install caution signs on all switchboards, distribution panels, panelboards, disconnects, and other equipment with selectively coordinated overcurrent protection devices. Sign at a minimum shall contain:

1. CAUTION: OVERCURRENT DEVICES IN THIS ENCLOSURE ARE SELECTIVELY COORDINATED. EQUIVALENT REPLACEMENTS AND TRIP SETTINGS ARE REQUIRED.

N. Underground Electrical Lines: For exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 (150mm) to 8 (205mm) inches below grade. A single plastic line marker is permitted when the width of the common trench does not exceed 16 inches; provide a second plastic line marker to mark each edge of the trench when 16 inches of width is exceeded. Limit line markers to direct-buried cables.

3.02 FEEDER AND BRANCH CIRCUIT DIRECTORIES

A. Product:

1. Adhesive labels and field markings
2. Nameplates and signs

B. Feeder Directories Branch: Provide each feeder, branch circuit, feeder modification, and branch circuit modification with a typed circuit directory label. Refer to technical equipment specification sections for additional requirements. Include the following with each label:

1. Load Description: Lighting, receptacles, specific equipment, spare, space, or similar description.
2. Location: Room name, number, location.

C. Provide a factory or custom clear plastic sleeve for each branch panel directory and secure to inside panel cover. Three ring binders with individual circuit directories for each applicable branch panel may be substituted when AHJ approved, all branch panels are within the same room and within sight of the binder, and the binder is supplied with three printed copies of each directory, an electronic editable copy of the directors is saved to USB within the binder, and the binder is permanently secured an adjacent wall with a chain or metal cable with adequate length to reference the binder within the working clearance space of each applicable panel. Provide a wall mounted drop-in office bin to store the binder.

3.03 LIGHTING CONTROL AND RECEPTACLE COVER PLATES

A. Product:

1. Adhesive labels and field markings
2. Nameplates and signs

B. Identification material to be a clear, 3/8-inch Kroy tape or Brother self-laminating vinyl label with black letters. Embossed Dymo-Tape labels are not acceptable. Permanently affix identification label to cover plates, centered above the receptacle openings.

C. Identification material to be engraved plastic-laminated labels, 1/16-inch minimum thickness with white letters on a red face. Letter and number size to 1/8-inch high.

D. Identification to be engraved directly on the stainless steel coverplates. Letter and number size to 1/8-inch high.

E. Provide identification on all switch and receptacle cover plates. Identification shall indicate source and circuit number serving the device (e.g. "C1A #24"). Identification for switch cover plates shall be installed on the inside cover.

3.04 POWER DISTRIBUTION EQUIPMENT IDENTIFICATION

A. Products:

1. Nameplates and signs

B. Provide identification on the front of all power distribution equipment such as panelboards, switchboards, switchgear, motor control centers, generators, UPS, storage battery disconnects, transfer switches, etc. Labels shall be visible on the exterior of the gear, correspond to the one-line diagram nomenclature, and identify each cubicle of multi-section gear.

1. Interior Equipment: The identification material shall be engraved plastic-laminated labels.
2. Exterior Equipment: The identification material shall be engraved vinyl labels.
3. Labeling shall include:

    a. Essential Electrical System EES: When applicable the label shall include "Essential Electrical System EES". Applicable equipment includes components of the life safety and critical branch for healthcare facilities (generators, transfer switches, switchboards, distribution panels, panelboards, etc.).
    b. Equipment type and contract documents designation of equipment.
    c. Voltage of the equipment.
    d. Name of the upstream equipment and location of the upstream equipment if it is not located within sight.
    e. Rating and type of the overcurrent protection device serving the equipment if it is not located within sight ("FED BY 400A/3P BREAKER").
    f. Sample Label:

        DISTRIBUTION PANEL DP-H1
        480Y/277V
        FED FROM SWITCHBOARD "SB-1" (LOCATED IN MAIN ELEC ROOM)

4. Provide the following on a separate label, installed below the label above:

    a. Available fault current; refer to one-line diagram or panel schedules
    b. Date of fault current study; refer to one-line diagram
    c. Sample Label:

        22,000 AMPS AVAILABLE FAULT CURRENT
        DATE OF STUDY: 1 JAN 2017

C. Service Equipment Label: A separate nameplate for the service entrance equipment and include:

1. Nominal system voltage, service wire size, quantity, material, distance
2. Maximum available fault current; refer to one-line diagram for values
3. Clearing time of overcurrent protection devices based on available fault current. Refer to calculations and report from Section 26 0573 for value.
4. Date of fault current study; refer to one-line diagram
5. Date of label

6. Sample Label:

   480Y/277V, 6 SETS 4#750KCM CU, 75FT
   39,800 AMPS AVAILABLE FAULT CURRENT
   0.07 SECOND CLEARING TIME
   DATE OF STUDY: 1 JAN 2017
   DATE OF LABEL: 4 JUL 2017

D. Arc Energy Reduction Label:

1. Provide a separate engraved plastic laminate label centered at the top of each vertical section of the electrical gear indicating the following when applicable.

   a. Label: "This equipment is designed with a system listed below".
   b. Applicable Systems:

      1) Zone-selective interlocking system for selective coordination and arc energy reduction
      2) Differential relaying system for selective coordination and arc energy reduction
      3) Arc energy reducing maintenance switch
      4) Energy reducing active arc flash mitigation system

E. Adjustable-Trip Over Current Protection Label:

1. Provide a separate engraved plastic laminate label adjacent to each overcurrent projection device with adjustable trip settings. Provide label separate from load identification label.

   a. Label:

      1) Long-time delay:
      2) Long-time pickup:
      3) Short-time delay:
      4) Short-time pickup:
      5) Instantaneous:
      6) Ground fault delay:
      7) Ground fault:

   b. Sample Label:

      Long-time delay: 10.0
      Long-time pickup: 1.0
      Short-time delay: 0.15
      Short-time pickup: 5.0
      Instantaneous: 2.0
      Ground fault delay: 0.25
      Ground fault: 50.0

F. Nominal System Voltage Label:

1. Where more than one nominal voltage system exists in a building or facility, the identification of color coding used in the panelboard or equipment shall be permanently posted on the interior of the door or cover.

G. Distribution panelboards and switchboards shall have each overcurrent protection device identified with name and location of the load being served ("AHU-1 LOCATED IN PENTHOUSE 1"). Provide a separate engraved plastic laminate label adjacent to each overcurrent projection device with feeder wire size, feeder wire quantity, conductor material and distance in feet. Provide label separate from load identification label and adjustable trip settings label.

1. Sample Labels for Feeders:

4#3/0 CU & 1#6 CU GND, 125FT
4#250KCM AL & 1#6 GND CU, 125FT
2 SETS 4#400KCM CU & 1#1 GND CU, 125FT

H. Branch panelboards shall be provided with typed panel schedules upon completion of the project. Existing panelboards shall have their existing panel schedules typed, with all circuit changes, additions or deletions also typed on the panel schedules. A copy of all panel schedules for the project shall be turned over as part of the O&M Manuals. Refer to Section 26 0500 for other requirements.

3.05 TRANSFORMER EQUIPMENT IDENTIFICATION

A. Products:

1. Nameplates and signs

B. Provide identification on the front of all transformers. The identification nameplate shall be an engraved plastic-laminated label.

C. Labeling shall include:

1. Equipment type and contract documents designation of equipment
2. Name of the upstream equipment.
3. Voltage and rating of the equipment.
4. Location of the upstream equipment if it is not located within sight.
5. Sample Label:

TRANSFORMER TR-15
480V: 208Y/120V 15KVA
FED FROM SWITCHBOARD "SB-1" (LOCATED IN ELEC 123)

END OF SECTION 26 0553

SECTION 26 0933

LIGHTING CONTROL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Line and low voltage standalone lighting controls

B. Automatic load control relay (ALCR20)

1.02 RELATED SECTIONS

A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:

1. 26 51 19 LED Lighting
2. Electrical Drawings: Plans, luminaire schedules, lighting control sequence of operations, diagrams, and details.

1.03 RELATED WORK

A. Section 01 9100 - Commissioning

B. Section 26 5100 - Lighting

1.04 QUALITY ASSURANCE

A. Manufacturers shall be regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. All components and assemblies are to be factory pre-tested prior to delivery and installation.

C. Comply with Electrical Code as applicable to electrical wiring work.

D. Comply with applicable portions of NEMA standards pertaining to types of electrical equipment and enclosures.

E. Panels and accessory devices are to be UL listed under UL 916 Energy Management Equipment. Panels and accessories used for control of life safety and critical branch circuits shall be listed under UL 924 Emergency Lighting and Power Equipment.

F. All assemblies are to be in compliance with FCC emissions standards specified in Part 15 Subpart J for Class A applications.

1.05 REFERENCES

A. FCC Rules and Regulations, Part 15, Subpart J - Radio Frequency Interference

B. FS W S 896 Switch, Toggle

C. California Energy Code - Building Energy Efficiency Standards Title 24

D. NEMA WD 1 - General Color Requirements for Wiring Devices

E. NEMA WD 7 - Occupancy Motion Sensors

F. NFPA 70 - National Electrical Code (NEC)

G. CEC California Electrical Code

H. UL Standard 916 Energy Management Equipment

I. UL 924 - Emergency Lighting and Power Equipment

J. UL 1472 - Solid-State Dimming Controls

1.06 SUBMITTALS

A. Submit product data under provisions of Section 26 0500.

B. Submit a comprehensive package including devices, hardware, software, product specification, finishes, dimensions, installation instructions, warranty, system software requirements, and roles and responsibilities of all persons and groups involved in installation, execution, and commissioning.

C. Provide floor plan showing location, orientation, and coverage area of each control device, sensor, and controller/interface. For areas requiring multiple sensor devices for appropriate coverage, submit specific manufacturer-approved sensor layout as an overlay directly on the project drawings, either in print or approved electronic form.

D. Submit a list of devices and equipment that will be installed for each sequence of operation.

E. Submit project specific control wiring diagrams showing all equipment, line voltage, and control wiring requirements for all components including, but not limited to, dimmers, relays, low voltage switches, occupancy sensors, control stations, dimmer panels, relay panels, and communication interfaces and programming instructions for each sequence of operation. Include network cable specification and end-of-line termination details, if required.

F. Project specific network riser diagram including floor and building level details. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.

G. Verify acceptance of communications connection to building automation system. Submit BACnet IP parameters.

1.07 EXTRA STOCK

A. Provide extra stock under provisions of Section 26 0500.

B. Sensors, Controls, Power Supplies, and Relays: Five (5) percent of quantity installed. Minimum of two (2) of each configuration and type.

C. Relays and Dimmer Modules: Five (5) percent of quantity installed. Minimum of two (2) of each size and type.

D. Control Stations: One (1) of each configuration and type, except for LCD touch screens requiring factory setup prior to installation.

1.08 PROJECT RECORD DOCUMENTS

A. Submit project record documents under provisions of Section 26 0500.

B. Accurately record location of all controls and devices. Include description of switching sequences and circuiting arrangements.

1.09 OPERATION AND MAINTENANCE DATA

A. Submit emergency, operation, and maintenance data under provisions of Section 26 0500. Data shall also include the following:

1. Schedule for routine maintenance, inspection, and calibration of all lighting control devices and system components. Recommended schedule for inspection and recalibration of sensors.
2. Complete narrative describing intended operation and sequence for each control scenario and system component, updated to reflect all changes resulting from commissioning of systems. Narrative shall indicate recommended settings for devices where applicable.
3. Replacement part numbers for all system components.

B. Identify installed location and labeling for each luminaire controlled by automated lighting controls.

C. Submit software operating and maintenance manuals, program software backup on compact disc or compatible media with data files, device address list, and a printout of software application and graphic screens, where applicable.

1.10 SYSTEM DESCRIPTION

A. Performance Statement: This specification section and the accompanying lighting design documents describe the minimum material quality, required features, and operational requirements of the lighting control system (LCS). These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the performance required of the system, as presented in these documents, the Contractor and system manufacturer/vendor are solely responsible for determining all equipment, wiring, and programming required for a complete and operational system.

B. Provide an integrated lighting controls system consisting of panels, power supplies, controllers, sensors, relays, switches, devices, wiring, etc. necessary to perform the Lighting Control Sequence of Operation as defined on the plans and specifications. Contractor is responsible for confirming that all components and luminaires interoperate as a single system.

1. Sequence of Operation: Describes the required operation and performance for lighting control in each space. Sequences of operation are indicated on the drawings.
2. Drawings: The drawings include sequences of operation, locations of control interface devices, sensors, and control zones. Wiring and additional equipment to make a complete and functioning system has not been shown, but shall be submitted with the shop drawings.

C. The following control types and features are acceptable. Acceptable control locations are shown on the drawings.

1. Line Voltage Control: Control equipment consists of traditional line voltage wiring devices and equipment such as switches, dimmers and combination occupancy/vacancy sensor switches, etc.
2. Distributed Control: Control equipment is in the space/zone being controlled; not reliant on centralized controllers.

    a. All locations shall have the ability to be networked for remote control and monitoring, but network connections are not required

3. Centralized Control: Control equipment is in a central location serving multiple spaces/zones and provides time-based schedule and remote control.

    a. The lighting control system (LCS) shall be networked with BACnet IP capabilities.
    b. The lighting control system (LCS) shall have DMX512 capabilities.

1.11 MOCKUP

A. Provide and install luminaires with power and control connections in mockup rooms as identified in Division 1. Approved luminaires and controls in mockup may be reused as part of complete work if in original condition.

B. The system shall be functionally tested by a factory-authorized engineer and comply with the Sequence of Operation. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system.

1.12 WARRANTY

A. Manufacturer shall warrant products under normal use and service to be free from defects in materials and workmanship for a period of two (2) years from date of commissioning.

B. Occupancy, vacancy, daylight sensors and controls shall have a five (5) year warranty from date of Substantial Completion.

PART 2 PRODUCTS

2.01 LIGHTING CONTROLS

A. All items of material having a similar function (e.g., switches, dimmers, sensors, contactors, relays, etc.) shall be of the same manufacturer, unless specifically stated otherwise on drawings or elsewhere in the specifications. Lighting control switches, systems, and components shall be listed.

B. Color of lighting controls and sensors shall match the receptacle wiring devices specified in the space.

C. The functions described in the lighting sequence of operation shall dictate the actual lighting control device required to accomplish the functions described for the space.

2.02 WALL SWITCHES

A. Refer to Electrical Symbols List for device type.

B. Switch touch surfaces shall have an antimicrobial additive that suppresses the growth of harmful bacteria, mold, mildew, and fungi. Coverplate color shall match the switch color.

1. Manufacturers:

    a. Cooper 7621 CuVerro
    b. Leviton A5621

C. **SW-1P**; Single Pole Switch:

1. Single throw, 120/277-volt, 20-amp maintained contact. Toggle handle, side and back wired.
2. Manufacturers:

    a. Hubbell HBL1221
    b. Leviton 1221-2
    c. Pass & Seymour PS20AC1

d. Cooper AH1221

3. Single throw, 120/277-volt, 20-amp maintained contact. Rocker handle, side and back wired.
4. Manufacturers:

a. Hubbell DS120
b. Leviton 5621
c. Pass & Seymour 2621
d. Cooper 7601.

D. **SW-3W-K;** Key Lock Three Way Switch:

1. Single throw, 120/277-volt, 20-amp maintained contact. Side and back wired. Provide key to Owner.
2. Manufacturers:

a. Hubbell HBL1223L
b. Leviton 1223-2L
c. Pass & Seymour PS20AC3-L
d. Cooper AH1223L

2.03 WALL DIMMERS

A. UL listed with integral air-gap switch for on/off control.

B. Integral EMI/RFI suppression.

C. Non-viewable heat sink.

D. Dimmer compatibility and wiring with the load being controlled shall be verified by Contractor prior to purchase and installation.

E. Dimmer to match device color.

F. **SW-D-6;** 600-Watt Single Pole Incandescent Dimmer:

1. 120-volt, linear slider operator with positive off. Mount in single gang box.
2. Manufacturers:

a. Lutron N-600
b. Lightolier MP600
c. Pass & Seymour CD700

G. **SW-OD;** Wall 0-10V Dimmer / Occupancy sensor:

1. Wall switch with manual on/auto off. 120VAC load rating of 0-800 W for electronic ballast, LED. 277VAC load rating of 0-1,800 W for electronic ballast, LED. adjustable OFF delay. 0-10V dimming with up to 30ma sink. Automatic ON/OFF, manual ON/automatic OFF, or occupancy on to predetermined dimming level go to last dimming setting upon occupancy.

2. Manufacturers:

    a. Sensor Switch WSX D Series

2.04 INDOOR OCCUPANCY AND VACANCY SENSORS

A. Mask sensors where necessary to prevent nuisance switching from adjacent areas.

Lighting Load	Load A	Load B
Step 1:	On	Off
Step 2:	Off	On
Step 3:	On	On
Step 4:	Off	Off

PART 3 EXECUTION

3.01 PRE-CONSTRUCTION MEETING

A. Schedule a pre-construction meeting with the controls representative, installing contractor, Architect/Engineer, and Owner to explain the proposed lighting control centralized, wireless, and distributed systems.

3.02 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify field dimensions and coordinate physical size of all equipment with the architectural requirements of the spaces into which they are to be installed. Allow space for adequate ventilation and circulation of air.

C. Verify that required utilities are available, in proper location, and ready for use.

D. Beginning of installation means installer accepts existing conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings.

B. All wiring shall be installed in conduit. Class II low voltage control wiring may be open wiring and shall maintain 150 mm (6 inch) spacing from electronic ballast and other RFI/EMI sources.

C. All branch load circuits shall be live tested before connecting the loads to the lighting control panel.

3.04 SUPPORT SERVICES

A. System Startup:

1. Manufacturer shall provide factory authorized technician to confirm proper installation and operation of all system components.

B. Testing:

1. System shall be completely functional tested by a factory-authorized technician. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system components.
2. Programming of initial zones, schedules, lighting levels, control station groups, and sensor settings shall be performed by a factory-authorized technician. Lighting Control Sequence of Operation shall serve as a basis for programming, However, all final decisions regarding groups and schedules shall be at the direction of the Owner. The following procedures shall be performed at a minimum:

    a. Confirm occupancy sensor placement, sensitivity, and time delay settings to meet specified performance criteria.
    b. Confirm daylight sensor placement, sensitivity, deadband, and delay settings to meet specified performance criteria.
    c. Confirm that schedules and time controls are configured to meet specified performance criteria and Owner's operating requirements.

3. Verify occupancy/vacancy and daylight sensor operation is correct after furniture and equipment is installed in each area. Make adjustments to sensor settings and time delays to allow proper operation.
4. Verify occupancy/vacancy sensors are located to provide complete coverage for the area served with no nuisance switching.

    a. Relocate sensors or provide additional sensors as necessary to provide adequate coverage.
    b. Mask occupancy sensors where necessary to prevent nuisance switching from adjacent areas.

C. Training:

1. Manufacturer shall provide competent factory-authorized technician to train Owner personnel in the operation, maintenance and programming of the lighting control system. Submit training plan with notification seven (7) days prior to proposed training dates.
2. Training duration shall be no less than three (3) days, with one (1) day being scheduled at least two (2) weeks after initial training.

D. Documentation:

1. Manufacturer shall provide system documentation including:

    a. System one-line showing all panels, number and type of control stations and sensors, communication line, and network or BMS/BAS interface unit.
    b. Drawings for each panel showing hardware configuration and numbering.
    c. Panel wiring schedules.
    d. Typical diagrams for each component.

3.05 SYSTEM COMMISSIONING

A. Contractors' tests shall be scheduled and documented in accordance with the commissioning requirements. Refer to Section 01 0900, General Commissioning, for further details.

B. System verification testing is part of the commissioning process. Verification testing shall be performed by the Contractor and witnessed and documented by the Commissioning Agent. Refer to Section 01 0900, General Commissioning, for system verification tests and commissioning requirements.

C. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative. The instruction shall be scheduled in coordination with the Owner's Representative after submission and approval of formal training plans. Refer to Section 01 0900, General Commissioning, for Contractor training requirements.

END OF SECTION 26 0933

SECTION 26 2200

DRY TYPE TRANSFORMERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Dry type two winding transformers **(TR-#)**

1.02 REFERENCES

A. NEMA - ST 1 - Specialty Transformers

B. NEMA ST 20 - Dry Type Transformers for General Applications

C. ANSI/IEEE C57.12.01 - General Requirements for Dry Type Distribution and Power Transformers

D. ANSI/IEEE C57.12.91 - Test Code for Dry Type Distribution and Power Transformers

E. Department of Energy 10 CFR Part 431 - Energy Conservation Program for Commercial Equipment: Distribution Transformers Energy Conservation Standards; Final Rule.

F. NEMA TP 2 - Standard Test Method for Measuring the Energy Consumption of Distribution Transformers

G. NEMA TP 3 - Standard for the Labeling of Distribution Transformer Efficiency

1.03 SUBMITTALS

A. Submit product data under provisions of Section 26 0500.

B. Include outline and support point dimensions of enclosures and accessories, unit weight, voltage, KVA, and impedance ratings and characteristics, loss data, efficiency at 35, 50, 75 and 100 percent rated load, sound level, tap configurations, insulation system type, and rated temperature rise.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store and protect products under provisions of Section 26 0500.

B. Store in a warm, dry location with uniform temperature. Cover ventilating openings to keep out dust.

C. Handle transformers using only lifting eyes and brackets provided for that purpose. Protect units against entrance of rain, sleet, or snow if handled in inclement weather.

PART 2 PRODUCTS

2.01 DRY TYPE TWO WINDING TRANSFORMERS

A. Acceptable Manufacturers:

1. Square D 7400 EX##T / SK300##KB Series
2. Eaton V48M / H48M / B48M Series
3. ABB 9T Series
4. Hammond SG / SMK Series
5. Siemens 3F3 Series

B. Dry Type Transformers: NEMA ST 20, factory-assembled copper windings, air-cooled dry type transformers; ratings as shown on the drawings. Transformers supplied under this project shall meet the US Department of Energy (DOE) 2016 Efficiency requirements or the most current DOE CFR in effect.

C. Insulation system and average winding temperature rise for rated KVA as follows:

Ratings	Class	Rise (degree C)
Less than 15	185	As shown on the drawings
or higher	220	As shown on the drawings

D. Case temperature shall not exceed 40°C rise above ambient at its warmest point.

E. Winding Taps, Transformers Less than 15 KVA: Two 5 percent below rated voltage, full capacity taps on primary winding.

F. Winding Taps, Transformers 15 KVA and Larger: Two (2) 2-1/2% below and two (2) 2-1/2% above rated voltage, full capacity taps on primary winding.

G. Sound Levels: Average audible sound level shall not exceed the values given below when tested to NEMA ST 20 standards:

	Average Sound Level, Decibels			
	Self-Cooled Ventilated			Self-Cooled Sealed
Equivalent Winding kVA Range	K-Factor = 1 K-Factor = 4 K-Factor = 9	K-Factor = 13 K-Factor = 20	Forced Air w/ Fans Running	
0-9	40	40	67	45
9.01-30.00	45	45	67	50
30.01-50.00	45	48	67	50
50.01-150.00	50	53	67	55
150.01-300.00	55	58	67	57

	Average Sound Level, Decibels			
	Self-Cooled Ventilated			Self-Cooled Sealed
Equivalent Winding kVA Range	K-Factor = 1 K-Factor = 4 K-Factor = 9	K-Factor = 13 K-Factor = 20	Forced Air w/ Fans Running	
300.01-500.00	60	63	67	59
500.01-700.00	62	65	67	61
700.00-1000.00	64	67	67	63

H. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

I. Mounting: Transformers 75 KVA and less shall be suitable for wall, floor, or trapeze mounting; transformers larger than 75 KVA shall be suitable for floor or trapeze mounting.

J. Coil Conductors: Continuous windings with terminations brazed or welded.

K. Enclosure: NEMA ST 20; Type 1. Provide lifting eyes or brackets.

L. Isolate core and coil from enclosure using vibration-absorbing mounts.

M. Nameplate: NEMA TP 3; Include transformer connection data and overload capacity based on rated allowable temperature rise.

KVA Rating	Insulation Class	Temperature Rise (degree C)
0.25-2	185	80
3-7.5	220	115

KVA Rating	Insulation Class	Temperature Rise (degree C)
0.25-2	185	80
3-7.5	220	115

KVA Rating	Insulation Class	Temperature Rise (degree C)
1-9	185	115
10-500	220	130

	Average Sound Level, Decibels			
	Self-Cooled Ventilated			Self-Cooled Sealed
Equivalent Winding kVA Range	K-Factor = 1 K-Factor = 4 K-Factor = 9	K-Factor = 13 K-Factor = 20	Forced Air w/ Fans Running	
0-9	40	40	67	45
9.01-30.00	45	45	67	50
30.01-50.00	45	48	67	50
50.01-150.00	50	53	67	55
150.01-300.00	55	58	67	57
300.01-500.00	60	63	67	59
500.01-700.00	62	65	67	61
700.00-1000.00	64	67	67	63

PART 3 EXECUTION

3.01 INSTALLATION

A. Set transformer plumb and level.

B. Use flexible conduit, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

C. Mount transformers on four 3”x3”x1/2” thick, 50 durometer rubber vibration isolating pads suitable for isolating the transformer noise from the building structure.

D. Ventilated transformers: Provide factory label on horizontal surface to prohibit storage on top, front, or adjacent to transformer.

E. Install primary, secondary, and grounding electrode conductors using factory or field fabricated enclosure entries. Conductors shall not be routed through ventilated openings.

3.02 FIELD QUALITY CONTROL

A. Check for damage and tight connections prior to energizing transformer.

B. Measure primary and secondary voltages and make appropriate tap adjustments. Adjustments shall be made at completion of project and at approximately 6 months following project acceptance when requested by the Owner.

END OF SECTION 26 2200

SECTION 26 2416

PANELBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Service and distribution panelboards:

B. Lighting and appliance branch circuit panelboards:

1.02 RELATED SECTIONS AND WORK

A. Refer to the Electrical Distribution Diagram and Electrical Schedules for size, rating, and configuration.

1.03 REFERENCES

A. NEMA AB 1 - Molded Case Circuit Breakers

B. NEMA FU 1 - Low voltage cartridge fuses

C. NEMA KS 1 - Enclosed Switches

D. NEMA PB 1 - Panelboards

E. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less

F. NEMA PB 1.2 - Application Guide for Ground-fault Protective Devices for Equipment

G. UL 248 - Low-Voltage Fuses

H. UL 67 - Panelboards

1.04 SUBMITTALS

A. Submit shop drawings for equipment and component devices under provisions of Section 26 0500.

B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

C. Arc Energy Reduction Documentation: Submit documentation to demonstrate the arc energy reduction system is set to operate at a value below the available arcing current.

D. Refurbished branch panel enclosure documentation for new branch panelboards installed in existing enclosures.

E. Submit manufacturer's instructions under provisions of Section 26 0500.

1.05 SPARE PARTS

A. Keys: Furnish four (4) each to the Owner.

B. Fuses: Furnish 10% or a minimum of three (3) spare fuses of each type and rating installed to the Owner.

C. Fuse Pullers: Furnish one (1) fuse puller to the Owner.

PART 2 PRODUCTS

2.01 RATINGS

A. Definitions:

1. Series rated equipment shall be defined as equipment that can achieve a required UL AIC rating with an upstream device such as a main breaker or a combination of devices to meet or exceed a required UL AIC rating. All series rated equipment shall have a permanently attached nameplate indicating that device rating must be maintained. See Section 26 0553 for additional requirements.
2. Fully rated equipment shall be defined as equipment where all devices in that equipment shall carry a minimum of the AIC rating that is specified.

B. The panelboards for this project shall be fully rated unless otherwise specifically noted in the Drawings or Specifications.

2.02 MAIN AND DISTRIBUTION PANELBOARDS

A. General

1. Manufacturers:

a. Eaton PRL4, PRL5

B. Panelboards: NEMA PB 1; type as shown on the drawings.

C. Enclosure: NEMA PB 1; Type 1.

D. Provide cabinet front with concealed trim clamps and hinged trim on door to allow access to wiring gutters without removal of trim and flush lock. Door hardware shall provide swing clear operation (180-degree swing). Finish in manufacturer's standard gray enamel.

E. Provide panelboards with copper bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.

F. All spaces shown on the one-line diagram shall be fully prepared spaces for future breakers.

G. Minimum Integrated Short Circuit Rating: 100,000 amperes rms symmetrical for 240-volt panelboards; 50,000 amperes rms symmetrical for 480-volt panelboards, or as shown on the drawings.

H. Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole.

I. Molded Case Circuit Breakers with Current Limiters: Provide circuit breakers with replaceable current limiting elements, in addition to integral thermal and instantaneous magnetic trip in each pole.

J. Solid State Molded Case Circuit Breakers: (All breakers identified on plans as solid-state with 1,200 ampere frame sizes and below.) Provide molded case switch with electronic sensing, timing, and tripping circuits for fully adjustable time current characteristic settings including ground fault trip, instantaneous trip, long time trip, long time delay, short time trip, and short time delay. Trip setting shall be field programmable with restricted access and a sealable clear cover.

K. Arc Energy Reduction:

1. Provide an arc energy reduction system to reduce the clearing time of an arc flash event. The arc energy reduction system shall be provided for overcurrent protection devices rated 1,200 amps or larger.
2. Energy-Reducing Maintenance Switch: Provide an energy-reducing maintenance switch visual status indication when engaged. Install the maintenance switch at the entrance to the electrical room

L. Suitable for use as service entrance equipment. Provide line side (service style) barriers.

2.03 BRANCH CIRCUIT PANELBOARDS

A. General

B. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.

C. Enclosure: NEMA PB 1; Type 1.

D. Provide cabinet front with door-in-door construction, concealed hinge, and flush lock all keyed alike. Door hardware shall provide swing clear operation (180-degree swing). Finish in manufacturer's standard gray enamel.

E. Provide panelboards with copperbus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.

F. All unlabeled circuits shown on the panelboard schedule shall be fully prepared spaces for future breakers.

G. All multiple-section panelboards shall have the same dimensional back box and cabinet front size.

H. Minimum Integrated Short Circuit Rating: As shown on the drawings.

I. Provide handle lock-on devices for all breakers serving exit sign and lighting circuits with emergency battery units. Provide handle lock-on devices and red handles for breakers serving fire alarm panels.

J. Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on the drawings. Do not use tandem circuit breakers.

K. Current Limiting Molded Case Circuit Breakers: Provide circuit breakers with integral thermal and instantaneous magnetic trip in each pole, coordinated with automatically resetting current limiting elements in each pole. Interrupting rating 100,000 symmetrical amperes, let-through current and energy level less than permitted for same size Class RK-5 fuse.

L. Suitable for use as service entrance equipment. Provide line side (service style) barriers.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install panelboards plumb as indicated on the drawings in conformance with NEMA PB 1.1.

B. Height: 6 feet to handle of highest device.

C. Provide filler plates for unused spaces in panelboards.

D. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

E. Stub five (5) empty one-inch conduits to accessible location above ceiling out of each recessed panelboard.

3.02 REFURBISHED ENCLOSURES - NEW PANELBOARDS

A. Existing panelboard enclosures may be reused to house new panelboards pending documented verification of the following provided with the applicable new equipment submittals.

1. New branch panelboard is listed for the existing enclosure or application.
2. Existing enclosure and new equipment is field evaluated by the manufacturer or nationally recognized testing laboratory for the available fault current, condition, and application.
3. Authority Having Jurisdiction AHJ approval.

3.03 FIELD QUALITY CONTROL

A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION 26 2416

SECTION 26 2716

CABINETS AND ENCLOSURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Cabinets

B. Terminal blocks and accessories

1.02 REFERENCES

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum)

B. ANSI/NEMA ICS 1 - Industrial Control and Systems

C. ANSI/NEMA ICS 4 - Terminal Blocks for Industrial Control Equipment and Systems

D. ANSI/NEMA ICS 6 - Enclosures for Industrial Control Equipment and Systems

1.03 SUBMITTALS

A. Submit product data under provisions of Section 26 0500.

B. Shop Drawings for Equipment Panels: Include wiring schematic diagram, wiring diagram, outline drawing and construction diagram as described in ANSI/NEMA ICS 1.

PART 2 PRODUCTS

2.01 CABINETS

A. Cabinet Boxes: Galvanized steel with removable endwalls, Insert inches wide, Insert inches high, Insert inches deep. dimensions as indicated on the drawings. Provide stainless steel construction for operating rooms, invasive procedure rooms, and medical scanning rooms.

B. |Cabinet Fronts: Steel, surface type with concealed trim clamps, concealed hinge and flush lock keyed to match branch circuit panelboard; finish in gray baked enamel.

2.02 TERMINAL BLOCKS AND ACCESSORIES

A. Terminal Blocks: ANSI/NEMA ICS 4; UL listed.

2.03 FABRICATION

A. Shop assemble enclosures and cabinets housing terminal blocks or electrical components in accordance with ANSI/NEMA ICS 6.

B. Provide conduit hubs on enclosures.

C. Provide protective pocket inside front cover with schematic diagram, connection diagram, and layout drawing of control wiring and components within enclosure.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install cabinets and enclosures plumb; anchor securely to wall and structural supports at each corner, minimum.

B. Provide accessory feet for free-standing equipment enclosures.

C. Install trim plumb.

END OF SECTION 26 2716

SECTION 26 2726

WIRING DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Device plates and box covers

B. Receptacles (REC-#)

1.02 RELATED SECTIONS

A. Section 26 0538 - Underfloor Ducts.

1.03 QUALITY ASSURANCE

A. Provide similar devices from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the Electrical Code, by a testing agency to Authorities Having Jurisdiction and marked for intended use.

C. Comply with the Electrical Code.

1.04 REFERENCES

A. DSCC W-C-896F - General Specification for Electrical Power Connector

B. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet

C. NEMA WD 1 - General Color Requirements for Wiring Devices

D. NEMA WD 6 - Wiring Devices - Dimensional Requirements

E. NFPA 70 - National Electrical Code (NEC)

F. CEC California Electrical Code

G. UL 498 - Standard for Attachment Plugs and Receptacles

H. UL 943 - Standard for Ground Fault Circuit Interrupters

1.05 SUBMITTALS

A. Submit product data under provisions of Section 26 0500.

B. Provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

C. Provide a non-returnable sample of each countertop and furniture-mounted receptacle assembly as part of the submittal process.

1.06 COORDINATION

A. Receptacles for Owner Furnished Equipment: Match plug configurations.

B. Cord and Plug Sets: Match equipment requirements.

PART 2 PRODUCTS

2.01 DEVICE COLOR

A. All switch, receptacle, and outlet colors shall be white unless indicated otherwise.

2.02 COVERPLATES

A. All switches, receptacles, and outlets shall be complete with the following:

1. Unbreakable thermoplastic/thermoset plastic and match device color coverplates in finished spaces where walls are finished.
2. Decorator Grade - Public: Decorator wallplates in public finished spaces where walls are finished.

    a. Manufacturer:

        1) Leviton Decora
        2) Hubbell Decorator
        3) or approved equal

3. #302 stainless steel coverplates in unfinished spaces for flush boxes.
4. Galvanized steel coverplates in unfinished spaces for surface mounted boxes.

B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.

C. Install nameplate identification as indicated in Section 26 0553.

D. Plate securing screws shall be metal with head color matching the wall plate finish.

2.03 RECEPTACLES

A. Refer to Electrical Symbols List for device type.

B. Devices that are shaded on the drawings shall be red.

C. Devices that are shaded on the drawings shall be red and shall have an illuminated face or indicator light to indicate that there is power to the device.

D. REC-DUP: NEMA 5-20R Duplex Receptacle:

1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face and steel back strap.

    a. Manufacturers:

        1) Hubbell 5352A
        2) Leviton, 5362-S
        3) Pass & Seymour 5362
        4) Cooper 5352

E. REC-DUP-GFI: NEMA 5-20R Ground Fault Duplex Receptacle:

1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face, listed.

    a. Device shall perform self-test of GFCI circuitry in accordance with UL 943.
    b. Manufacturers:

        1) Hubbell GF20L
        2) Leviton GFNT2
        3) Pass & Seymour 2097
        4) Cooper SGF20

F. REC-DUP-WP: NEMA 5-20R Weatherproof Ground Fault Duplex Receptacle:

1. 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face, weather resistant WR listed. Provide extra-duty NEMA 3R rated while-in-use clear cover.
2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.

    a. Manufacturers:

        1) Leviton GFWT2 with clear housing 5977-CL
        2) Pass & Seymour 2097TRWR with clear housing WIUC10-C
        3) Cooper WRSGF20 with aluminum housing WIUMV-1

G. REC-TAMP: NEMA 5-20R Tamper Resistant Duplex Receptacle:

1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face.

    a. Manufacturers:

        1) Hubbell BR20TR
        2) Leviton TBR20
        3) Pass & Seymour TR5362
        4) Cooper TRBR20

H. REC-QUAD: NEMA 5-20R Double Duplex Receptacle:

1. Consists of two duplex receptacles, double gang box, plaster ring and faceplate.

a. Manufacturers:

1) Refer to Duplex Receptacle above.

I. REC-QUAD-GFI: NEMA 5-20R Double Duplex GFI Receptacle:

1. Consists of two duplex GFI receptacles, double gang box, plaster ring and faceplate.

a. Manufacturers:

1) Refer to Duplex GFI Receptacle above.

J. Back wired devices shall be complete with eight holes that are screw activated with metal clamps for connection to #12 or #10 copper conductors.

K. Side wired devices shall have four binding screws that are undercut for positive wire retention.

L. Ground fault circuit interrupter (GFCI) receptacles shall be listed and comply with UL 943 requiring increased surge immunity, improved corrosion resistance, improved resistance to false tripping and diagnostic indication for miswiring if the line and load conductors are reversed during installation.

M. Hazardous (Classified) location receptacles shall comply with NEMA FB 11.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install convenience receptacles at elevations indicated in the General Installation Notes on the contract drawings.

B. Install specific-use receptacles at heights shown on the contract drawings. Install devices level, plumb, and square with building lines. Coordinate installation of adjacent devices of separate systems with common mounting heights, including lighting, power, systems, technology, and temperature control device rough-ins.

C. Ground Fault Protection: Provide ground fault protection for all branch circuit breakers serving 120/208 receptacles and electrical outlets rated 50 amps or less single-phase and 100 amps or less three-phase in the following locations, as shown on drawings, or required by adopted code:

1. Bathrooms, locker rooms,
2. Rooftops
3. Interior/Exterior locations subject to damp/wet conditions

4. When located within 6 feet of sinks, bathtubs, and shower stalls
5. Plug-and-cord receptacles when the utilization appliance is located within 6 feet of a sink edge.
6. Specific Appliances: Auto vacuum machines, water drink/bottle fill coolers, pressure staying machines, tire inflation machines, vending machines, sump pumps, dishwashers, electric ranges, ovens, clothes dryers, microwave ovens
7. Future Provisions: Provide a conduit raceway and backbox for the future addition of countertop pop-receptacle when receptacles are not installed in kitchen islands and peninsulas.

D. Arc-Fault Protection: Provide arc-fault protection for all branch circuit breakers serving the following spaces, or required by adopted code.

1. Dwelling unit living and occupied areas including but not limited to kitchens, family, dining, living, parlors, libraries, dens, bedrooms, sunrooms, recreation, closets, hallways, laundry, and similar spaces.
2. Dormitory bedrooms, living rooms, hallways, closets, bathrooms, and similar rooms
3. Guest rooms and guest suites
4. Sleeping rooms for nursing homes, limited care, and similar non-dwelling living quarters dedicated to sleeping

E. Tamper Resistant Protection: Provide tamper resistant protection for all 15 / 20-amp 120/208 straight blade wiring devices in the following locations, as shown on the drawings, or required by adopted code.
1. preschool, elementary, middle, high school, educational facilities

F. Drill opening for poke-through fitting installation in accordance with manufacturer's instructions. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This may include X-ray or similar non-destructive means.

G. Install receptacles vertically with ground slot up or where indicated on the drawings, horizontally with ground slot to the left.

H. Install decorative plates on switch, receptacle, and blank outlets in finished areas, using jumbo size plates for outlets installed in masonry walls.

I. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

J. Install devices and wall plates flush and level.

K. Install nameplate identification to receptacle cover plates indicated. Identification shall identify panel name and circuit number. Refer to Specification Section 26 0553 - Electrical Identification.

L. Test receptacles and modular wiring connectors for proper polarity, ground continuity and compliance with requirements.

END OF SECTION 26 2726

SECTION 26 2729

ELECTRIC VEHICLE CHARGING STATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electric vehicle charging stations: **EVCS-#**

B. Energy Load Management for electric vehicle charging stations

C. Electric vehicle radio frequency identification (RFID) card system

1.02 REFERENCES

A. The equipment and components in this specification shall be designed and manufactured according to the latest revision of the following standards (unless otherwise noted):

1. SAE J1772 Standard for Electric Vehicle Conductive Charge Coupler
2. Electrical Code Article 625 Electric Vehicle Charging Systems
3. CEC California Electrical Code Electric Vehicle Charging Systems
4. UL 2202, Electric Vehicle (EV) Charging System Equipment
5. UL 2231, Personnel Protection Systems for Electric Vehicle (EV) Supply Circuits
6. UL 2251, Plugs, Receptacles and Couplers for Electric Vehicles
7. UL 2594, Electric Vehicle Supply Equipment
8. UL and cUL listed
9. ISO 15693

1.03 SUBMITTALS

A. Submit product data under provisions of Section 26 0500.

B. Provide product data showing configurations, finishes, dimensions, cable, and coupling information.

C. Provide manufacturer installation, operation, and maintenance instructions.

D. Energy Load Management:

1. Submit overall diagram of system network including meters, communication / ethernet switches, EV charge stations, related power distribution equipment, system head-end, wiring and cabling.
2. Provide description of overall system, user interface, and system.

1.04 SPARE PARTS

A. Provide RFID cards:50.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Contractor shall inspect and report for damage.

B. Contractor shall store in a clean, dry space. Cover with heavy canvas or plastic to keep out dirt, water, construction debris, and traffic. Heat enclosures to prevent condensation.

C. Contractor shall handle in accordance with manufacturer's recommendations to avoid damaging equipment, installed devices, and finish.

D. Contractor shall store, protect, and handle products in accordance with recommended practices listed in manufacturer's installation and maintenance manuals.

PART 2 PRODUCTS

2.01 ELECTRIC VEHICLE CHARGING STATION

A. Plan Identification:

1. **(EVCS-1)** Electric vehicle charging station, single port type.
2. (**EVCS-1N)** Electric vehicle charging station, single port type, with network gateway to communicate with non-gateway enabled devices.
3. (**EVCS-2)** Electric vehicle charging station, dual port type.
4. (**EVCS-2N)** Electric vehicle charging station, dual port type, with network gateway to communicate with non-gateway enabled devices.

B. Approved Manufacturers:

1. Dual Port Charging Station Pedestal Style:

   a. Leviton EVR Green 4000
   b. Siemens EV Charging
   c. Bosch EV series
   d. Clipper Creek
   e. Charge Point CT4000 Series
   f. SEMAConnect 6/7/8 Series

C. Electric vehicle (EV) charging station, Level 2 charging, with LCD display, LED display for charging status, fault indication, power available, internal ground fault protection 20mA, integrated single phase revenue grade meter, anti-nuisance tripping, and re-closure feature, listed.

1. Enclosure Construction: Minimum NEMA 3R
2. System Supply: 40 **amp,** 208-volt, single phase, 60Hz.
3. Cable / Connector: Usable cable to not exceed 25ft, unless equipped with a cable management system. SAE J1772 compliant connector. Provide complete with cable/connector support while not in use bracket.
4. Environment: Wet location, -22°F to 122°F

D. Credit Card Revenue Generation:

1. Provide integral card / contactless credit card interface.
2. The Owner will enter into a contract with a revenue service plan. The contractor shall provide provisions to coordinate and set up the revenue service plan on behalf of the Owner.

E. RFID System Revenue Generation:

1. Provide EVCS with integral radio frequency identification (RFID) reader.
2. Provide manufacturer RFID software and RFID reader for customer programming of RFID cards.
3. Provide RFID cards: Refer to spare parts.

PART 3 EXECUTION

3.01 INSTALLATION

A. Provide concrete pad and mow apron for pedestal installation.

B. Placement:

1. Verify field measurements with civil and architectural plans.
2. Install pedestal 12 inches behind concrete curb / paving limits or as directed by the manufacturer.
3. Center pedestal in site islands 24 inches or less in width.
4. Center dual port pedestals between parking stalls. Align with vehicle parking lines.

C. Grounding Rod: Provide 5/8 x 10'-0" copper clad steel ground rod for each pedestal, installed 12 inches below finished grade. Provide bare #6 ground wire with exothermic weld for bonding to EVCS pedestal.

D. Labeling: Provide panel and circuit label for all circuits serving the electric vehicle charging station. Locate circuit labels on the inside utility access cover for the charging station.

E. Ethernet Connections: Provide final Ethernet cable and terminations per manufacturer instructions.

F. Cellular Network: Provide setup, testing, and configuration of cellular network per manufacturer instructions.

G. Disconnecting Means (Disconnecting Means NEC 625.43, where applicable):

1. Disconnecting Means. For electric vehicle supply equipment rated more than 60 amperes or more than 150 volts to ground, the disconnecting means shall be provided and installed in a readily accessible location. The disconnecting means shall be capable of being locked in the open position. The provision for locking or adding a lock to the disconnecting means shall be installed on or at the switch or circuit breaker used as the disconnecting means and shall remain in place with or without the lock installed. Portable means for adding a lock to the switch or circuit breaker shall not be permitted.

3.02 OWNER TRAINING AND SYSTEM COMMISSIONING:

A. Provide factory representative for Owner training and demonstration of the system. Owner training shall include service, maintenance, troubleshooting, and general operation of system. The factory representative shall also provide customer in-person training/support for the following:

1. RFID software setup on customer computer
2. Training for RFID card program
3. Cellular network registration, initialization, and testing
4. Energy Load Management System

END OF SECTION 26 2729

SECTION 26 2813

FUSES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fuses

B. Spare Fuse Cabinet

1.02 REFERENCES

A. UL 198C - High-Interrupting Capacity Fuses; Current Limiting Types

B. UL 198E - Class R Fuses

C. FS W-F-870 - Fuseholders (For Plug and Enclosed Cartridge Fuses)

D. NEMA FU 1 - Low Voltage Cartridge Fuses

E. NFPA 70 - National Electrical Code (NEC)

F. CEC California Electrical Code

1.03 SUBMITTALS

A. Submit product data under provisions of Section 26 0500.

1.04 EXTRA MATERIALS

A. Provide two fuse pullers.

B. Provide three of each size and type of fuse installed.

1.05 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40°F or more than 100°F, apply manufacturer's ambient temperature adjustment factors to fuse ratings.

PART 2 PRODUCTS

2.01 MANUFACTURERS - FUSES

A. Bussman, Division of Eaton

B. Edison Fuse, Division of Cooper Industries

C. Mersen

D. Littelfuse Inc

2.02 FUSES

A. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.

B. Voltage: Provide fuses with voltage rating suitable for circuit phase-to-phase voltage.

C. Fuses with ratings larger than 600 amperes: Class L (time delay), unless otherwise noted on the drawings.

D. Fuses with ratings larger than 200 amperes but equal to or less than 600 amperes: Class RK-1 (time delay), unless otherwise noted on the drawings.

E. Fuses with ratings less than or equal to 200 amperes (not including control transformer fuses): Class RK-5, unless otherwise noted on the drawings.

F. Control transformer fuses: Class CC (time delay).

G. Fuses for packaged equipment: Size and type as recommended by equipment manufacturer.

2.03 SPARE FUSE CABINET

A. Cabinet: Wall-mounted, 0.05-inch- thick steel unit with full-length, recessed piano-hinged door and key-coded cam lock and pull.

1. Size: Adequate for storage of spare fuses specified with 15 percent spare capacity minimum.
2. Finish: Gray, baked enamel.
3. Identification: "SPARE FUSES" in 1-1/2-inch- high letters on exterior of door.
4. Fuse Pullers: For each size of fuse.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install fuses where indicated on the drawings and specifications.

B. Install fuses in accordance with manufacturer's instruction.

C. Install fuses in packaged equipment as required by equipment manufacturer.

D. Install fuse with label oriented such that manufacturer, type, and size are easily read.

E. Install spare fuse cabinet in the Main Electrical Room.

END OF SECTION 26 2813

SECTION 26 2816

DISCONNECT SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fusible switches

B. Non-fusible switches

C. Elevator Service Disconnect Switch

1.02 RELATED SECTIONS AND WORK

A. Refer to the Disconnect and Starter Schedule for rating and configuration.

1.03 REFERENCES

A. NEMA KS 1 - Enclosed Switches

1.04 SUBMITTALS

A. Submit product data under provisions of Section 26 0500.

B. Product Data: For each type of enclosed switch, circuit breakers, accessory and component indicated, include dimensions, weights, and manufacturer's technical data on features, performance, and ratings.

C. Electrical Characteristics: For each type of enclosed switch, enclosure types, current and voltage ratings, short-circuit current ratings, UL listing for series rating of installed devices, features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

1.05 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 PRODUCTS

2.01 FUSIBLE AND NON-FUSIBLE SWITCHES

A. FDS-#; Fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position without a tool. Handle lockable in OFF position. Fuse Clips: Class 'R' fuse clips only, unless indicated otherwise on the drawings.

B. DS-##; Non-fusible Switch Assemblies: NEMA KS 1; Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position without a tool. Handle lockable in OFF position.

C. Enclosures: Type as indicated on the disconnect schedule.

D. Accessories: Provide the following accessories. Refer to Disconnect Schedule for additional requirements for each application.

1. Lockable
2. Provide finger safe barriers for exposed line-side terminations and energized components when the switch is in the open position.

2.02 ELEVATOR SERVICE DISCONNECT SWITCH

A. Acceptable Manufacturers:

1. Eaton Bussmann PS Series
2. Mersen ES Series
3. Littlefuse LPS Series

B. Elevator Service Fused Disconnect Switch: Type heavy duty, quick-make, quick-break, load interrupter enclosed knife switch with externally operable handle interlocked to prevent opening front cover with switch in ON position without a tool, with lockable handle, ratings per drawing schedule, 120 volt shut trip, two field convertible mechanically interlocked form C auxiliary contacts, shunt trip voltage monitor relay, integral control transformer, Pilot Light "on", neutral bar/lug, NEMA 1 enclosure, minimum 100K SCCR, UL Listed.

C. Provide with fire alarm interface relays for:

1. Elevator Recall
2. Elevator Shut Down Sequence
3. Fire Fighter's Cab Visual Alarm
4. Elevator Hoistway Damper

D. Accessories: Provide the following accessories. Refer to Disconnect Schedule for additional requirements for each application.

1. Lockable
2. Provide finger safe barriers for exposed line-side terminations and energized components when the switch is in the open position.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install disconnect switches where indicated on the drawings.

B. Install fuses in fusible disconnect switches.

C. Field coordinate installation with other contractors and equipment to maintain code required working space requirements.

D. Provide adhesive label on inside door of each switch indicating UL fuse class and size for replacement.

3.02 ELEVATOR SERVICE DISCONNECT SWITCH

A. Coordinate installation with elevator requirements and contractor.

B. Coordinate installation with fire alarm contractor.

3.03 ADJUSTING

A. Set field-adjustable circuit breaker trip ranges.

END OF SECTION 26 2816

SECTION 26 3100

SOLAR PHOTOVOLTAIC SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Photovoltaic Panels and Arrays

B. Power Optimizers

C. Photovoltaic Grid Tie String Inverter

D. Photovoltaic Central Inverter

E. Combiner/Disconnect

F. Photovoltaic Mounting Systems

1.02 QUALITY ASSURANCE

A. Manufacturer: Company specializing in photovoltaic panel or inverter systems with five years documented experience.

B. Operate, commission, and demonstrate seven (7) days of complete photovoltaic system operation prior to turnover to the Owner.

1. Refer to the Part 3 for system commissioning requirements.

1.03 REFERENCES

A. ANSI C62.41 - IEEE Recommended Practice for Surge Voltages in Low-Voltage AC Power Circuits

B. IEEE 519 - Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems.

C. IEEE 929 - Recommended Practices for Utility Interface of Photovoltaic Systems.

D. IEEE 1547 - Standard for Interconnecting Distributed Resources with Electronic Power Systems.

E. IEEE 1547.1 - Standard for Conformance Test Procedures for Equipment Interconnecting Distributed Resources with Electric Power Systems.

F. NFPA 70 - National Electrical Code (NEC) Article 690 - Solar Photovoltaic (PV) Systems

G. CEC California Electrical Code

H. UL 1703 - Standard for Flat-Plate Photovoltaic Modules and Panels

I. UL 1741 - Standard for Inverters, Converters, Controllers and Interconnection System Equipment for Use with Distributed Energy Resources

J. UL 1998 - Standard for Software in Programmable Components

1.04 SUBMITTALS

A. Submit product data under provision of Section 26 0500.

B. Photovoltaic Panels: Include unit dimensions, weight, material construction, wattage, voltage, current, open circuit voltage, short circuit current, installation and maintenance information, and manufacturer voltage correction factor in information.

C. Photovoltaic Inverter: Include unit dimensions, weight, installation and maintenance information. Also include the following:

1. Input: DC voltage range, max current input.
2. Output: AC voltage range, total harmonic distortion, power factor, efficiency, maximum current output.
3. General: Power consumption, enclosure type, compliance with references.
4. Environment: Ambient temperature rating, cooling requirements.

D. Array Mounting Frame:

1. Calculations, drawings and installation details shall be designed and sealed by a Professional Engineer licensed in the state where the project is located experienced in solar mounting frame design and installation.
2. Design of support shall be performed for loading indicated in this specification and structural general notes.
3. Coordination drawing drawn to scale and coordinating the photovoltaic array with other systems and equipment in the vicinity for use in the development and layout of the mounting frame.
4. Clear indication of design forces and maximum potential component forces at attachment points to building structure for confirmation of acceptability by the Structural Engineer of Record.
5. Plan drawings and details shall be cross-referenced. Details provided are to clearly indicate attachment to structure, correctly representing the fastening requirements.

E. Roof mounted system certification letter, signed by contractor, that the roof adhesives, fasteners, hardware, and accessories are approved by manufacturers of both the roofing system and the photovoltaic system.

F. Provide list of certified installers with proof of certification.

G. Provide calculation of expected annual total kilowatt hours for proposed equipment and installation.

H. Provide a list of manufacturer and model for photovoltaic panels, power optimizers, inverters and racking system with bid form for evaluation.

1.05 SPARE PARTS

A. Provide spare parts under provisions of Section 26 0500.

B. Provide three (3) additional fuses of each type and size installed.

C. Provide one (1) additional inverter convection cooling fan for each inverter module.

D. Provide two (2) spare photovoltaic panels.

E. Provide two (2) spare microinverters.

1.06 DELIVERY, STORAGE, HANDLING

A. Store and protect products under provisions of Section 26 0500.

B. Store in warm and dry location or per manufacturer's requirements.

C. Handle per manufacturer's requirements.

1.07 OPERATION AND MAINTENANCE DATA

A. Submit data under provision of Section 26 0500.

B. Include description of operation and servicing procedures, list of major components, recommended remedial and preventative maintenance procedures, and list of spare parts.

1.08 PRE-INSTALLATION CONFERENCE

A. Roof Mounted System: Conduct a pre-installation conference a minimum of one weekprior to commencing roof mounted system work. Minimum participants to include general contractor, roofing contractor, electrical contractor, and photovoltaic system installer. Minimum agenda items shall include:

1. Installation schedule.
2. Protocols to protect roof system and roof warranty.
3. Adhesive, fastener, accessories, and hardware approved to maintain roof system and photovoltaic system warranties.

B. Grade, Site, Building Mounted Systems: Conduct a pre-installation conference a minimum of one week prior to commencing roof mounted system work. Minimum participants to include general contractor, electrical contractor, photovoltaic system installer. Minimum agenda items shall include:

1. Installation schedule.
2. Protection of finished site and building envelope surfaces.
3. Adhesive, fastener, accessories and hardware required to support photovoltaics systems on surfaces installed by others.

1.09 SYSTEM DESCRIPTION

A. Complete photovoltaic system rated 25 kW 600 volt DC at STC including photovoltaic panels, inverter system, combiner/disconnects, metering, and reporting equipment. Systems shall be configured to produce 208Y/120 3 phase 4 wire 60 Hz power.

B. Grid-tie interconnection with utility, including island protection and net metering.

C. The photovoltaic system shall include a metering system for total system power production and a reporting system to monitor individual components.

D. The photovoltaic system and inverter shall be configured as a grid inter-tie solar photovoltaic system. The individual inverters shall automatically de-energize their output to the building electrical system and disconnect from the photovoltaic panels upon loss of the utility electrical service. The photovoltaic inverter system shall remain disconnected until the electrical utility voltage has been restored.

E. Equipment shall be identified for use in solar photovoltaic systems.

F. Equipment, including wiring, fuses, circuit breakers, etc., used in any DC portion of the photovoltaic power system shall be listed for use in **600** volt DC circuits.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Hanwa Q Cells series (basis of design)

B. Kyocera series

C. Mission Solar series

D. Or pre-approved equals

2.02 PHOTOVOLTAIC PANELS AND ARRAYS

A. Operating Environment Conditions:

1. Operating Temperature: -40 to 90°C
2. Wet location listed

B. Cell Material: Silicon-based solar cell construction with UV stabilized polymer. Provide with bypass diode technology for partial shading operation.

C. Panel Construction: Anodized aluminum frame with ground point and tempered glass cover.

D. Dimensions: 44**"** wide x **1.84"**deep x **82"** long.

1. Maximum Weight: TBD lbs.

E. Panel Connections and Terminations:

1. Provide manufacturer's wiring and quick-connect terminations for series creation of module-strings installation of panels.
2. Provide manufacturer wiring to combiner boxes for parallel grouping of module-strings.
3. All exterior wire and terminations shall be listed sunlight resistant.

2.03 POWER OPTIMIZERS

A. Provide power optimizer modules mounted to back of panels to track MPPT and minimize losses from shading and uneven string lengths.

B. Minimum Efficiency: 98%

C. Maximum System Voltage: 1000 VDC

D. Operating Temperatures: -40 to 85°C

E. Protection Rating: IP68 / NEMA 6P

F. Power optimizer must have been tested with submitted photovoltaic panel.

2.04 COMBINER/DISCONNECT

A. Combination of combiner box and solar array disconnect in a single enclosure.

B. Load break switch rated 600 VDC maximum with lockout provisions.

C. Fuse holders rated 30 amp maximum. Terminal blocks for each PV string.

D. Provide fused surge protective device (SPD) with visual status indicator and remoteBUSSMAN BSP series or approved equal.

E. Enclosure: NEMA 4X.

F. The inverter shall be constructed to not allow backfeeding from the electrical utility to the photovoltaic panels or DC input bus.

G. The inverter shall be cooled via a forced air cooling fan.

H. Inverters shall be provided with Ethernet connection for metering and recording system outputs. Provide communication gateway device(s) as required to connect inverter system to the Owner's LAN or network router.

2.05 PHOTOVOLTAIC GRID TIE CENTRAL INVERTERS

A. The inverter shall be constructed to not allow backfeeding from the electrical utility to the photovoltaic panels or DC input bus.

2.06 ARRAY MOUNTING

A. Basis of design is given so integrator can provide design and installation of an equivalent system that is compatible with the provided modules and structure. Subject to compliance with requirements, provide the named product or a comparable product by one of the following:

1. UNIRAC Large Array (U-LA) (Basis of Design)
2. DPW Direct Power and Water
3. PROSOLAR

B. Mounting system requirements Canopy mounting system:

1. 35-degree tilt angle.
2. Wind load requirements: As indicated on structural general notes.
3. 30 pounds per square foot snow load.
4. Total System Weight: 5 lbs/sf
5. Seismic Requirements: As indicated on structural general notes.
6. Provides four mounting supports for each panel in accordance with manufacturer's requirements.
7. Coordinate final dimensions with architectural drawings and existing conditions.
8. Structural aluminum members to be mill finish. All brackets and connections to be stainless steel.
9. Connect mounting system to electrode grounding system.

C. Provide complete solar array mounting system including rails, splices, fasteners, legs, clamps, standoffs, feet, and anchors.

PART 3 EXECUTION

3.01 INSTALLATION

A. Photovoltaic cabling shall be installed in raceways separate from other building system cabling. Photovoltaic cabling shall be installed in conduit when located interior to the building.

B. The photovoltaic panels and arrays shall be configured in an open circuit, short circuit, or provided with an opaque covering to disable the array from producing electrical power during installation. Refer to the manufacturer's information for additional disabling requirements during installation.

C. Install fuses in all fuse holders and disconnects. Provide a label on the inside of each disconnect identifying the size, type, and model of each fuse installed.

D. Provide provisions to seal all exterior penetrations. All photovoltaic system roof penetrations shall be sealed by the roofing contractor at the expense of the photovoltaic system contractor.

E. DC Arc-Fault Circuit Protection: Provide PVAFCI arc-fault circuit interruption protection for DC branch circuits.

F. DC Shock Hazard Protection: Provide PVHCS hazard control system to limit electric shock potential to 80 volts or less post rapid shutdown initiation or per code.

G. Roof Mounted Systems:

1. Provide photograph and report documentation of the roof system condition prior to installing any roof mounted photovoltaic systems. Provide a copy of the report to the general contractor and roofing contractor.
2. Provide protective roof mats during the fabrication and installation of roof mounted photovoltaic systems to protect the roofing system.
3. Provide provisions for roofing contractor to seal roof penetrations, provide roof protection at ballasted rack and raceway supports, and other points of interface between the roof and photovoltaic system at the expense of the photovoltaic installer.
4. Provide provisions for the roofing contractor to repair any penetrations, wear, or general damage caused by installation of the photovoltaic system at the expense of the photovoltaic system installer.

H. Wire and Cable Schedule:

1. These requirements are in addition to the requirements of Section 26 0513.
2. DC Distribution System:

    a. Exterior: Photovoltaic panel manufacturer-supplied cabling with quick connects.
    b. Interior: Copper, stranded conductor, 600 volt insulation, XLPE or EPR.
    c. Underground or Wet Locations: Copper, stranded conductor, 600 volt insulation, XLPE or EPR.
    d. Conductors shall be color coded as follows:

        1) PV-: Black
        2) PV+: Red
        3) Ground Bond: Green

3. AC Distribution System:

    a. Refer to Section 26 0513.

4. Use no wire smaller than 10 AWG for DC wiring of the photovoltaic system.
5. Use 8 AWG for DC wiring of photovoltaic systems with distances between the photovoltaic panel and photovoltaic inverter greater than 100 feet.

I. Interconnect photovoltaic inverters and/or communications gateway to each other and to the facility's local area network patch panel using Category 6 cable or other cable as directed by the inverter manufacturer.

J. Provide provisions for programming and initializing the system metering and reporting software per the Owner's requirements. The Contractor shall organize a meeting with the Owner to finalize the programming and user interfaces of the program software.

K. Install equipment per the manufacturer's recommendations.

3.02 LABELING

A. Refer to Section 26 0553 for product requirements.

B. Label all photovoltaic system equipment as required by code.

C. Label ground fault indicators:

1. "IN THE EVENT OF A GROUND FAULT INDICATION - THE NORMALLY GROUNDED CONDUCTORS MAY BE ENERGIZED AND UNDERGROUNDED"

D. Label all AC-alternating current and DC-direct current disconnects of the photovoltaic power system.

1. "---PHOTOVOLTAIC SYSTEM DISCONNECT---WARNING. ELECTRIC SHOCK HAZARD. DO NOT TOUCH TERMINALS. TERMINALS ON BOTH THE LINE AND LOAD SIDES MAY BE ENERGIZED IN THE OPEN POSITION"

E. The AC disconnecting means for each photovoltaic inverter shall be labeled with the following:

1. Operating Current:
2. Operating Voltage:
3. Maximum System Voltage:

F. Label DC raceways, cabling, junction boxes, and conduit bodies with adhesive markings and labels suitable for the environment:

1. Color: White capital letters on red background.
2. Label Text: PHOTOVOLTAIC POWER SOURCE.
3. Label intervals: Maximum 10 intervals or as required by code to identify all conduits run exposed or located above accessible ceilings. Conduits located above non-accessible ceiling or in floors and walls shall be labeled within 3 feet of becoming accessible, or separated by enclosures, walls, partitions, ceilings, and floors. Labels for multiple conduits shall be aligned.

G. Label DC system disconnect and power conversion equipment with the following:

1. Equipment type and contract documents designation of equipment.
2. Name of upstream equipment and location of the upstream equipment if it is not located within sight.
3. Nominal equipment voltage and rating.
4. Max DC Voltage.
5. Available fault current (from batteries if applicable).
6. Date of fault current study; refer to one-line diagram.

H. Label each electrical service location with rapid shutdown feature:

1. Label text: "SOLAR PV SYSTEM WITH RAPID SHUTDOWN. TURN RAPID SHUTDOWN SWITCH TO THE "OFF" POSITION TO SHUT DOWN PV SYSTEM AND REDUCE SHOCK HAZARD IN ARRAY."

I. Short Circuit Current: The interactive system point of interconnection shall be labeled at the disconnecting means with the following:

1. Maximum AC Output Operating Current:
2. Operating AC Voltage:

J. The building service entrance disconnect shall be clearly labeled to identify there is a photovoltaic system interconnection. The location of the interactive system disconnect shall be identified with a plaque reading: "WARNING - PHOTOVOLTAIC SYSTEM DISCONNECT LOCATED AT TBD."

K. Conductor Identification:

1. PV System DC circuit conductors shall be identified at all termination connections.
2. Identification shall include color coded shrink tube tagging, conductor colored insulation, or marking tape. Include +, POSITIVE, or POS identification style labeling in addition to color identification.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 26 0500.

B. Check for damage and tight connections prior to allowing the photovoltaic panels to begin power generation.

C. Check for damage and proper operation of the photovoltaic inverters.

D. Verify operation of the metering and reporting system components. Adjust and update the graphical user interface for project specific conditions.

3.04 SYSTEM COMMISSIONING

A. Provide system commissioning report under provisions of Section 26 0500.

B. Notify Architect/Engineer seven days prior to beginning final witness testing of the photovoltaic system.

1. The Electrical Contractor shall fully test the complete photovoltaic system prior to notifying the Architect/Engineer for final witness testing.

C. Test, measure, and record the following system values:

1. Date:
2. Time of test:
3. Testers:
4. Sun overcast conditions (full sun) (scattered clouds) (full cloud coverage).
5. Inverter:

a. DC input current:
b. DC input voltage:
c. AC output current:
d. AC output voltage:
e. Output power:

D. Performance Test of Interactive Inverter System:

1. Verify proper operation of the photovoltaic system. Verify the photovoltaic system is producing power and delivering it to the building electrical distribution system.
2. Simulate power outage of electrical utility by switching the main electrical service disconnect from "closed" to "open".
3. Verify that each individual photovoltaic inverter has stopped producing electrical energy and has disconnected itself from the photovoltaic panels and building electrical distribution system.
4. Simulate return of utility electrical power by switching the main electrical service disconnect from "open' to "closed".
5. Verify each photovoltaic inverter has reconnected to the photovoltaic panels and building electrical distribution system. Verify power delivery from the photovoltaic inverters to the building electrical distribution system.
6. Document any test failure, including reason for failure and corrective actions. Retest the photovoltaic system to complete satisfactory operation.

3.05 OWNER TRAINING

A. Provide Owner training under provisions of Section 26 0500.

B. Provide complete overview of the photovoltaic system to the Owner including:

1. System overview
2. System operation
3. Manufacturer maintenance instructions
4. System component locations
5. Operation of the metering and reporting components and software

C. Minimum Training Time:

1. Eight hours includes:

a. Four hours system components.
b. Four hours computer software operation.

END OF SECTION 26 3100

SECTION 26 4300

SURGE PROTECTION DEVICES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section describes materials and installation requirements for factory and field wired low voltage surge protection devices (SPD) for the protection of all AC electrical circuits. SPD equipment to be installed at designated service entrance equipment, distribution panels, electronic equipment, elevators, and receptacle devices

1.02 QUALITY ASSURANCE

A. The specified unit shall be designed, manufactured, tested and installed in compliance with the above references. The unit shall be "Listed by Underwriters Laboratories" to UL 1449.

B. Each unit shall be designed and manufactured by a qualified manufacturer of power conditioning equipment. The qualified manufacturer must have been engaged in the design and manufacturer of such products for a minimum of five years.

1.03 REFERENCES

A. ANSI/IEEE C62.33 - IEEE Guide on Testing of MOV components

B. ANSI/IEEE C62.35 - IEEE Guide on Testing of SAD components

C. ANSI/IEEE C62.41 - IEEE Recommended Practice on Surge Voltage in Low Voltage AC Power Circuits

D. ANSI/IEEE C62.45 - IEEE Guide on Surge Testing for Equipment Connected to Low Voltage AC Power Circuits

E. ANSI/UL 1449 Latest Edition - UL Standard for Safety for Surge Protective Devices

F. CBEMA - Computer Business Equipment Manufacturers Association

G. IEC 664 - International Engineering Consortium, Standard for Clamping Voltage

H. NFPA 70 - National Electrical Code (NEC)

I. CEC California Electrical Code

J. UL 67 - Listed for Internal Panelboard Transient Voltage Surge Suppressors

K. UL 96A - Devices listed as approved for secondary surge arrestors (VZCA)

L. UL 248-1 - Fusing

M. UL 1283 - Electromagnetic Interference Filters, Fifth Edition

1.04 SUBMITTALS

A. Shop Drawings: Should include device dimensions, mounting requirements including wire size and over-current protection device rating, nameplate nomenclature, electrical ratings, short circuit current rating, and test results as indicated below under "Testing, Warranty and Life Expectancy" as provided by an independent test lab or a UL certified test lab for the category(ies) of suppression device(s) specified using the appropriate IEEE test wave. Product data sheets with installation instructions for each size and type of device are required. Shop drawings submitted without the testing data as required by section this section will be rejected.

B. Fuse information: Provide fuse information if required for operation. Include size, manufacturer, time-current chart responses to UL 1449 testing requirements, maximum surge protection capability per mode and phase as limited by the fuse, and verification of repetitive surge protection device operation without system degeneration greater than 10%.

1.05 SPARE PARTS

A. Surge Protection Modules: Furnish 1 replacement module for each type installed.

B. Fuses: Furnish to the Owner 3 spare fuses of each type and rating installed.

1.06 TESTING, WARRANTY AND LIFE EXPECTANCY

A. Manufacturer must provide independent testing on repetitive capability and maximum surge current rating of service entrance suppressor units. This shall be performed at a nationally recognized lab not affiliated with the manufacturer.

1. Single pulse surge current capacity: Single pulse surge current tested in a mode at rated surge currents.
2. Single pulse surge current capacity test: An initial UL 1449 defined 1.2 x 50µs, 6000V open circuit voltage waveform and an 8 x 20µs, 500A and 3kA short circuit current waveform shall be applied to benchmark the unit's suppression voltage (VPR).
3. A single 8 x 20µs waveform pulse of maximum rated surge current per mode shall then be applied. To complete the test, another UL 1449 surge shall be applied to verify the unit's survival. Survival is achieved if the suppression voltage measured from the two UL1449 surges does not vary by more than 10%.

B. Minimum Repetitive Surge Current Capacity:

1. Service entrance suppressor units should be tested repetitively at an independent lab to verify repetitive capacity.
2. Minimum Repetitive Surge Current Capacity Test:

    a. An initial UL 1449 surge defined as 1.2 x 50µs, 6000V open circuit voltage waveform and an 8 x 20µs, 500A and 3kA short circuit current waveform shall be applied to benchmark the unit's suppression voltage.

b. A repetitive number of ANSI/IEEE C62.41.2-2002 (Category C3) surges, defined as a 1.2 x 50µs 10kV or 20kV open circuit voltage waveform and an 8 x 20µs 10,000A short circuit current waveform, shall then be applied at one-minute intervals.
c. To complete the test, another UL 1449 surge shall be applied to verify the unit's survival.

3. Survival is achieved if the suppression voltage (VPR) does not vary by more than 10%.
4. Proof of such testing shall be the test log generated by the surge generator.

C. Provide UL 1449 classification white sheet pages indicating the VPR (voltage protection rating) for each SPD unit submitted for this product using the 6kV/3kA combination wave surge.

D. Warranty: Ten (10) years. Includes workmanship, installation and programming.

E. No scheduled parts replacement or preventative maintenance shall be required.

PART 2 PRODUCTS

2.01 DESCRIPTION

A. General: The unit shall provide transient voltage suppression, surge current diversion and high-frequency noise attenuation, when connected in parallel to the facilities distribution system. The unit MCOV shall not be less than 115% of the nominal system voltage. Operating frequency shall be for a 60 Hz system. The unit shall provide protection in all normal modes for "wye" and "delta" systems.

B. Short Circuit Current Rating: Provide factory label for SCCR rating. The short circuit current rating shall be the larger of the listed value on the drawings or as required by the equipment protected.

2.02 RATINGS

A. **SPD-**Insert # **#** Secondary Distribution Suppressors:

1. For 277/480-volt, 3 phase, 4 wire, type 2, category B3/C1 unit.

a. Surge current capacity: 60,000/120,000 amps per protection mode/phase
b. Nominal Discharge Current (I_N): 20 kA.
c. Mounting: Refer to the drawings.
d. Voltage Protection Rating: Refer to requirements below.
e. Components: Minimum component size of 20mm metal thermally protected oxide varistors (MOV).

2. Manufacturers:

a. Eaton SPD Series

B. **SPD-#;** Critical Load Protection - Fixed Equipment:

1. For 120-volt, 1 phase, 3 wire, type 3, category A3 unit.

    a. Surge Current Capacity (I_N): 15,000 amps per protection phase
    b. Mounting: External, NEMA 1 enclosure
    c. Components: Nonmodular units composed of 20mm metal oxide varistors (MOV). Series inductors, SAD, or selenium cells may be used in addition to MOVs.
    d. Protection Modes and UL 1449 Clamping Voltage: 700 volt L-N, L-G, and 900 volt N-G.

2. Manufacturers:

    a. Eaton
    b. Or approved equal

PART 3 EXECUTION

3.01 INSPECTION

A. Examine equipment for size and type of surge protection device to be used to ensure physical compatibility.

B. Inspect surge protection device for any signs of physical damage due to shipping or handling before installing surge protection device.

3.02 INSTALLATION

A. Mounting Location:

1. The unit shall be installed as close as practical to the pane and transformer secondary lugs in accordance with applicable national/Local Electrical Codes and the manufacturer's recommended installation instructions. Connect the unit to the transformer switchboard or panel using a conduit nipple. Flush mount the unit in the front of the switchboard. Mount unit directly across from the breaker or disconnect serving it.
2. Integral surge protection devices mount between the main and branch circuit breakers.
3. If internal surge protection device is specified, device shall be installed in a barrier compartment isolated from other components.

B. Connections:

1. Conductors from the protected bus to the unit shall not be any longer than necessary avoiding unnecessary bends. The conductor leads shall be twisted together and as short as possible. Connection shall be with mechanical lugs for each phase, neutral, and ground if applicable. Contractor shall provide wire and circuit breakers sized per the approved manufacturer's requirements. Maximum lead length from protected bus to surge protection device shall be per manufacturer's requirements, but no greater than 5'-0".

2. The surge protection unit shall be isolatable from the electrical distribution system via 3 pole circuit breaker mounted in the switchboard/panelboard**or be equipped with a factory supplied integral fused switch or circuit breaker**. Single phase 120-volt units shall be hardwired without a disconnecting means.
3. Neutral and ground shall not be bonded together at secondary panelboard locations.

C. General:

1. Check unit for proper operation of protection and indication under start-up.
2. Check unit to ensure all MOVs for each mode of protection are operational. Verify integral fuse links are operational and have not melted.
3. Surge suppression devices shall not be installed ahead of the main service disconnect(s).
4. Install fuses in all fuse holders and fused disconnects internal to the surge protection unit. Use fuses recommended by the manufacturer to satisfy repetitive UL 1449 operation of the surge suppression unit. External fusing of the surge protection device is not allowed.
5. Coordinate location of surge protection device to allow adequate clearances for maintenance.
6. Manufacturer service phone number shall be posted on the front of the surge protection device.

END OF SECTION 26 4300

SECTION 26 5119

LED LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires and accessories

B. Exterior luminaires and accessories

C. LED emergency lighting units

D. Emergency exit signs

1.02 RELATED SECTIONS

A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:

1. 26 09 33 Lighting Control Systems

    a. Automatic load control relay (ALCR) (individual luminaire - integral) (ALCR3)

2. 26 52 15 Emergency Lighting Inverter
3. Electrical drawings: Plans, luminaire schedules, lighting control sequence of operations, diagrams, and details.

1.03 REFERENCES

A. ANSI C78.377 - Specifications for the Chromaticity of Solid State Lighting Products

B. ANSI C82.16 - Light-Emitting Diode Drivers - Method of Measurement

C. ANSI C82.77 - Standard for Harmonic Emission Limits and Related Power Quality Requirements for Lighting Equipment

D. NFPA 70E - National Electrical Safety Code

E. NEMA SSL1 - Electronic Drivers for LED Devices, Arrays or System

F. UL 8750 - Light Emitting Diode (LED) Equipment for use in Lighting Products

G. LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products

H. LM-80 - Measuring Luminous Flux and Color Maintenance of LED

I. FS W-L-305 - Light Set, General Illumination (Emergency or Auxiliary)

J. UL 924 - Standard for Emergency Lighting and Power Equipment

K. Project site classification as defined in IESNA RP-33 LZ0.

1.04 SUBMITTALS

A. Submit product data under provisions of Section 26 0500.

B. Basic Requirements of Submittal:

1. Submit product data sheets for luminaires, LED light engines, drivers and poles. Include complete product model number with all options as specified. Submittal shall be arranged with luminaires listed in ascending order, and with each luminaire's, LED light engine, driver, or pole information following luminaire's product data. Failure to organize submittal in this manner will result in the submittal being rejected.
2. Submit lens product data, dimensions and weights if not included in product data sheet submittal.
3. Include outline drawings, support points, weights, and accessory information for each luminaire.
4. Submit manufacturer origin of LED chipset and driver.

C. LED Lighting - Performance Testing Submittal (when requested by Architect/Engineer):

1. IESNA LM-79: Include photometric report for the latest generation system being furnished. Provide name of independent testing laboratory, report number, date of test, luminaire series/model number, input wattage, and light source specifications.
2. IESNA LM-80: Measuring Lumen Maintenance of LED Light Sources.

D. LED Lighting - Control Compatibility Submittal:

1. Submit lighting control capability data for each LED luminaire. The submittal shall clearly identify device data proposed by the Contractor and approved by the luminaire manufacturer for dimming, switching, addressable, wireless, and similar control characteristics.

E. Submit utility rebate forms where offered at project location. Submit completed rebate forms within30 days of Substantial Completion.

1.05 EXTRA STOCK

A. Provide extra stock under provisions of Section 26 0500.

B. LED Light Engines or Modules: 5 percent of quantity installed, minimum one (1) of each size and type of field replaceable light engine or module. Provide field replacement installation instructions.

C. Lenses: Three (3) percent of quantity installed, minimum one (1) of each size and type.

D. LED Drivers: **5** percent of quantity installed, minimum one (1) of each size and type.

E. Exit Signs: Provide **5 a**dditional exit sign luminaires complete with labor, conduit, and wire. Additional exit luminaires shall be located per the Architect/Engineer or provided as attic stock when a location is not defined prior to Owner occupancy. When multiple exit signs are scheduled, the quantity listed above shall represent each type listed.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site. Store and protect under provisions of Section 26 0500.

B. Protect luminaire finishes, lenses, and trims from damage during storage and installation. Do not remove protective films until construction cleanup within each area is complete.

C. Handle site lighting poles carefully to prevent breakage and damage to finish.

1.07 MOCKUP

A. Provide and install luminaires with power and control connections in mockup rooms as identified in Division 1. Approved luminaires in mockup may be reused as part of complete work if in original condition.

1.08 WARRANTY

A. The warranty period begins at the date of Substantial Completion.

B. LED Light Engines and Drivers:
1. LED Drivers and Dimming Drivers: Five (5) years
2. Light Emitting Diode (LED) Light Engines: Five (5) years

C. Emergency Lighting Units and Exit Signs:

1. Emergency Lighting Units: Three (3) year, non-prorated
2. Exit Signs: Three (3) year, non-prorated
3. Emergency Unit and Exit Sign Battery: Sealed lead acid or lead calcium cell, requiring no maintenance or replacement for ten (10) years under normal conditions.

D. Emergency Drivers:

1. Emergency LED Driver Five (5) years

E. Emergency Inverter for LED Light Engines:

1. Emergency Inverter and Battery: Sealed nickel cadmium five (5) year, non-prorated.

F. Automatic Load Control Relay (ALCR): Five (5) year

1.09 REGULATORY REQUIREMENTS

A. Conform to NFPA 101 for installation requirements.

PART 2 PRODUCTS

2.01 INTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

A. Lensed Troffers: Provide hinged frames with latches and 0.125-inch thick virgin acrylic lenses. Prismatic lenses shall have depth of no less than 0.080", KSH12 or equal. Other lenses as scheduled.

B. Recessed Luminaires: Confirm ceiling and wall type and furnish trim and accessories necessary to permit proper installation in each system. Where fire-rated ceiling or wall assemblies are specified, furnish and install listed enclosures around luminaires that maintain the system rating.

C. Luminaires: Louvers shall be anodized low iridescent specular aluminum with mitered corners and interlocking construction.

D. Suspended Luminaires: Coordinate power feed and suspension canopies with ceiling type and architectural RCP for proper fit and location. Ensure finished installations are plumb and level at elevations specified. Verify suspension length prior to submittal.

E. Painted reflector surfaces shall have a minimum reflectance of 90%.

F. All painted components shall be painted after fabrication.

2.02 EXTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

A. Listed for wet or damp location as scheduled. Provide ingress protection (IP) rating when scheduled.

B. Provide low temperature LED drivers, with reliable starting to -20°F.

C. In-grade luminaires shall have lamp/optic separation to prevent surface temperature from exceeding 115°F. Compartment separation of wire entry and control gear/lamp chamber.

D. Exterior LED luminaires shall contain separate, easily accessible and replaceable Category C surge protection device.

2.03 EMERGENCY EXIT SIGNS

A. Exit Signs: Stencil face, 6-inch high letters, directional arrows as indicated, universal mounting type as indicated on the drawings.

B. Directional Indicators: The directional indicator for exit signage shall be of a chevron type meeting all requirements of NFPA 101.

PART 3 EXECUTION

3.01 INSTALLATION

A. Securely fasten luminaires to the listed and labeled ceiling framing member by mechanical means such as bolts, screws, rivets or listed clips identified for use with the type of ceiling framing members. The architectural ceiling framing system may be used in lieu of independent support with prior written approval by the ceiling system manufacturer and Authority Having Jurisdiction (AHJ). Luminaires and wiring installed in fire-rated ceiling assemblies shall be independently supported for all applications.

1. Install recessed flanged luminaires to permit removal from below. Use manufacturer-supplied plaster frames and swing gate supports. Provide independent support as follows:

    a. Luminaires less than 56 lbs: Provide a minimum of two (2) #12 gauge suspended ceiling support wires located on diagonal corners of the luminaires.
    b. Luminaires 56 lbs or greater: Provide a minimum of four (4) #12 gauge suspended ceiling support wires located on diagonal corners of the luminaires. Support luminaire independent of the ceiling system.
    c. Luminaires larger than eight square feet (8 ft2): Support luminaire independent of the ceiling system.

B. Do not fasten luminaire supports to piping, ductwork, mechanical equipment, or conduit, unless otherwise noted. Support wires shall be tightly wrapped (minimum of three turns within 3 inches of the connection) and sharply bend to prevent vertical movement.

C. Support suspended or pendant mounted luminaires independent of ceiling grid with adjustable stainless steel aircraft cables or per luminaire schedule mounting requirements. Suspension assembly and anchors shall be capable of supporting 300 pounds dead load at each suspension point.

D. Support wire used to independently support luminaires, raceways, and wiring systems shall be distinguishable from ceiling support systems by color (field paint), tagging or equivalent means.

E. Provide seismic bracing of luminaires per IBC Chapter 16. Design pendant luminaires on a component seismic coefficient (Cc) of 0.67. Design vertical supports with a factor of safety of 4.0. Contractor shall verify the Seismic Hazard Exposure Group and Performance Criteria Factor.

F. Install lamps in lamp holders of luminaires.

G. Adjust aimable luminaires to obtain lighting levels on objects and areas as directed to obtain desired lighting levels.

H. Recessed luminaires and other optical accessories shall remain in protective wraps or films until construction in area is complete and area has been cleaned.

I. Industrial Pendant Luminaires: Use power hook hangers rated 500 pounds minimum or provide safety chain between driver and structure. Provide safety chain between reflector and driver.

J. Luminaire Pole Bases: Sized and constructed as indicated on the drawings. Project anchor bolts 2 inches minimum above base. Install poles plumb with double nuts for adjustment. Grout around pole anchor base.

K. Embedded Luminaire Poles: Depth as indicated. Install plumb.

L. Use belt slings or non-chafing ropes to raise and set pre-finished luminaire poles.

3.02 CONSTRUCTION USE OF PROJECT LUMINAIRES

A. The Contractor shall provide temporary construction lighting per the requirements of Division 1.

B. The project luminaires shown on the construction documents shall not be used for temporary construction purposes without providing a plan for Owner approval that addresses energy and luminaire operating hours.

3.03 AUTOMATIC LOAD CONTROL RELAYS

A. Factory or field installation per manufacturer requirements.

B. Remote Test Switch: Provide connection to remote test switch.

C. Fire Alarm Override: Provide connection to addressable fire alarm relay.

3.04 RELAMPING

A. Replace failed LED light engine modules or arrays at completion of work.

3.05 ADJUSTING AND CLEANING

A. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.

B. Touch up luminaire and pole finish at completion of work.

3.06 LUMINAIRE SCHEDULE

A. As shown on the drawings.

END OF SECTION 26 5119

SECTION 27 0500

BASIC COMMUNICATIONS SYSTEMS REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basic Communications Systems Requirements specifically applicable to Division 27 sections, in addition to Division 1 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.02 REFERENCES

A. CCR California Code of Regulation

B. CBC California Building Code

C. CFC California Fire Code

D. CEC California Electric Code

E. CMC California Mechanical Code

F. CPC California Plumbing Code

G. California Title 24 - Building Energy Efficiency Standards

H. SCAQMD Southern California Air Quality Management Division

1.03 SCOPE OF WORK

A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Communications Systems.

B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make the portion of the Communications Work a finished and working system.

C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.

D. Description of Systems include, but are not limited to, the following:

1. Complete Structured Cabling System integrated with e including, but not limited to:

    a. Backbone cabling and terminations.
    b. Horizontal cabling and terminations.
    c. Information outlets (IOes) including faceplates, jacks and labeling.

d. Equipment racks, cabinets, cable management, and equipment.
e. Telecommunication Room equipment including patch panels, optical distribution cabinets, and termination blocks.
f. Cabling pathways.
g. Grounding and Bonding
h. Testing

2. Complete Paging Systems integrated with existing campus system.
3. Mounting and patching of wireless access points provided by others.
4. Removal/demolition work and/or relocation and reuse of existing systems and equipment.
5. Low Voltage Communications Wiring (less than +120VAC) as specified and required for proper system control and communications.
6. All associated electrical backboxes, conduit, miscellaneous cabling, and power supplies required for proper system installation and operation as defined in the "Suggested Matrix of Scope Responsibility".
7. Firestopping of penetrations as described in Section 27 0503.
8. Seismic requirements as described in Section 26 0548 "Seismic Requirements for Equipment and Supports".

1.04 WORK SEQUENCE

A. All construction work that will produce excessive noise levels and interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during non-occupied hours. The Owner shall reserve the right to set policy as to when restricted construction hours will be required.

1.05 DIVISION OF WORK BETWEEN ELECTRICAL AND COMMUNICATIONS CONTRACTORS

A. Division of work is the responsibility of the Prime Contractor. Any scope of work described in the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described in the contract documents. The following division of responsibility is a guideline based on typical industry practice.

B. Definitions:

1. "Electrical Contractor" as referred to herein refers to the Contractors listed in Division 26 of this Specification.
2. "Electrical Contractor" shall also refer to the Contractor listed in Division 27 of this specification when the "Suggested Matrix of Scope Responsibility" indicates the work shall be provided by the EC. Refer to the Contract Documents for the "Suggested Matrix of Scope Responsibility".
3. "Technology Contractor" as referred to herein refers to the Contractors listed in Division 27 of this Specification.
4. Low Voltage Technology Wiring: The wiring (less than 120VAC) associated with the Technology Systems, used for analog and/or digital signals between equipment.

5. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation and mounting of the telecommunications/technology outlet. Rough-in shall include conduit from the information outlet backbox to above the lay-in ceiling. Where surface mounted backboxes are required, conduit shall be routed to above the lay-in ceiling.

C. General:

1. The purpose of these specifications is to outline typical Electrical and Technology Contractor's work responsibilities as related to technology systems including telecommunications rough-in, audio/visual systems rough-in, conduit, cable tray, power wiring, and low voltage communications and technology wiring. The prime contractor is responsible for all divisions of work.
2. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals are approved. Therefore, only known wiring, conduits, raceways, and electrical power as related to such items, is shown on the technology drawings. Other wiring, conduits, raceways, junction boxes, and electrical power not shown on the technology drawings but required for the successful operation of the systems shall be the responsibility of the Technology Contractor and included in the Contractor's bid.
3. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of technology systems, the final installation shall not begin until a coordination meeting between the Electrical Contractor and the Technology Contractor has convened to determine the exact location and requirements of the installation.
4. Where the Electrical Contractor is required to install cable tray that will contain low voltage technology wiring, the installation shall not begin until the Technology Contractor has completed a coordination review of the cable tray shop drawing.
5. This Contractor shall establish electrical and technology utility elevations prior to fabrication and installation. The Technology Contractor shall cooperate with the Electrical Contractor and the determined elevations in accordance with the guidelines below. This Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:

    a. Lighting Fixtures
    b. Gravity Flow Piping, including Steam and Condensate
    c. Sheet Metal
    d. Electrical Busduct
    e. Cable Trays, including 12" access space
    f. Sprinkler Piping and other Piping
    g. Conduit and Wireway
    h. Open Cabling

D. Electrical Contractor's Responsibility:

1. Assumes all responsibility for all required conduit and power connections when shown on the "Suggested Matrix of Scope Responsibility" to be provided by the Electrical Contractor.
2. Assumes all responsibility for providing and installing cable tray.
3. Responsible for Communications Systems grounding and bonding.

4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Technology Contractor's Responsibility:

1. Assumes all responsibility for the low voltage technology wiring of all systems, including cable support where open cable is specified.
2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being provided by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility."
3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).
4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of technology equipment which is required to be bonded to the technology bonding system.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.06 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

    a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
    b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    d. Maintenance clearances and code-required dedicated space shall be included.
    e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

    a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

    a. Scale of drawings:

        1) General plans: 1/4 Inch = 1 '-0" (minimum).
        2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
        3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
        4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1 '-0" (minimum).
        5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.

3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

    a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
    b. Potential layout changes shall be made to avoid additional access panels.
    c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
    d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
    e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain signoff of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.07 QUALITY ASSURANCE

A. Telecommunications Structured Cabling System Standards:

1. All work and equipment shall conform to the most current ratified version of the following published standards unless otherwise indicated that draft standards are to be followed:

    a. ANSI/NECA/BICSI 568 - Standard for Installing Commercial Building Telecommunications Cabling

b. ANSI/TIA-568-C.0 - Generic Telecommunications Cabling for Customer Premises

   1) C.1 - Commercial Building Telecommunications Standard
   2) C.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standard
   3) C.3 - Optical Fiber Cabling Components Standard
   4) C.4 - Broadband Coaxial Cabling and Components Standard

c. ANSI/TIA-569-C - Telecommunications Pathways and Spaces
d. ANSI/TIA-606-B - Administration Standard for Commercial Telecommunications Infrastructure
e. ANSI/TIA-607-B - Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications
f. ANSI/TIA-758-B - Customer-Owned Outside Plant Telecommunications Standard
g. ANSI/TIA-1152 - Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
h. ANSI/TIA/EIA-598-C - Optical Fiber Cable Color Coding
i. NFPA 70 (NEC) - National Electrical Code (Current Edition)
j. UL 444 - Standard for Safety for Communications Cable
k. California Electrical Code Article 725

B. Refer to individual sections for additional Quality Assurance requirements.

C. Qualifications:

1. Only products of reputable manufacturers as determined by the Architect/Engineer will be acceptable.
2. The installing Contractor shall be certified by the manufacturer of the structured cabling system. Certification of Contractor shall have been in place for a minimum of one (1) year prior to bidding this project. Documentation of certification is required at the time of bid. Shop drawings will not be approved until proof of certification is submitted. Refer to the end of this specification section for certification documentation requirements.
3. Each Contractor and their subcontractors shall employ only workers who are skilled in their respective trades and fully trained. All workers involved in the termination of cabling shall be individually certified by the manufacturer.
4. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.
5. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and copper structured cabling systems and have personnel adequately trained in the use of such tools and equipment.
6. A resume of qualification shall be submitted with the Contractor's bid indicating the following:

   a. Documentation of certification of This Contractor by the proposed structured cabling system manufacturer as required at the end of this specification section.

b. A list of test equipment proposed for use in verifying the installed integrity of copper and fiber optic systems on the project.
c. A technical resume of experience for the Contractor's project manager and on-site installation supervisor assigned to this project.

D. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of Lawndale Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all published standards ofLawndale Elementary School District.
3. In the event there are no local codes having jurisdiction over this job, the current issue of the National Electrical Code shall be followed.
4. If there is a discrepancy between the codes and regulations having jurisdiction over this installation, and these specifications, Architect/Engineer shall determine the method or equipment used.
5. If the Contractor notes, at the time of bidding, any parts of the drawings and specifications which are not in accordance with the applicable codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time to follow this procedure, he shall submit with the proposal, a separate price required to make the system shown on the drawings comply with the codes and regulations.
6. Verify the installation environment prior to purchasing or installing any cable. Cable installed in a plenum environment shall be appropriately rated. Bring all discrepancies between the contract documents and installation conditions to the attention of the Architect/Engineer prior to purchase or installation.
7. All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.

E. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all applicable laws, regulations, ordinances, and other rules of the State or Political Subdivision wherein the work is done, or as required by any duly constituted public authority.
3. Pay all applicable charges for such permits or licenses that may be required.
4. Pay all applicable fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections due to codes, permits, licenses or as otherwise may be required by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized independent agency/consultant.
7. Pay any charges by the service provider related to the service or change in service to the project.
8. All equipment and materials shall be as approved or listed by the following (unless approval or listing is not applicable to an item by all acceptable manufacturers):

a. Factory Mutual
b. Underwriters' Laboratories, Inc.

F. Examination of Drawings:

1. The drawings for the technology systems work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and the exact routing of cabling to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining this layout. Where a specific route is required, such route will be indicated on the drawings.
3. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
4. If an item is either shown on the drawings, called for in the specifications or required for proper operation of the system, it shall be considered sufficient for including same in this contract.
5. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.
6. Where words "provide", "install", or "furnish" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and terminate completely ready for operation, the items mentioned.

G. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
4. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
5. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
6. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
7. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

H. Field Measurements:

1. Before ordering any materials, this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.

2. Field conditions that will result in telecommunications drops that exceed the length limitations identified in the contract documents shall be brought to the attention of the Architect/Engineer prior to installation. The cost of reworking cabling that is too long, that was not brought to the written attention of the Architect/Engineer will be borne entirely by the Contractor.
3. This Contractor shall provide the Architect/Engineer with written documentation of any cabling drops that will not be able to use the cable tray (where cable tray is available) due to the resulting cabling lengths. This documentation shall be submitted prior to installation and installation shall not commence until approved by the Architect/Engineer.

1.08 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

Referenced Specification Section	Submittal Item	Coordination Drawings
27 05 03	Through Penetration Firestopping	
27 05 26	Communications Bonding	
27 05 28	Interior Communications Pathways	Yes
27 05 43	Exterior Communications Pathways	Yes
27 05 53	Identification and Administration	
27 11 00	Communication Equipment Rooms	Yes
27 13 00	Backbone Cabling Requirements	
27 15 00	Horizontal Cabling Requirements	
27 17 10	Testing	
27 51 13	Paging Systems	Yes

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

   a. Date
   b. Project title and number
   c. Contractor's name and address
   d. Description of items submitted and relevant specification number
   e. Notations of deviations from the contract documents
   f. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

   a. Date
   b. Project title and number

c. Architect/Engineer
d. Contractor and subcontractors' names and addresses
e. Supplier and manufacturer's names and addresses
f. Description of item submitted (using project nomenclature) and relevant specification number
g. Notations of deviations from the contract documents
h. Other pertinent data
i. Provide space for Contractor's review stamps

3. Composition:

   a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
   b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
   c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:

   a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
   b. Unstamped submittals will be rejected.
   c. The Contractor's review shall include, but not be limited to, verification of the following:

      1) Only approved manufacturers are used.
      2) Addenda items have been incorporated.
      3) Catalog numbers and options match those specified.
      4) Performance data matches that specified.
      5) Electrical characteristics and loads match those specified.
      6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
      7) Dimensions and service clearances are suitable for the intended location.
      8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
      9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:

   a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
   b. The Contractor shall clearly indicate the size, finish, material, etc.
   c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
   d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.

    a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.

16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. Submittal file name: 27 XX XX.description.YYYYMMDD
    b. Transmittal file name: 27 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.09 CHANGE ORDERS

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.

B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.

C. Change order work shall not proceed until authorized.

1.10 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

A. Exercise care in transporting and handling to prevent damage to fixtures, equipment and materials.

B. Store materials on the site to prevent damage.

C. Keep fixtures, equipment and materials clean, dry and free from deleterious conditions.

1.11 NETWORK / INTERNET CONNECTED EQUIPMENT

A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.12 WARRANTY

A. At a minimum, provide a one (1) year warranty for all equipment, materials, and workmanship. Individual specifications sections within Division 27 may require additional warranty requirements for specific equipment or systems.

B. The warranty period for the entire installation described in this Division of the specifications shall commence on the date of substantial completion unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner or their representative.

C. Warranty requirements shall extend to correction, without cost to the final user, of all work and/or equipment found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from such defects or nonconformance with contract documents exclusive of repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.13 INSURANCE

A. Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.14 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required.

B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meets all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor bears full responsibility for the unnamed manufacturers equipment adequately meeting the intent of design. The Architect/Engineer may reject manufacturer at time of shop drawing submittal. The Contractor assumes all costs incurred by other trades on the project as a result of changes necessary to accommodate the offered material, equipment or installation method.

D. Should this Contractor be unable to secure approval from the Architect/Engineer for other unnamed manufacturers as outlined above, this Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder. Should a voluntary alternate material be accepted, This Contractor shall assume all costs that may be incurred as a result of using the offered material, article or equipment necessitating extra expense on This Contractor or on the part of other Contractors whose work is affected.

PART 2 PRODUCTS

2.01 CABLE JACKET RATING

A. This project requires all cable jackets to carry a plenum rating.

2.02 Refer to individual sections.

PART 3 EXECUTION

3.01 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Installation of all conduit and cabling shall comply with Sections 26 05 33 and 26 05 13. Additional conduit requirements described within this Division shall be supplemental to the requirement described in Section 26 0533. Should conflicts exist between the two Divisions the more stringent (more expensive material and labor) condition shall prevail until bidding addendum or construction clarification or RFI can be submitted and responded to. In no case shall the Contractor carry the least stringent condition in the pricing.

B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.

C. The Contractor shall be responsible for identifying and reporting to the Architect/Engineer any existing conditions including but not limited to damage to walls, flooring, ceiling and furnishings prior to start of work. All damage to interior spaces caused by this Contractor shall be repaired at this Contractor's expense to pre-existing conditions, including final colors and finishes.

D. All cables and devices installed in damp or wet locations, including any underground or underslab location, shall be listed as suitable for use in such environments. Follow manufacturer's recommended installation practices for installing cables and devices in damp or wet locations. Any cable or device that fails as a result of being installed in a damp or wet location shall be replaced at the Contractor's expense.

3.03 FIELD QUALITY CONTROL

A. General:

1. Refer to specific Division 27 sections for further requirements.
2. The Contractor shall conduct all tests required and applicable to the work both during and after construction of the work.
3. The necessary instruments and materials required to conduct or make the tests shall be supplied by the Contractor who shall also supply competent personnel for making the tests who has been schooled in the proper testing techniques.
4. In the event the results obtained in the tests are not satisfactory, This Contractor shall make such adjustments, replacements and changes as are necessary and shall then repeat the test or tests which disclose faulty or defective work or equipment, and shall make such additional tests as the Architect/Engineer or code enforcing agency deems necessary.
5. All communications cable tests that fail, including those due to excessive cabling lengths, shall be remedied by the Contractor without cost to the project.

B. Protection of cable from foreign materials:

1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited, to overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.

2. Application of foreign materials of any kind on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

3.04 PROJECT CLOSEOUT

A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. The Architect/Engineer will not perform a final jobsite observation until the project is ready. This is not dictated by schedule, but rather by completeness of the project.
2. Refer to the end of this specification section for a "STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION."
3. The Contractor shall sign this form and return it to the Architect/Engineer so that the final observation can commence.

C. Before final payment will be authorized, this Contractor must have completed the following:

1. Submitted operation and maintenance manuals to the Architect/Engineer for review.
2. Submitted bound copies of approved shop drawings.
3. Record documents including edited drawings and specifications accurately reflecting field conditions, inclusive of all project revisions, change orders, and modifications.
4. Submitted a report stating the instructions given to the Owner's representative complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representative as having received the instructions.
5. Submitted testing reports for all systems requiring final testing as described herein.
6. Submitted start-up reports on all equipment requiring a factory installation inspection and/or start.
7. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site; submit receipt to Architect/Engineer prior to final payment being approved.

8. Provide System Assurance Warranty certificate for the telecommunications system.

3.05 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. O&M file name: O&M.div27.contractor.YYYYMMDD
    b. Transmittal file name: O&Mtransmittal.div27.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

3.06 INSTRUCTING THE OWNER'S REPRESENTATIVE

A. Adequately instruct the Owner's designated representative or representatives in the maintenance, care, and operation of the complete systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representative or representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

D. The Architect/Engineer shall be notified of the time and place for the verbal instructions to be given to the Owner's representative so that their representative can be present if desirable.

E. Refer to the individual specification sections for minimum hours of instruction time for each system.

F. Operating Instructions:

1. The Contractor is responsible for all instructions to the Owner and/or Owner's operating staff on the Communications Systems.

2. If the Contractor does not have Engineers and/or Technicians on staff who can adequately provide the required instructions on system operation, performance, troubleshooting, care and maintenance, they shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.07 SYSTEM STARTING AND ADJUSTING

A. The Communications Systems included in the construction documents are to be complete and operating systems. The Architect/Engineer will make periodic job site observations during the construction period. The system start-up, testing, configuration, and satisfactory system performance is the responsibility of the Contractor. This shall include all calibration and adjustments of electrical equipment controls, equipment settings, software configuration, troubleshooting and verification of software, and final adjustments that may be required.

B. All operating conditions and control sequences shall be simulated and tested during the start-up period.

C. The Contractor, subcontractors, and equipment suppliers are expected to have skilled technicians to ensure that the system performs as designed. If the Architect/Engineer is requested to visit the job site for the purpose of trouble shooting, assisting in the satisfactory start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period through no fault of the design; the Contractor shall reimburse the Owner on a time and material basis for services rendered at the Architect/Engineer's standard hourly rates in effect at the time the services are requested. The Contractor shall be responsible for making payment to the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.08 RECORD DOCUMENTS

A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.

B. Mark specifications to indicate approved substitutions, change orders, and actual equipment and materials used.

C. This Contractor shall maintain at the job site, a separate and complete set of technology drawings which shall be clearly and permanently marked and noted in complete detail any changes made to the location and arrangement of equipment or made to the Technology Systems and wiring as a result of building construction conditions or as a result of instructions from the Architect or Engineer. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should This Contractor fail to complete Record Documents as required by this contract, This Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.

D. Record actual routing of all conduits sized 2" or larger.

E. The above record of changes shall be made available for the Architect and Engineer's examination during any regular work time.

F. Upon completion of the job, and before final payment is made, This Contractor shall give the marked-up drawings to the Architect/Engineer.

3.09 ADJUST AND CLEAN

A. Contractor shall thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.

B. Contractor shall clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from equipment.

C. Contractor shall remove all rubbish, debris, etc., accumulated during the Contractor's operations from the premises.

3.10 SPECIAL REQUIREMENTS

A. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
   1. South Coast Air Quality Management District Rule 1168 - Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.

B. South Coast Air Quality Management District Rule SCAQMD 1113 - Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION

To assist the contractor in a timely close-out of the project, it is crucial that the final jobsite observation is not conducted prior to the project being ready. The contractor is required to review the completion status of the project at the time the observation is scheduled. This review, and the subsequent submittal of this form to the Architect/Engineer, shall indicate the contractor's agreement that the area of the project being requested for final observation is ready as defined below. The following list represents the degree of completeness required prior to requesting a final observation:

1. All cabling pathways (cable tray, ladder rack, conduit sleeves, etc.) are installed and all cabling has been pulled through them.
2. All mechanical firestop products are installed and all other penetrations have been sealed.
3. All telecommunications jacks are installed in the faceplates.
4. All telecommunications cabling is pulled and at least 90% of all jacks have been terminated at the jack and at the telecom room.
5. Telecommunications testing is in progress and at least 50% of testing has been completed.
6. Telecommunications labeling has been provided on at least 50% of each type of component requiring a label.
7. All telecommunications related grounding is complete.
9. All overhead or integrated paging systems, including speakers, back boxes, cabling, and power supplies, and all headend equipment is installed, programmed and operational.
11. All access control system equipment, including card readers, conduits, cabling, electronic locks, controllers and all headend equipment, is installed, programmed and operational.

Prime Contractor: _____ By: _____

Requested Observation Date _____ Today's Date: _____

Contractor shall sign this readiness statement and transmit to Architect/Engineer at least 10 days prior to the requested date of observation.

It is understood that if the Architect/Engineer finds that the project is not complete as defined above and that the final jobsite observation cannot be completed on the requested date, the Architect/Engineer will return to the site at a later date. All additional visits to the site for the purposes of completing the final observation will be billed T&M to the Contractor at our standard hourly rates, including travel expenses or the contractor's retainage may be deducted for the same amount.

TELECOMMUNICATIONS - PROOF OF CERTIFICATION

There are specific Contractor qualification requirements for this project as defined in Section 27 0500, which may include Manufacturer Certification and RCDD or CNIDP credentials. This Proof of Certification document, and the supporting documentation require herein, is required to be submitted at the time of bid to show compliance with the requirements of 27 05 00.

Statement of Compliance:
The named Contractor's base bid is a structured cabling solution from the connectivity manufacturer: _____. Named Contractor is trained and certified, under the named manufacturer's formal certification program to provide and install all materials and work required by this project. Further, said Contractor is authorized, by the named manufacturer, to offer all product, labor and system assurance warranties required for this project by these contract documents.

The certification of this named manufacturer is valid, current and in effect as of the bid day of this project, the _____ day of _____, 20____.

The named Contractor is not employing any other sub-contractor on the telecommunications portion of this project that does not also meet this certification requirement.

Contractor Company Name:
_____

Authorized Representative: (print)
_____

Date: _____
Manufacturer Certification Number (if any): _____

If this project requires RCDD certification, complete the following:

Submit the following with the bid:
This form.
Proof of Manufacturer Certification indicated above.

END OF SECTION 27 0500

SECTION 27 0503

THROUGH PENETRATION FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Through-Penetration Firestopping.

1.02 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section.

B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.03 REFERENCES

A. UL 263 - Fire Tests of Building Construction and Materials

B. UL 723 - Surface Burning Characteristics of Building Materials

C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops

D. UL 2079 - Tests for Fire Resistance of Building Joint Systems

E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)

F. Intertek / Warnock Hersey - Directory of Listed Products

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops

I. CBC California Building Code

J. The Building Officials and Code Administrators National Building Code

K. 1997 Uniform Building Code

L. 2021 International Building Code

M. NFPA 5000 – Building Construction Safety Code

1.04 SUBMITTALS

A. Submit under provisions of Section 27 0500.

B. Submit Firestopping Installers Certification for all installers on the project.

C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Intertek / Warnock Hersey Assembly number.

D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
4. F ratings for each firestop system.

E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

F. Submit VOC rating of firestopping material in g/L (less water) with documentation that it meets the limits set forth in SCAQMD Rule 1168.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.

B. Install material prior to expiration of product shelf life.

1.06 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
2. South Coast Air Quality Management District Rule 1168 - Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
3. South Coast Air Quality Management District Rule SCAQMD 1113 - Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

1.07 WARRANTY

A. Provide one year warranty on parts and labor.

B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 PRODUCTS

2.01 THROUGH PENETRATION FIRESTOP SYSTEMS

A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.

B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.

C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.

D. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.

E. Provide firestopping systems allowing continuous insulation for all insulated pipes.

F. Any opening in walls or floors shall be coordinated with the firestopping manufacturer.

G. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.

C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.

D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.02 INSTALLATION

A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.

B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.

C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.03 CLEANING AND PROTECTING

A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.04 INSPECTION

A. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.

B. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.

END OF SECTION 27 0503

SECTION 27 0526

COMMUNICATIONS BONDING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Bonding Conductors

B. Bonding Connectors

C. Grounding Busbar (PBB and SBB)

D. Rack-mount Telecommunications Grounding Busbar

1.02 RELATED WORK

A. Section 26 0533 - Conduit and Boxes

B. Section 26 0536 - Cable Trays

C. Section 26 0513 - Wire and Cable

D. Section 26 0526 - Grounding and Bonding

E. Section 27 0500 - Basic Communications Systems Requirements

F. Section 27 0503 - Through Penetration Firestopping

G. Section 27 1100 - Communication Equipment Rooms

H. Section 27 0528 - Interior Communication Pathways

I. Section 27 0553 - Identification and Administration

1.03 QUALITY ASSURANCE

A. Refer to Section 27 0500 for relevant standards.

B. Communications bonding system component, device, equipment, and material manufacturer(s) shall have a minimum of five (5) years documented experience in the manufacture of communications bonding products.

C. The entire installation shall comply with all applicable electrical codes, safety codes, and standards. All applicable components, devices, equipment, and material shall be listed by Underwriters' Laboratories, Inc.

1.04 REFERENCES

A. ANSI/IEEE 1100 - Recommended Practice for Power and Grounding Sensitive Electronic Equipment in Industrial and Commercial Power Systems

B. ANSI/TIA 568-C - Commercial Building Telecommunications Cabling Standard

C. ANSI/TIA 569-A - Commercial Building Standard for Telecommunications Pathways and Spaces

D. ANSI/TIA 606 - Administration Standard for the Telecommunications Infrastructure of Commercial Buildings

E. ANSI/TIA 758 - Customer Owned Outside Plant

F. ANSI/TIA-607-D - Generic Telecomunications Bonding and Grounding (Earthing) for Customer Premises

G. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System Part 1: Normal Measurements

H. IEEE 837 - IEEE Standard for Qualifying Permanent Connections Used in Substation Grounding

I. NFPA 70 - National Electrical Code

J. UL 467 - Grounding and Bonding Equipment

1.05 SUBMITTALS

A. Submit product data and shop drawings under provisions of Section 27 0500 and Division 1.

B. Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:

1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item-by-item, including construction, materials, ratings, and all other parameters identified in Part 2 - Products.
2. Manufacturer's installation instructions indicating application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

C. Provide CAD-generated, project-specific system shop drawings as follows:

1. Provide a system block diagram indicating system configuration, system components, interconnection between components, and conductor routing. The diagram shall clearly indicate all wiring and connections required in the system. When multiple devices or pieces of equipment are required in the exact same configuration (e.g., multiple identical equipment racks or sections of ladder tray), the diagram may show one device and refer to the others as "typical" of the device shown. The diagram shall list room numbers where system equipment will be located.
2. Installation details for all system components.

D. Provide system checkout test procedure to be performed at acceptance.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the site under the provisions of Section 27 0500.

B. Store and protect products under the provisions of Section 27 0500.

C. Contractor shall exercise care to prevent corrosion of any products prior to installation. Corroded products shall not be acceptable for use on this project.

1.07 SYSTEM DESCRIPTION

A. This section describes the requirements for the furnishing, installation, adjusting, and testing of a complete turnkey communications bonding system, including connection to the electrical ground grid.

B. Performance Statement: This specification section and the accompanying drawings are performance based, describing the minimum material quality, required features, operational requirements, and performance of the system. These documents do not convey every wire that must be installed, every equipment connection that must be made, or every feature and function that must be configured. Based on the equipment constraints described and the performance required of the system as presented in these documents, the Contractor is solely responsible for determining all components, devices, equipment, wiring, connections, and terminations required for a complete and operational system that provides the required performance.

C. This document describes the major components of the system. All additional hardware, subassemblies, supporting equipment, and other miscellaneous equipment required for complete, proper system installation and operation shall be provided by the Contractor.

D. Basic System Requirements:

1. A complete communications bonding infrastructure is required for this project. Refer to the drawings and the requirements of ANSI-J-STD-607-D and NFPA 70 for complete information.
2. The bonding system shall include, but not be limited to, the following major components:

    a. Telecommunications Bonding Conductor (TBC)
    b. Primary Bonding Busbar (PBB)

c. Telecommunications Bonding Backbone (TBB)
d. Secondary Bonding Busbar(s) (SBB)
e. Rack mount Telecommunications Grounding Busbar(s)
f. Bonding Conductor(s) (BC)
g. Bonding Connectors
h. Bonding system labeling and administration as defined in Section 27 0553.

1.08 PROJECT RECORD DOCUMENTS

A. Submit documents under the provisions of Section 27 0500.

B. Provide final system block diagram showing any deviations from approved shop drawing submittal.

C. Provide floor plans that document the following:

1. Actual locations of system components, devices, and equipment.
2. Actual conductor routing.
3. Actual system component, device, equipment, and conductor labels.

D. Provide statement that system checkout test, as outlined in the approved shop drawing submittal, is complete and test results were satisfactory.

E. Complete all operation and maintenance manuals as described below.

1.09 OPERATION AND MAINTENANCE DATA

A. Submit under provisions of Section 27 0500.

B. Submitted data shall include:

1. Approved shop drawings.
2. Descriptions of recommended system maintenance procedures, including:

a. Inspection
b. Periodic preventive maintenance
c. Fault diagnosis
d. Repair or replacement of defective components

PART 2 PRODUCTS

2.01 BONDING CONDUCTORS

A. Bare Copper:

1. Annealed uncoated stranded conductor.
2. Minimum size 6 AWG.

B. Insulated Copper:

1. Annealed uncoated stranded conductor.
2. Insulation:

   a. PVC insulation with nylon outer jacket.
   b. Rated at 600 volts.
   c. Green.

3. Minimum size 6 AWG.

C. All bonding conductors shall be listed and recognized by a nationally recognized testing laboratory as being suitable for the intended purpose and for installation in the space in which they are installed.

D. Bonding Conductor Sizing:

1. All communications bonding system conductors shall be sized by length as follows:

Length Linear ft (m)	Size (AWG)
Less than 13 (4)	6
14 - 20 (4 - 6)	4
21 - 26 (6 - 8)	3
27 - 33 (8 - 10)	2
34 - 41 (10 - 13)	1
42 - 52 (13 - 16)	1/0
53 - 66 (16 - 20)	2/0
67 - 84 (20 - 26)	3/0
85 - 105 (26 - 32)	4/0
106 - 125 (32 - 38)	250 kcmil
126 - 150 (38 - 46)	300 kcmil
151 - 175 (46 - 53)	350 kcmil
176 - 250 (53 - 76)	500 kcmil
251 - 300 (76 - 91)	600 kcmil
Greater than 301 (91)	750 kcmil

2. The TBC shall be the same size as the TBB or larger.

2.02 BONDING CONNECTORS

A. Acceptable Types:

1. Two-hole compression lug
2. Exothermic weld
3. Irreversible compression

B. Connectors shall be provided in kit form and selected per manufacturer's written instructions.

C. Connectors shall comply with IEEE 837 and UL 467 and be listed for use for specific types, sizes, and combinations of conductors and connected items.

2.03 GROUNDING BUSBAR (PBB AND SBB)

A. Features:

1. Wall-mount configuration.
2. Listed and recognized by a nationally recognized testing laboratory as being suitable for intended purpose.
3. Hole patterns compliant with BICSI recommendations and ANSI-J-STD-607-D standards.
4. Predrilled holes.
5. Integral insulators.
6. Stainless steel offset mounting brackets.

B. Specifications:

1. Material: Electrolytic tough pitch copper bar with tin plating.
2. Refer to drawings for grounding busbar size(s).

    a. Minimum Dimensions: Refer to drawings.
    b. Increase dimensions and/or quantity furnished and installed as required to accommodate all terminations required by the project, plus 20% spare capacity.
    c. Hole patterns on busbars accommodate two-hole lugs per the recommendation of ANSI/BICSI N3-20 and ANSI/TIA-607 standards.

2.04 RACK-MOUNT TELECOMMUNICATIONS GROUNDING BUSBAR

A. Features:

1. Listed and recognized by a nationally recognized testing laboratory as being suitable for intended purpose.
2. Predrilled holes.
3. Mounts in a standard 19" equipment rack.

B. Specifications:

1. Material: Electrolytic tough pitch copper bar with tin plating.
2. Minimum Dimensions: 3/16" thick x 3/4" high x 19" long.

    a. Increase dimensions and/or quantity furnished and installed as required to accommodate all terminations required by the project, plus 20% spare capacity.

3. Hole pattern shall include:

    a. A minimum of eight (8) 6-32 tapped lug mounting holes on 1" centers.
    b. A minimum of two (2) pairs of 5/16" diameter holes spaced 3/4" apart.

PART 3 EXECUTION

3.01 INSTALLATION

A. General Bonding Requirements:

1. The communications bonding system shall be a complete system. Contractor shall furnish and install all necessary miscellaneous components, devices, equipment, material, and hardware, including, but not limited to, lock washers, paint-piercing washers, hex nuts, compression lugs, insulators, mounting screws, lugs, etc., to provide a complete system.
2. A licensed electrician shall perform all bonding.
3. Comply with the manufacturer's instructions and recommendations for installation of all products.

B. Main Cross Connect and Service Entrance Room Bonding Requirements:

1. Locate the PBB in the service entrance room unless otherwise noted on the drawings.
2. The location of the PBB shall be the shortest practical distance from the telecommunications primary lightning protection devices.
3. Bond the telecommunications primary protectors to the PBB. Maintain a minimum 1 foot separation of the bonding conductor from all DC power cables, switchboard cable, and high frequency cable.

C. Primary Bonding Busbar (PBB) Requirements:

1. Install PBB such that it is insulated from its support with a minimum 2" standoff.
2. Bond the PBB to the electrical service ground via the TBC.

    a. A minimum of 1 foot separation shall be maintained between the TBC and any DC power cables, switchboard cable, or high frequency cables.

3. PBB shall be bonded to all electrical panels located in the same room or space as the PBB. PBB shall be bonded to all electrical panels providing electrical power to communications equipment located in the same room or space as the PBB.
4. PBB shall be bonded to accessible metallic building structure located within the same room or space as the PBB.
5. All metallic continuous cable pathways, including, but not limited to, cable trays, basket trays, ladder racks, raceways, conduits, conduit sleeves, and fire-rated cable pathway devices, located within the same room or space as the PBB, shall be bonded to the PBB.
6. All metallic communications equipment, including, but not limited to, cable pair protectors, surge suppressors, cross-connect frames, patch panels, equipment cabinets, etc., located within the same room or space as the PBB, shall be bonded to the PBB.

D. Secondary Bonding Busbar (SBB) Requirements:

1. Provide a SBB in each telecommunications equipment room.
2. Install SBB such that it is insulated from its support with a minimum 2" standoff.

3. Bond each SBB to the PBB via the TBB.

    a. A minimum of 1 foot separation shall be maintained between the TBB and any DC power cables, switchboard cable, or high frequency cables.
    b. The TBB may be routed from PBB to SBB or as a radial feed to each SBB as the layout requires.

4. When two or more TBBs are used within a multi-story building, the TBBs shall be bonded together with a BBC at the top floor and at a minimum of every third floor in between the lowest floor level.
5. If more than one (1) SBB is provided within the same room or space, they shall all be bonded together via a BC the same size as the TBB.
6. SBBs shall be bonded to accessible metallic building structure located within the same room or space as the SBBs.
7. SBBs shall be bonded to all electrical panels located in the same room or space as the SBB. SBBs shall be bonded to all electrical panels providing electrical power to communications equipment located in the same room or space as the SBB.
8. All metallic continuous cable pathways, including, but not limited to, cable trays, basket trays, ladder racks, raceways, conduits, conduit sleeves, and fire-rated cable pathway devices, located within the same room or space as the SBB, shall be bonded to the SBB.
9. All metallic communications equipment, including, but not limited to, cable pair protectors, surge suppressors, cross-connect frames, patch panels, equipment cabinets, etc., located within the same room or space as the SBB, shall be bonded to the SBB.

E. Rack Bonding Busbar Requirements (RBB):

1. Provide a rack-mount telecommunications ground bar in each equipment rack and equipment rack enclosure.
2. Install RBB such that it is electrically bonded to the rack. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond between RBB and equipment rack.
3. Bond each RBB to the PBB/SBB via a telecommunications equipment bonding conductor (TEBC).
4. If more than one (1) RBB is provided within the same room or space, they shall all be bonded together via a TEBC.
5. All contractor-furnished and/or contractor-installed metallic communications equipment, including, but not limited to patch panels, fiber optic distribution enclosures, splice enclosures, active electronics, uninterruptible power supplies, etc., mounted within the same equipment rack as the RBB, shall be bonded to the RBB. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond between equipment rack and installed metallic communications equipment. Active electronics and uninterruptible power supplies shall be bonded to the RBB via a dedicated unit bonding conductor (UBC) for each device.

F. Metallic Interior Communication Pathway Bonding Requirements:

1. All metallic interior continuous communication cable pathways, including, but not limited to, conduit, conduit sleeves, fire-rated cable pathway devices, cable tray, basket tray, and ladder rack, shall be bonded to the communications bonding system.

G. Bonding Conductor Requirements:

1. Bonding conductors shall be green or marked with a distinctive green color.
2. Bonding conductors shall be routed parallel and perpendicular to building structure along shortest and straightest paths possible. Number of bends and changes in direction should be minimized. Install and secure conductors in a manner that protects the conductors from impact and from physical or mechanical strain or damage.
3. Bonding conductors shall not be installed in metallic conduit.
4. All conductors, including, but not limited, to the TBC, TBB, BBC, and TEBC(s), shall be installed splice-free. If the Contractor believes that site conditions do not allow a splice-free installation, the Contractor may request permission from the Architect/Engineer to splice a specific communications bonding system conductor.

    a. Where documented permission to splice a conductor is granted:

        1) The number of splices shall be limited to as few as possible.
        2) Splices shall be made using exothermic welding or irreversible compression-type connections only. Splice hardware shall be listed for grounding and bonding. Solder is not an acceptable means of splicing conductors.
        3) Splices shall be made in telecommunications spaces in accessible locations to facilitate future inspection and maintenance.
        4) Splices shall be adequately supported and protected from impact and from physical or mechanical strain or damage.

5. All bonding conductors shall be labeled in accordance with the requirements of Section 27 0553. In addition to the requirements of Section 27 0553:

    a. Labels shall be nonmetallic.
    b. Labels shall be printer-generated.
    c. Labels shall be located on conductors as close as is practical to their point of termination in a readable position.
    d. Additionally, conductors shall be labeled as follows:

        1) "IF THIS CONNECTOR OR CABLE IS LOOSE OR MUST BE REMOVED, PLEASE CALL THE BUILDING TELECOMMUNICATIONS MANAGER."

6. Interior water piping is not acceptable for use as a communications bonding system bonding conductor.
7. Metallic cable shields are not acceptable for use as communications bonding system bonding conductors.

H. Bonding Connection Requirements:

1. Make all connections in accessible locations to facilitate future inspection and maintenance.
2. Communications bonding system connections shall be made using exothermic welding, two-hole compression lugs, or other irreversible compression-type connections. The use of 1-hole lugs is prohibited, except for connections to a rack-mount telecommunications ground bar. Connection hardware shall be listed for grounding and bonding. Sheet metal screws shall not be used to make communications bonding system connections.
3. Thoroughly clean conductors before installing lugs and connectors.
4. Install and tighten all connectors in accordance with manufacturer's instructions, using the appropriate purpose-designed tool(s) recommended by the manufacturer for that purpose. Exercise care not to tighten connectors beyond manufacturer's recommendations.
5. Where necessary, remove paint and/or use paint-piercing washers to provide proper electrical bond at all connections.
6. All bonding connections shall be coated in anti-oxidant joint compound that is purpose-designed and purpose-manufactured for that use. Anti-oxidant joint compound shall be applied in accordance with manufacturer's recommendations and instructions.
7. All installed connectors on conductors installed in damp locations shall be sealed with dielectric grease and then covered with heat shrink tubing to protect against moisture ingress. Applied heat shrink tubing shall overlap conductor's outer jacket a minimum of four (4) inches past connector and be installed in accordance with manufacturer's recommendations and instructions.

3.02 FIELD QUALITY CONTROL

A. Field testing shall be performed under provisions of Section 27 0500.

B. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product from a reputable manufacturer that meets the requirements of the specifications.

C. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the contract documents.

3.03 ADJUSTING

A. Adjust work under provisions of Section 27 0500.

B. Contractor shall make any and all adjustments to the communications bonding system necessary to ensure that the installed system meets all requirements listed herein. Modifications necessary to comply with listed requirements or to provide specified performance shall be completed by the Contractor at no additional cost to the Owner.

3.04 TESTING

A. Measure and document resistance to ground at PBB, each SBB, each RBB, and each electrical distribution panel bonded to the PBB or a SBB.

1. Measurements shall be made not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage, and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests by the fall-of-potential method according to IEEE 81.
2. The preferred measured resistance to ground for the grounding electrode system is 10 ohms or less. Refer to Division 26 for exact project requirements.
3. Under no circumstances shall any point in the communications bonding system have a lower resistance to ground than that of nearby electrical distribution system components that it is bonded to.

B. Two-point Ground/Continuity Test:

1. Two-point ground continuity test shall be performed per TIA-607D standards.
2. Contractor shall use an earth ground resistance tester to confirm a resistance of less than 100 milliohms between the building's electrical grounding electrode system and any other point in the telecommunications bonding system.
3. At a minimum, perform tests in the following areas:

    a. PBB to the electrical ground in distributors
    b. Each SBB to the electrical ground in distributors
    c. PBB/SBB to the structural metal (if present)
    d. PBB to SBB(s)
    e. Structural metal (if present) to the electrical ground

4. Complete testing prior to installation of Owner-provided equipment.

C. Include measurement documentation in test data submitted at completion of project under provisions of Section 27 1710.

3.05 SYSTEM TRAINING

A. All labor and materials required for on-site system training shall be provided. Training shall be conducted at the project site using the project equipment.

1. Provide two week's advanced notice of training to the Owner and Architect/Engineer.
2. The Architect/Engineer shall be presented with the option to attend the training.
3. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.

B. At a minimum, the following training shall be conducted:

1. A course detailing the system functions and operations that a technical user will encounter. Provide training on all aspects of using the system, including making new bonding connections to the PBB, SBB, or RBB. Provide training on all recommended inspection, maintenance, and repair procedures for the system.

C. Minimum on-site training times shall be:

1. Technical user: Two hours.

END OF SECTION 27 0526

SECTION 27 0528

INTERIOR COMMUNICATION PATHWAYS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, tests and services to install complete wire mesh support systems, conduits, sleeves, innerduct, etc. for an interior cabling plant as shown on the drawings.

B. Wire mesh support systems are defined to include, but are not limited to straight sections of continuous wire mesh, field formed horizontal and vertical bends, tees, drop outs, supports and accessories.

1.02 RELATED WORK

A. Section 26 0533 - Conduit and Boxes

B. Section 27 0500 - Basic Communications Systems Requirements

C. Section 27 0526 - Communications Bonding

1.03 QUALITY ASSURANCE

A. Refer to Section 27 0500 for requirements.

1.04 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code

B. NEMA VE 2-2000 - Cable Tray Installation Guidelines

1.05 SUBMITTALS

A. Under the provisions of Section 27 0500 and Division 1, prior to the start of work the Contractor shall submit:

1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
2. Manufacturer's installation instructions.

B. Coordination Drawings:

1. Include cable tray and conduit sleeve layout in composite electronic coordination files. Refer to Section 27 0500 for coordination drawing requirements.

1.06 DRAWINGS

A. The drawings, which constitute a part of these specifications, indicate the general route of the wire mesh support systems, conduit, sleeves, etc. Data presented on these drawings is as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification of all dimensions, routing, etc., is required.

PART 2 PRODUCTS

2.01 CONDUIT

A. Refer to Section 26 05 33 for conduit requirements for this project.

2.02 WIRE MESH CABLE TRAY - OVERHEAD

A. General: Provide wire mesh of types and sizes indicated on drawings; with connector assemblies, clamp assemblies, connector plates, splice plates and splice bars. Provide drop-out fittings where cable tray is installed over equipment racks. Two drop-out fittings shall be installed over each rack so that a controlled radius is maintained into each side of every equipment rack that cable tray passes over. Construct units with rounded edges and smooth surfaces; in compliance with applicable standards; and with the following additional construction features.

B. Wire mesh shall be made of high strength steel wires and formed into a standard 2 inch by 4-inch wire mesh pattern with intersecting wires welded together. All wire ends along wire mesh sides (flanges) shall be rounded during manufacturing for safety of cables and installers.

C. Materials and Finishes: Material and finish specifications for each wire mesh type are as follows:

1. Electro-Galvanized Zinc: Straight sections shall be made from steel meeting the minimum mechanical properties of ASTM A510 and shall be electro-plated zinc in accordance with ASTM B633 SC2. .
2. Accessories:

    a. Pre-Galvanized Zinc: Wall brackets and other pre-galvanized accessories shall be coated with zinc in accordance with ASTM A653.
    b. Electro-Galvanized Zinc: Support accessories and miscellaneous hardware shall be coated in accordance with ASTM B633 SC3. All threaded components shall be coated in accordance with ASTM B633 SC1.

D. Type of Overhead Wire Mesh Support System:

1. All straight section longitudinal wires shall be straight (with no bends).
2. Wire mesh supports shall be trapeze hangers or wall brackets. Center hung supports will not be allowed.
3. Trapeze hangers are to be supported by 1/4 inch or 3/8-inch diameter rods.

4. Provide manufacturer approved grounding clips as necessary for continuous grounding of tray.
5. Basis of Design

    a. Refer to drawings

2.03 CABLE HANGERS AND SUPPORTS

A. Provide a non-continuous cable support system suitable for use with open cable.

B. Cable Hooks:

1. Construction: Flat bottom design with a minimum cable bearing surface of 1-5/8". Hooks shall have 90-degree radius edges.
2. All cable hook mounting hardware shall be recessed to prevent damage to cable during installation. Installed cabling shall be secured using a cable latch retainer that shall be removable and reusable.
3. Finish: Pre-galvanized steel, ASTM A653 suitable for general duty use.

C. Cable Hangers:

1. Adjustable, non-continuous cable support slings for use with low voltage cabling.
2. Steel and woven laminate construction, rated for indoor non-corrosive use. Laminate material shall be suitable for use in plenum environments.
3. Sling length shall be adjustable to a capacity of 425 4-pair UTP cables.
4. Cabling hanger load limit shall be 100 lbs per foot.

PART 3 EXECUTION

3.01 CABLE HOOK SUPPORT SYSTEM

A. In areas where cabling is not supported by cable tray, ladder rack, enclosed wireway or installed in conduit, such cabling shall be supported by an approved cable hook support system.

B. Refer to manufacturer's requirements for allowable fill capacity for selected cable hook. In no case shall a 40% fill capacity be exceeded.

C. Cable hooks shall be securely mounted per manufacturer's instructions. In no case shall the side-to-side travel of any cable hook exceed 6".

D. Cable hooks shall be selected based on the contractor's cable routing. Hooks shall be capable of supporting a minimum of 30 pounds with a safety factor of 3.

E. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet.

F. The resting and supporting of cabling on structural members shall not meet the requirements for cabling support specified herein.

G. The use of tie-wraps or hook and loop type fasteners is specifically prohibited as a substitute for cable hooks specified herein.

3.02 CONDUIT AND CABLE ROUTING

A. Refer to Section 26 0533 for additional requirements.

B. All conduits shall be reamed and shall be installed with a nylon bushing.

C. Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of less than 2", maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter 2" or greater, maintain a bend radius of at least 10 times the internal diameter.

D. No conduit or sleeve containing more than two (2) cables shall exceed 40% fill ratio, regardless of length.

E. Any conduit exceeding 90' in length or containing more than two (2) 90-degree bends shall contain a pull box sized per ANSI/TIA/EIA 569 requirements.

1. A separate pull box is required for each 90' (or greater) length section.
2. A separate pull box is required after any two (2) consecutive 90-degree bends.
3. Pull box shall be located in an area that maintains accessibility of box, including the ability to remove box lid without removal or relocation of any other materials.

F. Any conduit with bends totaling 90 degrees or more shall have the fill capacity derated by 15% for each 90 degrees of cumulative bend.

G. Cables installed in any conduits that do not meet the above requirements shall be replaced at the Contractor's expense, after the conduit condition has been remedied.

3.03 WIRE MESH TRAY INSTALLATION

A. The wire mesh cable tray system shall be only for telecommunications.

B. Install wire mesh as indicated; in accordance with recognized industry practices (NEMA VE-2 2000), to ensure that the cable tray equipment complies with requirements of NEC, and applicable portions of NFPA 70B and NECA's "Standards of Installation" pertaining to general electrical installation practices.

C. Cable tray sections shall be grounded in accordance with manufacturer's recommendations using manufacturer approved hardware. Painted sections shall have paint removed at each grounding attachment point.

D. Test wire mesh support systems to ensure electrical continuity of bonding and grounding connections, and to demonstrate compliance with specified maximum grounding resistance. Refer to NFPA 70B, Chapter 18, for testing and test methods.

E. Provide sufficient space encompassing wire mesh to permit access for installing and maintaining cables.

F. Tray shall be continuous from source to termination and shall not change elevation, direction or otherwise expose cables to travel without 2" x 4" mesh support.

G. Overhead Tray shall be field cut using only manufacturer approved cutting device and methods. Cutting device shall be an offset blade bolt cutter; standard bolt cutters are specifically not permitted.

H. Bends in overhead tray shall be accomplished by utilizing manufacturer's cutting guides.

I. All splices of tray shall be provided with splice washers, bars or springs as recommended by the manufacturer.

3.04 ATTACHMENT TO METAL DECKING

A. Where supports for cable trays and cable hook systems attach to metal roof decking, excluding concrete on metal decking, do not exceed 25 lbs. per hangar and a minimum spacing of 2'-0" on center. This 25-lb. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

END OF SECTION 27 0528

SECTION 27 0543

EXTERIOR COMMUNICATION PATHWAYS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section describes the products and execution requirements relating to furnishing and installing exterior racks, ladders, conduits, sleeves, innerduct, etc. for an exterior cabling plant.

1.02 QUALITY ASSURANCE

A. Refer to Section 27 0500 for relevant standards.

1.03 REFERENCES

A. Section 27 0500 - Basic Communications Systems Requirements.

1.04 SUBMITTALS

A. Under the provisions of Section 27 0500 and Division 1, prior to the start of work the Contractor shall submit:

1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
2. Manufacturer's installation instructions.

B. Submit shop drawings and product data under provisions of Section 27 0500.

C. Submit manufacturer's installation instructions under provisions of Section 27 0500.

D. Coordination Drawings:

1. Include manholes, hand holes, and conduits 1.5" and larger in coordination files. Include all in-floor and underfloor conduit in coordination files. Refer to Section 27 0500 for coordination drawing requirements.

1.05 REGULATORY REQUIREMENTS

A. Equipment and material shall be UL (Underwriters Laboratory) listed and labeled.

PART 2 PRODUCTS

2.01 OUTSIDE PLANT CONDUIT

A. High-Density Polyethylene (HDPE) Conduit:

1. Minimum Size: 2 inches, unless noted otherwise.

2. Materials used for the manufacture of polyethylene pipe and fittings shall be extra high molecular weight, high-density polyethylene resin. The material shall be listed by PPI (Plastic Pipe Institute) and shall meet the following resin properties:

ASTM Test	Description	Values HDPE
D-1505	Density g/CM 3	Less than 0.941
D-1238	Melt Index, g/10 min Condition E	Greater than 0.55 grams/10 min.
D-638	Tensile Strength at yield (psi)	3000 min.
D-1693	Environmental Stress Crack Resistance Condition B, F 20	96 hrs.
D-790	Flexural Modulus, MPa (psi)	Less than 80,000
D-746	Brittleness Temperature	-75°C Max

3. The pipe shall contain no recycled compound except that generated in the manufacturer's own plant from resin of the same raw material, including both the base resin and coextruded resin. The pipe shall be homogeneous throughout and free of visible cracks, holes, voids, foreign inclusions, or other defects that may affect the wall integrity.
4. Fitting and Conduit Bodies:

   a. Directional Bore and Plow Type Installation: Electrofusion or universal aluminum threaded couplings. Tensile strength of coupled pipe must be greater than 2,000 lbs.
   b. For All Other Types of Installation: Coupler must provide a watertight connection. The tensile strength of coupled pipe must be greater than 1,000 lbs.
   c. E-loc type couplings are not acceptable in any situations.

2.02 TEXTILE INNERDUCT

A. Contractor shall provide and install innerduct in each conduit identified to have copper and fiber optic cable installed.

B. Innerduct shall have an 18 gauge solid copper core tracer wire installed into each cell to allow for detection by industry standard toning equipment.

C. Each innerduct cell shall have a pull tape installed.

SIZE	OD	ID
1"	1.375" (Max.)	1.0" (Min.)
1-1/4"	1.67" (Max.)	1.25" (Min.)
1-1/2"	2.0" (Max.)	1.5" (Min.)

2.03 UNDERGROUND WARNING TAPE

A. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core, bright-colored, compounded for direct-burial service.

B. Overall Thickness: 5 mils.

C. Foil Core Thickness: 0.35 mil.

D. Orange colored tape 3-wide with 1-inch high black letters permanently imprinted with "CAUTION ““ BURIED COMMUNICATIONS LINE BELOW". Printing on tape shall be permanent and shall not be damaged by burial operations.

E. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.

F. Comply with ANSI Z535.1 through ANSI Z535.5.

PART 3 EXECUTION

3.01 INSTALLATION - DUCTBANK

A. Make duct bank installations and penetrations through foundation walls watertight.

B. Top of duct banks shall be a minimum of 24 inches below grade, unless otherwise indicated on drawings.

C. Assemble duct banks using non-magnetic saddles, spacers and separators. Position separators to provide 3-inch minimum separation between the outer surfaces of the ducts.

D. Transition from non-metallic to galvanized rigid steel conduit where duct banks enter buildings, manholes, and hand-holes.

E. Where ducts enter structures such as manholes, hand-holes, pullboxes and buildings, terminate the ducts in suitable end bells.

F. Slope duct runs for drainage toward manholes and away from buildings with a slope of approximately 3-inches per 100 feet.

G. After completion of the duct bank and prior to pulling cable, pull a mandrel, not less than 12 inches long and with a cross section approximately 1/4 inch less than the inside cross section of the duct, through each duct. Then pull a rag swab or sponge through to make certain that no particles of earth, sand, or gravel have been left in the duct.

H. Plug and seal empty spare ducts entering buildings and structures. Seal watertight all ducts in use entering buildings and structures.

3.02 INSTALLATION - TEXTILE INNERDUCT

A. Provide two (2) 3-cell innerducts per 4" conduit or as recommended by the manufacturer.

B. Install innerduct per manufacturer's guidelines.

C. Cut and tie off innerduct and pull tape inside each communications vault or Entrance Room.

3.03 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. The Contractor shall do all necessary excavating, securing, filling, backfilling, compacting, and restoration in connection with their work.

B. Excavation:

1. Excavations for trenches shall be excavated to proper dimensions to permit installation and inspection of work.
2. Where excavations are carried in error below indicated levels, thoroughly compacted sand-gravel fill, shall be placed in such excess excavations.
3. Excavations shall be protected against frost action and freezing.
4. Care shall be exercised in excavating so as to not damage surrounding structures, equipment, and buried utilities. In no case shall any major structural footing or foundation be undermined.
5. Excavation shall be performed in all ground characteristics, including rock, if encountered. Each bidder shall visit the premises and determine, by actual observations, borings, or other means, the nature of the soil conditions. The cost of all such inspections, borings, etc., shall be borne by the bidder.
6. In the case where the trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
7. Where satisfactory bearing soil is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately and no further work shall be done until further instructions are given.
8. Mechanical excavation of the trench to line and grade of the conduit, unless otherwise indicated on the drawings.

C. Dewatering:

1. The Contractor shall be responsible for the furnishing, installation, operation and removal of all dewatering pumps and lines necessary to keep the excavation free of water at all times.

D. Underground Obstructions:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811. The Contractor is responsible for obtaining all utility locates for all trades on the project to determine obstructions indicated. The Contractor shall use great care in installing in the vicinity of underground obstruction.

E. Fill and Backfilling:

1. No rubbish or waste material shall be permitted in excavations for trench fill and backfill.
2. The Contractor shall provide the necessary sand for backfilling.
3. Dispose of the excess excavated earth as directed.
4. Soils for backfill shall be suitable for required stability and compaction, clean and free from perishable materials, frozen earth, debris or earth with an exceptionally high void content, and free from stones greater than 4 inches in diameter. Under no circumstances shall water be permitted to rise in unbackfilled trenches after installation has been placed.
5. All trenches shall be backfilled immediately after installation of conduit, unless other protection is directed.
6. All conduit shall be laid on a compacted bed of sand at least 3" deep. Backfill around the conduit with sand, spread in 6" layers, then compact each layer.
7. Use sand for backfill up to grade for all conduit located under building slabs or paved areas. Native soil materials may be used as backfill if approved by the Geotechnical Engineer. All other conduit shall have sand backfill to 6" above the top of the conduit.
8. The backfilling above the sand shall be placed in uniform layers not exceeding 6" in depth. Each layer shall be placed, then carefully and uniformly tamped, so as to eliminate the possibility of lateral or vertical displacement.
9. Install a warning tape approximately 12 inches below finished grade over all underground duct banks. The identifying warning tape shall be as specified above.
10. Where the fill and backfilling will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density as determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content as determined by AASHTO T-99 or ASTM D-698 test.
11. After backfilling of trenches, no superficial loads shall be placed on the exposed surface of the backfill until a period of 48 hours has elapsed.

3.04 RESTORATION REQUIREMENTS

A. Where soil and sod has been removed, it shall be replaced as soon as possible after backfilling is completed. All areas disturbed by work shall be restored to their original condition. The restoration shall include any necessary topsoiling, fertilizing, liming, seeding, or mulching,

END OF SECTION 27 0543

SECTION 27 0553

IDENTIFICATION AND ADMINISTRATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section describes the identification and administration requirements relating to the structured cabling system and its termination components and related subsystems.

B. Identification and labeling.

1.02 RELATED WORK

A. Section 27 0500 - Basic Communications Systems Requirements

1.03 QUALITY ASSURANCE

A. Refer to Section 27 0500 for relevant standards.

B. Perform all work in accordance with Lawndale Elementary School District standard.

1.04 SUBMITTALS

A. Under the provisions of Section 27 0500 and Division 1, prior to the start of work the Contractor shall submit:

1. Documentation of labeling scheme.

PART 2 PRODUCTS

2.01 LABELING

A. Adhesive labels shall meet the requirements of UL 969 (Ref D-16) for legibility, defacement and adhesion. Exposure requirements of UL 969 for indoor and outdoor (as applicable) use shall be met.

B. Insert labels shall meet the requirements of UL 969 for legibility, defacement and general exposure.

C. Labeling shall be consistent for all common elements in the project. This consistency shall include label size, color, typeface an attachment method.

D. Color Code: Observe the following requirements for color coding:

1. Labels on each end of a cable shall be the same color for each termination.
2. Labels for cross-connects shall be two different colors at each termination fields, representative of the color of that field.
3. Orange (Pantone 15C) shall be used for the demarcation point.

4. Green (Pantone 353C) shall be used for the termination point of network connection on the facility side of the demarc.
5. Purple (Pantone 264C) shall be used to identify the termination of cables from common equipment (PBX, computers, LANS, etc.)
6. White shall be used to identify the first-level backbone termination in the main cross-connect.
7. Gray (Pantone 422C) shall be used to identify the second-level backbone termination in the main cross-connect.
8. Blue (Pantone 291C) shall be used to identify the termination of station cabling at the telecommunications closet and/or equipment room end of the cable.
9. Brown (Pantone 465C) shall be used to identify the termination of the interbuilding backbone cable terminations.
10. Yellow (Pantone 101C) shall be used to identify the termination of auxiliary circuits, alarms, maintenance, security, etc.
11. Red (Pantone 184C) shall be used to identify the termination of key telephone systems.
12. In facilities that do not contain a main cross-connect, the color white may be used to identify second-level backbone terminations.

E. Tag all CAT 6 and optical fiber cables at both the Communications Equipment Room and the information outlets using the following alphanumeric labeling system:

1. (Room Number) - (Outlet Number) - (Jack Number) - (Use).
2. "Outlet Number" shall start with 1 in each room, with additional outlets in each room numbered sequentially.
3. "Jack Number" shall start with 1 for the upper left jack in each outlet, increasing sequentially from left to right and top to bottom across the outlet face.
4. "Use" shall be designated by the following:

    a. "V" for voice (RJ-45)
    b. "D" for data (RJ-45)
    c. "C" for video (coax)
    d. "M" for multimedia retrieval (coax)
    e. "S" for speaker (RCA)

5. Example #1: "106-1-1-V" indicates the top left voice jack in outlet #1 in Room 106.
6. Example #2: "109-3-4-D" indicates the bottom right data jack (assuming a 4-port faceplate) in outlet #3 in Room 109.

2.02 DOCUMENTATION/AS-BUILTS/RECORDS

A. General:

1. Upon completion of the installation, the Contractor shall submit as-builts per the requirements of Section 27 0500 and Division 1. Documentation shall include the items detailed in the subsections below.
2. All documentation, including hard copy and electronic forms shall become the property of the Owner.

B. Record Drawings:

1. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons and drawing conventions used shall be consistent throughout all documentation provided.

PART 3 EXECUTION

3.01 IDENTIFICATION AND LABELING

A. Cable Labeling: Backbone and horizontal cables shall be labeled at each end.

1. Provide additional cable labeling at each manhole and pull box.
2. Cables that are routed through multiple pathway segments shall contain reference to all pathway segments in the pathway linkage field.
3. Cables that differ only by performance class shall have a suitable marking or label to indicate the higher performance class. For example, station cabling utilizing the blue color, may include blue with a white stripe to indicate the higher performance class station cabling.

B. Information Outlet Labeling: Tag all voice and data jacks as defined herein.

END OF SECTION 27 0553

SECTION 27 1100

COMMUNICATION EQUIPMENT ROOMS (CER)

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section describes the products and execution requirements related to furnishing and installing equipment for communication equipment rooms.

1.02 RELATED WORK

A. Section 27 0500 - Basic Communications Systems Requirements

B. Section 27 0526 - Communications Bonding

C. Section 27 0528 - Interior Communication Pathways

D. Section 27 1500 - Horizontal Cabling Requirements

1.03 QUALITY ASSURANCE

A. Refer to Section 27 0500 for applicable standards.

1.04 SUBMITTALS

A. Under the provisions of Section 27 0500 and Division 1, prior to the start of work the Contractor shall submit:

1. Manufacturer's data covering all products including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
2. Manufacturer's installation instructions.

B. Coordination Drawings:

1. Include ladder racking, equipment racks, cable tray and conduit sleeve layout in composite electronic coordination files. Refer to Section 27 0500 for coordination drawing requirements.

PART 2 PRODUCTS

2.01 EQUIPMENT GROUNDING

A. Refer to specification section 27 0526 for grounding requirements.

B. All equipment required to be grounded shall be provided with a grounding lug suitable for termination of the specified size electrode conductor.

2.02 EQUIPMENT RACKS AND CABINETS

A. Where identified on the drawings in Communication Equipment Rooms, equipment racks and/or equipment cabinets shall be furnished and installed by the Contractor to house cable termination components (e.g., copper, optical fiber, coax) and network electronics.

B. The equipment rack shall conform to the following requirements:

1. Standard TIA/EIA 19" Floor Rack:

a. Equipment rack shall be 84" in height, self-supporting and provide a useable mounting height of 45 rack units (RU) (1 RU = 1 3/4").
b. Channel uprights shall be spaced to accommodate industry standard 19" mounting.
c. Equipment rack shall be double side drilled and tapped to accept 12-24 screws. Uprights shall also be drilled on back to accept cable brackets, clamps, power strip(s), etc. Hole pattern on rack front shall be per TIA/EIA specifications (5/8"-5/8"-1/2"). Hole pattern on the rear shall be at 3" intervals to accept cable brackets.
d. Equipment racks shall be provided with a supply of spare screws (minimum of 24).
e. Equipment racks shall be provided with a ground bar and #6 AWG ground lug.
f. Provide all mounting hardware and accessories as required for a complete installation.

2.03 CABLE MANAGEMENT - VERTICAL AND HORIZONTAL

A. Equipment Racks:

1. Equipment racks shall be equipped with vertical and horizontal cable management hardware in the form of rings and guides. Racks shall incorporate vertical and horizontal covers, to allow an orderly, hidden, routing of copper, optical fiber, and coax jumpers from the modular patch panels and/or 110-type termination blocks to the customer provided network electronics. Vertical and horizontal cable management hardware shall be as follows:

a. Horizontal cable management hardware shall be 16 gauge cold rolled steel construction with six (6) pass-thru holes and seven (7) front-mounted 3.5" steel rod D-rings. Provide with cover designed to conceal and protect cable.
b. At a minimum, horizontal cable management hardware shall be positioned above and below (a) each grouping of two rows of jacks on modular patch panels, and (b) above and below each optical fiber patch panel and (c) each grouping of two rows of F-type connectors on coax patch panels.

c. Vertical cable management hardware shall provide for cable routing on front and rear of each rack and be 12" deep x 6" wide (minimum). Where multiple equipment racks are to be installed, this hardware shall be mounted between the uprights of adjacent equipment racks. Equipment rack uprights and the spacers shall be secured together per manufacturer's recommendations. Provide with cover designed to conceal and protect cable.

2. Each equipment rack shall be supplied with a minimum of 12 releasable (e.g., "hook and loop") cable support ties.
3. Where cable termination hardware is wall-mounted, the Contractor shall be responsible for establishing a cable pathway for jumpers routed from the equipment rack(s) to the wall. This shall be in the form of slotted ducts or troughs. Routing of jumpers via the overhead cable tray or ladder rack system is NOT acceptable. The proposed method shall be included in the submittals required by this document and shall be approved by the Architect/Engineer prior to installation.

2.04 PATCH PANELS

A. Where identified on the drawings in Communication Equipment Rooms, modular patch panels shall be furnished and installed by the Contractor for termination of copper cable.

B. Copper cabling shall be terminated in Communication Equipment Rooms on modular patch panels consisting of a modular connector system incorporating modular jacks meeting the specifications for the jacks detailed in Section 27 1500.

C. The largest single modular patch panel configuration shall not exceed 48-Ports. Modular patch panels shall be fully populated (all ports occupied by jacks) and be provided in increments of no less than 12 jacks. High-density modular patch panels will not be accepted.

D. The modular patch panel blocks shall have the ability to seat and cut eight (8) conductors (4 pairs) at a time and shall have the ability of terminating 22- through 26-gauge plastic insulated, solid and stranded copper conductors. Modular patch panel blocks shall be designed to maintain the cables' pair twists as closely as possible to the point of mechanical termination.

E. Modular patch panels shall incorporate cable support and/or strain relief mechanisms to secure the horizontal cables at the termination block and to ensure that all manufacturers minimum bend radius specifications are adhered to.

2.05 OPTICAL FIBER PANELS

A. All terminated optical fibers shall be mated to simplex LC-type couplings mounted on enclosed fiber distribution cabinets. Couplings shall be mounted on a panel that, in turn, snaps into the enclosure. The proposed enclosure shall be designed to accommodate a changing variety of connector types including SC, ST, Fixed Shroud Duplex (e.g., "FDDI Connector"), Biconic, FC, and MT-RJ by changing panels on which connector couplings are mounted.

B. The fiber distribution cabinet shall be sized to accommodate the total fiber count to be installed at each location as defined in the specifications and drawings, including those not terminated (if applicable). Connector panels and connector couplings (sleeves, bulkheads, etc.) adequate to accommodate the number of fibers to be terminated shall be furnished and installed by the Contractor.

C. The fiber distribution cabinet shall be an enclosed assembly affording protection to the cable subassemblies and to the terminated ends. The enclosures shall incorporate a hinged or retractable front cover designed to conceal and protect the optical fiber couplings, connectors, and cable.

D. Access to the inside of the fiber distribution cabinet's enclosure during installation shall be from the front and/or rear. Panels that require any disassembly of the fiber distribution cabinet to gain entry will not be accepted.

E. The fiber distribution cabinet's enclosure shall provide for strain relief of incoming optical fiber cables and shall incorporate radius control mechanisms to limit bending of the optical fiber to the manufacturer's recommended minimums or 1½", whichever is larger.

F. All fiber distribution cabinets shall provide protection to both the "facilities" and "user" side of the coupling. The fiber distribution cabinet's enclosure shall be configured to require front access only when patching. The incoming optical fiber cables (e.g., backbone, riser, horizontal, etc.) shall not be accessible from the patching area of the panel. The fiber distribution cabinet's enclosure shall provide a physical barrier to access such optical fiber cables.

G. Where "Loose Buffered" cables are installed, the 250 µµm coated optical fibers contained in these cables may be terminated either by (1) splicing of factory-terminated cable assemblies ("pigtails") or (2) the use of a "fan-out" kit. In the latter approach, individual fibers are to be secured in a protective covering, an Aramid (e.g., Kevlar¢¢) reinforced tube for example, with connectors mated to the resulting assembly. In both instances, the proposed termination hardware shall incorporate a mechanism by which cable and subassemblies are secured to prevent damage. Splicing shall be by the "fusion" method. Individual splice loss shall not exceed 0.3 dB for multi-mode fibers. Direct termination of 250 µµm coated optical fibers shall not be permitted.

2.06 OPTICAL FIBER COUPLERS/ADAPTERS

A. Optical Fiber Couplings (LCtype) (Singlemode):

1. LC-type optical fiber couplings shall be used to terminate optical fiber backbone cable on fiber distribution cabinet panels in communication equipment rooms. Horizontal optical fiber cables shall also be terminated using optical fiber couplings at their designated work area locations on information outlet faceplates for "fiber to the desk."
2. LC-type optical fiber couplings shall be snap-type with locking washer and nut.
3. LC-type optical fiber couplings shall incorporate domed zirconia ferrule and shall utilize a PC polish to ensure fiber-to-fiber physical contact for low loss and reflections.

4. LC-type optical fiber couplings shall accept 125-micron outside diameter multimode fiber.
5. The attenuation per mated pair shall not exceed 0.7 dB (individual) and 0.5 dB (average). Connectors shall sustain a minimum of 200 mating cycles per TIA/EIA-455-21 without violating specifications.
6. LC-type optical fiber couplings shall meet the following performance criteria:

Test Procedure	Maximum Attenuation Change
Cable Retention (FOTP-6)	0.2 dB
Durability (FOTP-21)	0.2 dB
Impact (FOTP-2)	0.2 dB
Thermal Shock (FOTP-3)	0.2 dB
Humidity (FOTP-5)	0.2 dB

7. Performance Requirements:

    a. Length: 2 inches
    b. Operating Temperature: -40 to 85 degrees C

8. Basis of Design:

    a. CommScope

2.07 LADDER RACK

A. Provide complete ladder rack system including metallic ladder rack, splice connectors, fastening hardware and other miscellaneous materials as required for a complete installation per manufacturer's recommendations.

B. Tubing Style Ladder Rack:

1. Rolled steel siderail stringer, minimum 1.5" stringer height, 9" spaced welded rungs.
2. Steel shall meet the requirements of ASTM A1011 SS Grade 33.
3. Loading limits shall be 185 lbs/ft for 4 ft spans.

C. Ladder rack finish shall be flat black powder coat.

2.08 D-RINGS

A. Rounded edge D-rings for support of cabling in vertical and horizontal configurations.

B. EIA 310D compliant, manufactured from materials meeting UL94-V0 specifications.

C. Provide 1/4" screw holes for wall mounting.

2.09 COPPER PATCH CORDS

A. Modular Patch Panel:

1. Provide Category 6 copper patch cords for 50% of all assigned ports on the modular patch panel. Of these cords, 60% shall be 3' in length and 40% shall be 5' in length. These patch cords shall be the cross-connect between the network electronics and the horizontal RJ-45 modular patch panel. Copper patch cords shall be equipped with a 4-pair RJ-45 connector on each end.
2. Refer to Section 27 1500 for cable and connector performance requirements.
3. Patch cords shall not be made-up in the field.
4. Basis of Design (Refer to 27 17 20 for Acceptable Manufacturers):

    a. CommScope

2.10 FIBER PATCH CORDS

A. Optical Fiber Patch Cords (Multimode):

1. Provide 50/125 mm multimode (MM) optical fiber utilizing tight buffer construction for 50% of all assigned ports on the fiber distribution cabinet. These patch cords shall be the cross-connect between the backbone fiber distribution cabinet and the Owner's network electronics (hub/switch). Optical fiber patch cords shall be equipped with a ceramic tipped LC-type connector on each end and shall be a minimum of 5 feet in length. Connector body shall be of materials similar to that used in the proposed couplings. Provide required lengths as determined on the plans.
2. Channels shall be of equal length.
3. Refer to Section 27 1500 for cable and connector performance requirements.
4. Basis of Design (Refer to 27 17 20 for Acceptable Manufacturers):

    a. CommScope

PART 3 EXECUTION

3.01 EQUIPMENT RACKS

A. Equipment racks shall be furnished and installed as shown on the drawings.

B. The Contractor shall bolt the rack to the floor as recommended by the manufacturer. Multiple racks shall be joined and the ground made common on each. The rack shall be stabilized by extending a brace to the wall. Alternately, overhead ladder rack by which the cabling accesses the equipment rack(s) may provide this function.

C. A space between the rack upright and the wall (approximately 4") should be provided to allow for cabling in that area. The rear of the rack should be approximately 40" from the wall to allow for access by maintenance personnel. In all cases, a minimum of 40" workspace in front of the rack is also required. Locations where these guidelines cannot be followed should be brought to the attention of the Architect/Engineer for resolution prior to installation.

D. All hardware and equipment is to be mounted between 18" and 79" above floor level. This is to afford easy access and, in the case of the lower limit, prevent damage to the components. Positioning of hardware should be reviewed and approved by the Architect/Engineer and Site Coordinator(s) prior to installation.

E. Equipment racks shall be equipped with cable management hardware as to allow an orderly and secure routing of optical fiber and/or copper cabling to the optical fiber distribution cabinets and/or modular patch panels. At minimum, one such horizontal jumper management panel shall be placed below each optical fiber distribution cabinet installed by the Contractor. Additional Jumper Management panels may be required pending installation of other cable types on the equipment rack.

F. Each rack shall be grounded to the Telecommunications Ground Bar (GND) using a #6 AWG (or larger) insulated stranded copper conductor (GREEN jacket) directly or via an adjacent grounded equipment rack. Refer to grounding requirements below.

3.02 LADDER RACK

A. Provide support for ladder rack on 4 ft centers.

B. Maintain a 1.5 safety factor on all load limits specified herein.

C. Ladder rack support shall be by 5/8" diameter threaded rod when ceiling mounted. Ladder rack requiring wall mounting shall utilize accessories supplied by the ladder rack manufacturer specifically for the purpose of wall mounting ladder rack.

3.03 D-RINGS

A. Provide D-rings for cable routing and management in all areas where open cabling is routed along the wall in an Equipment Room.

B. Locate D-rings on 24" centers vertically and horizontally.

C. Securely attach D-rings to the wall as required by the manufacturer.

3.04 GROUNDING

A. Provide a complete grounding system in accordance with the requirements of Section 27 0526.

3.05 CROSS CONNECT INSTALLATION

A. Bend radius of cable shall not exceed 4 times the outside cable diameter or manufacturer's recommendation, whichever is less.

B. Cables shall be neatly bundled and dressed to their respective panels and/or blocks. Each shall be fed by an individual bundle separated and dressed to the point of cable entrance into the rack and/or frame.

C. The cable jacket shall be maintained as close as possible to the termination point.

D. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that is visible without removing the bundle support.

3.06 OPTICAL FIBER TERMINATION

A. All fiber slack shall be neatly coiled within fiber splice enclosures or splice trays. No slack loops shall be allowed external to the enclosure.

B. Each cable shall be individually attached to the respective fiber enclosure by mechanical means. The cable strength member shall be securely attached to the cable strain relief bracket in the enclosure.

C. Each cable shall be clearly labeled at the entrance to all enclosures.

D. A maximum of 12 strands shall be spliced in any tray.

3.07 CONDUITS AND CABLE ROUTING

A. Refer to Section 26 0533 for additional requirements.

B. Where conduits enter a telecommunications room, conduits shall be terminated on the wall where shown on the contract documents. Conduits entering the room from the floor shall extend 3" above the floor slab.

C. Where cabling rises vertically in a telecommunications rooms, provide vertical cable management to support the cabling from floor to ceiling level.

D. All conduits shall be reamed and shall be installed with a nylon bushing.

E. Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of 2" or less, maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter greater than 2", maintain a bend radius of at least 10 times the internal diameter.

END OF SECTION 27 1100

SECTION 27 1300

BACKBONE CABLING REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section describes the products and execution requirements relating to furnishing and installing backbone communications cabling and termination components and related subsystems as part of a cabling plant. The cabling plant consists of both optical fiber and/or copper cabling.

1.02 RELATED WORK

A. Section 27 0500 - Basic Technology Systems Requirements.

B. Section 27 1500 - Horizontal Cabling Requirements.

C. Section 27 1720 - Structured Cabling System Warranty.

1.03 QUALITY ASSURANCE

A. Refer to Section 27 0500 for relevant standards.

1.04 SUBMITTALS

A. Under the provisions of Section 27 0500 and Division 1, prior to the start of work the Contractor shall submit:

1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
2. Manufacturer's installation instructions.

PART 2 PRODUCTS

2.01 GENERAL

A. The basis of design is listed herein. Refer to Section 27 1720 for additional acceptable manufacturers.

2.02 OPTICAL FIBER BACKBONE - OUTSIDE PLANT

A. Exterior Conduit (Singlemode):

1. This optical fiber cable shall be suitable for installation in underground duct and in innerduct.
2. Optical fiber cable materials shall be all dielectric (no conductive materials).
3. Optical fiber cable shall be filled with a water-blocking material.

4. Outer Sheath: Polyethylene (PE). The outer sheath shall be marked with the manufacturer's name, words identifying the cable type (e.g., "Optical Fiber Cable" or "Fiber Optic Cable"), year of manufacture, and sequential length markings. The actual length of the optical fiber cable shall be within -0/+1% of the length markings. The marking shall be in a contrasting color to the cable jacket.
5. Temperature Range:

    a. Storage: -40°C to +70°C (no irreversible change in attenuation).
    b. Operating: -40°C to +70°C.

6. Humidity Range: 0% to 100%.
7. Maximum Tensile Strength:

    a. During Installation: 2700 Newton (600 lb. force) (no irreversible change in attenuation).
    b. Long Term: 890 N (200 lb. force).

8. Bending Radius:

    a. During Installation: 20 times cable diameter.
    b. No Load: 10 times cable diameter.

9. Basis of Design (Singlemode):

    a. Corning.
    b. Additional acceptable manufacturers:

        1) Hubbell
        2) Mohawk
        3) Berk-Tek
        4) Superior Essex

B. Optical Fiber Pigtails (Singlemode):

1. Single-fiber fiber optic pigtails shall be constructed from singlemode (SM) optical fiber of the same grade as the singlemode fiber optic backbone cable utilizing tight buffer construction.
2. Fiber optic pigtails shall be factory terminated with a ceramic tipped LC-type connector on one end and shall be a minimum of 5 feet (1.5m) in length or as indicated on the drawings. Channels shall be of equal length.
3. Connector body shall be of materials similar to that used int he proposed couplings. Refer to Section 27 1500 for connector performance requirements.
4. Provide in quantity to terminate all backbone fiber optic cable strands on each end.
5. Basis of Design:

    a. Singlemode Optical Fiber Pigtails shall be from the same manufacturer as used for the fiber optic termination equipment.

C. Optical Fiber Connectors (LC-type) (Singlemode):

1. LC-type Optical Fiber Connectors: Shall be used to terminate optical fiber in communication equipment rooms.
2. LC-type optical fiber connector plugs shall be snap-type with an integrated pull-proof design.
3. LC-type optical fiber connector plugs shall incorporate a zirconium ceramic ferrule and shall utilize a factory pre-polish end face to ensure fiber-to-fiber physical contact for low loss and reflections.
4. LC-type optical fiber connector plugs shall accept 1.6mm - 2.0mm and 3.0mm outside diameter fiber.
5. The average insertion loss is 0.3db for multimode and single mode connectors
6. LC-type optical fiber connector plugs shall meet the following performance criteria:

Test Procedure	Maximum Attenuation Change
Cable Retention (FOTP-6)	0.2dB
Durability (FOTP-21)	0.2dB
Impact (FOTP-2)	0.2dB
Thermal Shock (FOTP-3)	0.2dB
Humidity (FOTP-5)	0.2dB

7. Additional Performance Requirements:

   a. Length: 2.23 inches
   b. Operating Temperature: -40 to 85 degrees C

8. Basis of Design:

   a. Optical Fiber Pigtails shall be from the same manufacturer as used for the fiber optic termination equipment.

2.03 OPTICAL FIBER BACKBONE PERFORMANCE

A. Singlemode (SM):

1. Fiber Type: Singlemode; doped silica core surrounded by a concentric glass cladding.
2. Core Diameter: 8 to 9 µm. All optical fibers shall be of the same nominal core diameter and profile.
3. Cladding Diameter: 125 ±± 1.0 µm.
4. Cladding Non-circularity: ä? 1%.
5. Core to Cladding Offset: ä? 0.8 µm.
6. Fiber Coating Diameter:

   a. 245 ±± 15µm (primary coating).
   b. 900-nm (nominal) secondary coating (tight buffer).
   c. All coatings shall be mechanically strippable without damaging the optical fiber.

7. Cut-off Wavelength (cabled fiber; ìccf) ä? 1260-nm.
8. Mode Field Diameter: 8.3 to 9.8 m at 1300-nm; 10.5 ±± 1.0 µm at 1550-nm.

9. Zero Dispersion Wavelength (ì0): 1301.5 nm less than l0 less than 1321.5 nm.
10. Zero Dispersion Slope (S0): Less than 0.092 ps/nm2*km.
11. Fiber Attenuation (maximum @ 23 ±± 5°°C; Backbone):

    a. @ 1300-nm: 2.0 dB/km
    b. @ 1550-nm: 1.75 dB/km

        1) When tested in accordance with FOTP-3, "Procedure to Measure Temperature Cycling Effects on Optical Fibers, Optical Cable, and Other Passive Fiber Optic Components," the average change in attenuation over the rated temperature range of the optical fiber cable shall not exceed 0.05 dB/km at 1550-nm. The magnitude of the maximum attenuation change of each individual optical fiber shall not be greater than 0.15 dB/km at 1550-nm.

12. Fiber Dispersion (maximum):

    a. @ 1285 to 1330-nm: 3.2-ps/nm*km
    b. @ 1550-nm: 18-ps/nm*km

13. No optical fiber shall show a point discontinuity greater than 0.1 dB at the specified wavelengths. Such a discontinuity or any discontinuity showing a reflection at that point shall be cause for rejection of that optical fiber by the Owner.

PART 3 EXECUTION

3.01 CABLE INSTALLATION REQUIREMENTS

A. Cable slack shall be provided in each backbone fiber optic cable. This slack is exclusive of the length of fiber that is required to accommodate termination requirements and is intended to provide for cable repair and/or equipment relocation. The cable slack shall be stored in a fashion as to protect it from damage and be secured in the termination enclosure or a separate enclosure designed for this purpose. Multiple cables may share a common enclosure.

B. A minimum of 5 meters (approximately 15 feet) of slack cable (each cable if applicable) shall be coiled and secured at both ends located in the entrance room, Telecommunications Room or main equipment room, for backbone and intra-building cable.

C. Where exposed, all backbone fiber optic cable shall be installed in protective inner duct. This includes areas where the cable is routed in cable tray and where making a transition between paths (e.g., between conduit and cable tray or into equipment racks). The inner duct should extend into the termination and/or storage enclosure(s) at system endpoints.

3.02 CROSS-CONNECTS

A. The Owner will be responsible for all cross-connects between the data backbone cabling and network electronics and between the data network electronics and horizontal cabling.

B. The Owner shall be responsible for the cross-connect wiring between the horizontal and backbone voice cabling.

END OF SECTION 27 1300

SECTION 27 1500

HORIZONTAL CABLING REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section describes the products and execution requirements relating to furnishing and installing horizontal communications cabling and termination components and related subsystems as part of a cabling plant. The cabling plant consists of copper cabling.

1.02 RELATED WORK

A. Section 27 0500 - Basic Communications Systems Requirements

B. Section 27 1720 - Structured Cabling System Warranty

1.03 QUALITY ASSURANCE

A. Refer to Section 27 0500 for relevant standards and plenum or non-plenum cable requirements.

B. The channel shall be required to meet the performance requirements indicated herein. The manufacturer shall warranty the performance of their system to the required performance (and not just to the Standard, should the required performance exceed the Standard).

C. Specific components of the channel shall be required, at a minimum, to meet the Standard component requirements for that particular component.

D. The installing contractor must be certified by the manufacturer of the structured cabling system.

1.04 SUBMITTALS

A. Under the provisions of Section 27 0500 and Division 1, prior to the start of work the Contractor shall submit:

1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
2. Manufacturer's installation instructions.

PART 2 PRODUCTS

2.01 HORIZONTAL CABLE

A. CAT 6 Cable:

1. The horizontal cable requirements must be met, as well as the following channel requirements.
2. CAT 6 cable shall terminate on rack-mounted modular patch panels in their respective communication equipment room as indicated on the drawings.
3. Performance tests shall be conducted using swept frequency testing through 250 MHz for the channel. All numbers given are for a 4-connection channel. Discrete frequency testing results at 250 MHz is not acceptable.
4. Performance data shall be characterized as "Guaranteed Headroom" and shall be guaranteed by the manufacturer to perform at guaranteed margins over ANSI/TIA/EIA-568-C.2. Performance data that is not warranted by the manufacturer will not be considered.
5. The structured cabling and connectivity must be provided by the same company. For the purpose of this specification that shall mean that the cabling and connectivity must be marketed, branded, supported, warranted, and distributed by the same company. Specifically, ally or partnerships between cabling manufacturers and connectivity manufacturers do not meet this requirement unless otherwise listed in Section 27 1720 as an acceptable manufacturer. Specifically, products made by others through an OEM relationship are acceptable if the products are marketed, branded, supported, warranted, and distributed by the same company.
6. The 4-connector channel performance margins in the table below shall be guaranteed margins above ANSI/TIA/EIA-568-C.2:

Electrical Value (1 - 250 MHz)	Minimum Margin
Insertion Loss:	5%
NEXT:	3.0 dB
PS NEXT:	5.0 dB
ACR-F (ELFEXT):	4.0 dB
PS ACR-F (PS ELFEXT):	5.0 dB
Return Loss:	2 dB

7. The jacket color for CAT 6 cable shall be blue for all applications.
8. Basis of Design:

    a. Hubbell HC6R Series
    b. Additional acceptable manufacturers:
        1) Belden
        2) Berk-Tek
        3) Commscope/Uniprise
        4) Panduit
        5) Siemon
        6) Superior Essex

2.02 FACEPLATES/JACKS

A. CAT 6 Jacks:

1. CAT 6 horizontal cable shall each be terminated at their designated work area location on RJ-45 modular jacks. These modular jack assemblies shall snap into a modular mounting frame. The combined modular jack assembly is referred to as an information outlet.
2. The same orientation and positioning of modular jacks shall be utilized throughout the installation. Prior to installation, the Contractor shall submit the proposed configuration for each information outlet type for review by the Architect/Engineer.
3. Information outlet faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.
4. Where standalone CAT 6 only modular jacks are identified, the information outlet faceplate shall be configured as to allow for the addition of one (1) additional modular jack (CAT 3, CAT 5E, or CAT 6) to be installed to supplement each such modular jack as defined by this project. The installation of these supplemental modular jacks is NOT part of this project.
5. Any unused modular jack positions on an information outlet faceplate shall be fitted with a removable blank inserted into the opening.
6. The information outlet faceplate shall be constructed of high impact plastic (except where noted otherwise). The information outlet faceplate color shall:

    a. Match the receptacle color used for other utilities in the building, or
    b. When installed in surface raceway (if applicable), match the color of that raceway.

7. Different faceplate and frame designs for locations, which include optical fiber cabling relative to those, that terminate only copper cabling are acceptable. Information outlets that incorporate optical fiber shall be compliant with the above requirements plus:

    a. Be a low-profile assembly.
    b. Incorporate a mechanism for storage of cable and fiber slack needed for termination.
    c. Position the optical fiber couplings to face downward or at a downward angle to prevent contamination.
    d. Incorporate a shroud that protects the optical fiber couplings from impact damage.

8. All information outlets and the associated modular jacks shall be of the same manufacturer throughout the project.
9. The CAT 6 modular jacks shall be non-keyed 8-pin modular jacks.
10. The interface between the modular jack and the horizontal cable shall be a 110-type termination block or insulation displacement type contact. Termination components shall be designed to maintain the horizontal cable's pair twists as closely as possible to the point of mechanical termination.
11. CAT 6 modular jacks shall be pinned per T-568B.
12. CAT 6 termination hardware shall, as a minimum, meet all the mechanical and electrical performance requirements of the following standards:

a. ANSI/TIA/EIA-568-A-5
b. ANSI/TIA/EIA-568A
c. ISO/IEC 11801
d. IEC 603-7
e. FCC PART 68 SUBPART F

13. The color for CAT 6 jacks shall be blue for all applications. Alternately, a color-coded bezel or icon may be used to identify the CAT 6 modular jack.

2.03 COPPER WORK AREA CORDS

A. RJ-45:

1. Provide the same quantity of Category 6 copper work area cords as copper patch panel cords specified in Section 27 1100. Copper work area cords shall be equipped with an 8-pin modular RJ-45 connector on each end.
2. Work area cords shall be 10' in length.
3. Manufacturer of copper patch cable shall be the same as the manufacturer of the horizontal copper cable.

PART 3 EXECUTION

3.01 CABLE INSTALLATION REQUIREMENTS

A. Horizontal Cabling:

1. The maximum horizontal cable drop length for Data UTP shall not exceed 295 feet (90 meters) in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and must include any slack required for the installation and termination. The Contractor is responsible for installing horizontal cabling in a fashion so as to avoid unnecessarily long runs. Any area that cannot be reached within the above constraints should be identified and reported to the Architect/Engineer prior to installation. Changes to the contract documents shall be approved by the Architect/Engineer.
2. All cable shall be free of tension at both ends. In cases where the cable must bear some stress, Kellum grips may be used to spread the strain over a longer length of cable.
3. Manufacturer's minimum bend radius specifications shall be observed in all instances.
4. Horizontal cabling installed as open cabling shall be supported at a maximum of 5' between supports. Refer to the specifications for required cable supports.
5. Horizontal cabling installed as open cable or in cable tray shall be bundled at not less than 10' intervals with hook-and-loop tie wraps. The use of plastic cable ties is strictly prohibited.
6. The maximum conduit fill for horizontal cabling shall not exceed 40% regardless of conduit length.
7. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.

B. A coil of 3 feet in each cable shall be placed in the ceiling at the last support (e.g., J-hook, bridle ring, etc.) before the cables enter a fishable wall, conduit, surface raceway or box. At any location where cables are installed into movable partition walls or modular furniture via a service pole, approximately 15-feet of slack shall be left in each horizontal cable under 250 feet in length to allow for change in the office layout without re-cabling. These "service loops" shall be secured at the last cable support before the cable leaves the ceiling and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.

1. To reduce or eliminate EMI, the following minimum separation distances from 480V power lines shall be adhered to:

    a. Twelve (12) inches from power lines of less than 5-kVa.
    b. Eighteen (18) inches from high-voltage lighting (including fluorescent).
    c. Thirty-nine (39) inches from power lines of 5-kVa or greater.
    d. Thirty-nine (39) inches from transformers and motors.

2. Information outlets shown on floor plans with the subscript "W" are intended to be used for wall mounted telephones. Back boxes for wall mounted telephones shall not be located within 12" vertically, or horizontally, from any light switches, power receptacles, nurse call devices, thermostats, or any other architectural element that would otherwise prevent the installation of a wall mounted telephone on the mating lugs.

3.02 CABLE TERMINATION REQUIREMENTS

A. Cable Terminations - Data UTP:

1. Modular patch panels shall be designed and installed in a fashion as to allow future horizontal cabling to be terminated on the panel without disruption to existing connections.
2. If the "last" patch (per rack) is greater than 50% utilized, one additional patch panel shall be provided for future use..
3. At information outlets and modular patch panels, the Contractor shall ensure that the twists in each cable pair are preserved to within 0.5-inch of the termination for data cables. The cable jacket shall be removed only to the extent required to make the termination.

END OF SECTION 27 1500

SECTION 27 1710

TESTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section describes the testing requirements relating to the structured cabling system and its termination components and related subsystems.

1.02 RELATED WORK

A. Section 27 0500 - Basic Communications Systems Requirements

1.03 QUALITY ASSURANCE

A. Refer to Section 27 0500 for relevant standards.

1.04 SUBMITTALS

A. Under the provisions of Section 27 0500 and Division 1, prior to the start of work, the Contractor shall submit:

1. Complete information on testing procedure as described herein.
2. Test plan summary for each cable type to be tested including equipment to be used, setup, test frequencies or wavelengths, results format, etc.

PART 2 PRODUCTS

2.01 TESTING COPPER

A. General Requirements:

1. Perform acceptance tests as indicated below for each sub-system (e.g., backbone, horizontal, etc.) as it is completed.
2. Supply all equipment and personnel necessary to conduct the acceptance tests. The method of testing shall be approved by the Architect/Engineer.
3. Visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring pattern defined herein. Provide the Architect/Engineer with a written certification that this inspection has been made.
4. Conduct acceptance testing according to a schedule coordinated with the Owner/Architect/Engineer. Representatives of the Owner may be in attendance to witness the test procedures. Provide a minimum of one (1) week's advance notice to the Architect/Engineer to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.

5. Tests related to connected equipment of others shall only be done with the permission and presence of the Contractor involved. The Contractor shall ascertain that testing only is required to prove the wiring connections are correct.
6. Provide test results and describe the conduct of the tests including the date of the tests, the equipment used, and the procedures followed. At the request of the Architect/Engineer, provide copies of the original test results in their native format.
7. All cabling shall be 100% fault-free unless noted otherwise. If any cable is found to be outside the specification defined herein, that cable and the associated termination(s) shall be replaced at the expense of the Contractor. The applicable tests shall then be repeated.
8. Should it be found by the Architect/Engineer that the materials or any portion thereof furnished and installed under this Contract fail to comply with the specifications and drawings with respect or regard to the quality, amount, or value of materials, appliances, or labor used in the work, it shall be rejected and replaced by the Contractor and all work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.

    a. CAT 6 Cable:

        1) Testing shall be from the modular jack at the information outlet to the modular patch panel in the communication equipment room.
        2) Horizontal cable shall be free of shorts within the pairs, and be verified for continuity, pair validity and polarity, and conductor position on the modular jack (e.g., wire map). Any defective, split, or mis-positioned pairs must be identified and corrected.
        3) CAT 6 horizontal cable shall be tested to 250 MHz as defined by TIA/EIA-568-C.2. Measurements shall be of the "Permanent Link", including cabling and modular jacks at the information outlet and modular patch panel. Parameters to be tested must include:

            a) Wire Map
            b) Length
            c) NEXT Loss (Pair-to-Pair)
            d) NEXT (Power Sum)
            e) ELFEXT (Pair-to-Pair)
            f) ELFEXT (Power Sum)
            g) Return Loss
            h) Attenuation
            i) Propagation Delay
            j) Delay Skew

        4) The maximum length of horizontal cable shall not exceed 295 feet, which allows 33 feet for technology equipment and modular patch cords.

5) To establish testing baselines, cable samples of known length and of the cable type and lot installed shall be tested. The cable may be terminated with an eight-position CAT 6 modular connector (8-pin) to facilitate testing. Nominal Velocity of Propagation (NVP) and nominal attenuation values shall be calculated based on this test and be utilized during the testing of the installed cable plant. This requirement can be waived if NVP and nominal attenuation data is available from the cable manufacturer for the exact cable type under test.
6) CAT 6 horizontal cable testing shall be performed using a test instrument designed for testing to 250 MHz or higher. Test records shall verify, "PASS" on each cable and display the specified parameters, comparing test values with standards based "templates" integral to the unit. Test records that report a PASS*, FAIL*, or FAIL result for any of the parameters will not be accepted.
7) In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacements, and changes as necessary and shall then repeat the test or tests that disclosed faulty or defective material, equipment, or installation methods, and shall make additional tests as the Architect/Engineer deems necessary at no additional expense to the project or user agency.

2.02 TESTING FIBER

A. General Requirements:

1. Perform acceptance tests as indicated below for each optical fiber sub-system (e.g., backbone, horizontal, etc.) as it is completed.
2. Supply all equipment and personnel necessary to conduct the acceptance tests. The method of testing shall be approved by the Architect/Engineer.
3. Visually inspect all optical fiber cabling and termination points to ensure that they are complete and conform to the standards defined herein. Provide the Architect/Engineer with a written certification that this inspection has been made.
4. Conduct acceptance testing according to a schedule coordinated with the Owner/Architect/Engineer. Representatives of the Owner may be in attendance to witness the test procedures. Provide a minimum of one (1) week's advance notice to the Architect/Engineer to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.
5. Tests related to connected equipment of others shall only be done with the permission and presence of the Contractor involved. The Contractor shall ascertain that testing only is required to prove that the optical fiber connections are correct.
6. Provide test results and describe the conduct of the tests including the date of the tests, the equipment used and the procedures followed. At the request of the Architect/Engineer, provide copies of the original test results.
7. All optical fiber cabling shall be 100% fault-free unless noted otherwise. If any optical fiber cable is found to be outside the specification defined herein, that optical fiber cable and the associated connector(s) shall be replaced at the expense of the Contractor. The applicable tests shall then be repeated.

8. Should it be found by the Architect/Engineer that the materials or any portion thereof furnished and installed under this Contract fail to comply with the specifications and drawings with respect or regard to the quality, amount, or value of materials, appliances, or labor used in the work, it shall be rejected and replaced by the Contractor and all work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.
9. The optical fibers utilized in the installed cable shall be traceable to the manufacturer. Upon request by the Owner, provide cable manufacturer's test report for each reel of cable provided. These test reports shall include manufacturer's on-reel attenuation test results at 850-nm and 1300-nm for each optical fiber of each reel prior to shipment from the manufacturer.

    a. On-the-reel bandwidth performance as tested at the factory. Factory data shall be provided upon request.
    b. The testing noted for optical fiber cabling utilizes an Optical Time Domain Reflectometer (OTDR). However, the Contractor may submit to the Architect/Engineer for pre-approval of alternate fiber optic testing equipment.

B. Tests Prior to Installation: The Contractor, at their discretion and at no cost to the Owner, may perform an attenuation test with an OTDR at 850-nm or 1300-nm on each optical fiber of each cable reel prior to installation. Supply this test data to the Architect/Engineer prior to installation.

C. Tests After Installation: Upon completion of cable installation and termination, the optical fiber cabling shall be tested to include:

1. Optical Attenuation ("Insertion Loss" Method):

    a. Optical Attenuation shall be measured on all terminated optical fibers in one direction of transmission using the "Insertion Loss" method measurement in accordance with the TIA/EIA 526-14, Method B, and be inclusive of the optical connectors and couplings installed at the system endpoints. Access jumpers shall be used at both the transmit and receive ends to ensure that an accurate measurement of connector losses is made. Singlemode optical fibers (if applicable) shall be tested at 1300 ±± 20 nm.
    b. Attenuation of optical fibers shall not exceed the values calculated as follows:

        1) Attenuation (max.) = 2*C+L*F+S dB.
        2) Where C is the maximum allowable Connector Loss (in dB), L is the length of the run (in kilometers), and F is the maximum allowable optical fiber loss (in dB/km). S is the total splice loss (# of splices * maximum attenuation per splice).

2. Verification of Link Integrity (OTDR):

    a. All optical fibers shall be documented in one direction of transmission using an Optical Time Domain Reflectometer (OTDR). Singlemode optical fibers (if applicable) shall be tested at 1310-nm and 1550-nm (nominal). The OTDR(s) shall incorporate high-resolution optics optimized for viewing of short cable sections. Access jumpers of adequate length to allow viewing of the entire length of the cable, including the connectors at the launch and receive end, shall be used. Access jumpers used for testing shall match the type and core diameter of the fiber optic strand under test.
    b. Set OTDR's test variables to the manufacturer's published backscatter coefficient and velocity of propagation figure for the specific strand of fiber under test. OTDR's range should be set to approximately 1.5 times the length of the strand under test, pulse width should be optimized for the length of the fiber optic strand under test, and number of averages should be adjusted to approximately 120 seconds per wavelength.
    c. OTDR traces revealing a point discontinuity greater than 0.1 dB in a singlemode optical fiber (if applicable) at any of the tested wavelengths or any discontinuity showing a reflection at that point shall be a valid basis for rejection of that optical fiber by the Owner. The installation of that optical fiber cable shall be reviewed in an effort to remove any external stress that may be causing the fault. If such efforts do not remove the fault, that optical fiber cable and the associated terminations shall be replaced at the expense of the Contractor.

2.03 DOCUMENTATION/AS-BUILTS/RECORDS

A. General:

1. Upon completion of the installation, submit as-builts per the requirements of Section 27 0500 and Division 1. Documentation shall include the items detailed in the subsections below.
2. All documentation, including hard copy and electronic forms, shall become the property of the Owner.
3. The Architect/Engineer may request that a 10% random field retest be conducted on the cable system at no additional cost to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the Contractor, additional testing can be requested to the extent determined necessary by the Architect/Engineer, including a 100% retest. This retest shall be at no additional cost to the Owner.

B. Copper Media Test Data:

1. Test results shall include a record of test frequencies, cable type, conductor pair and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s).

2. Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package. The Contractor shall furnish this information in electronic form (USB thumb drive). The thumb drive shall contain the electronic equivalent of the test results as defined by the bid specification and be in the tester's native format as well as summaries of each test in pdf format. Provide a licensed copy of the software required to view and print the data that is provided in a proprietary format. Furnish one (1) copy of the data and display (if applicable) software.

C. Optical Fiber Media Test Data:

1. Test results shall include a record of test wavelengths, cable type, fiber and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s).
2. OTDR traces of individual optical fiber "signatures" obtained as specified above shall be provided to the Architect/Engineer in electronic form for review. Trace files shall be so named as to identify each individual optical fiber by location in the cable system and optical fiber number or color. Where traces are provided in electronic form, provide along with the above documentation, one (1) licensed copy of software that will allow for the display of OTDR traces provided. The software shall run on a Microsoft Windows-based personal computer.

D. Record Drawings:

1. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided.

PART 3 EXECUTION (Not Used)

END OF SECTION 27 1710

SECTION 27 1720

STRUCTURED CABLING SYSTEM WARRANTY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section describes support and warranty requirements relating to the structured cabling system and related subsystems.

1.02 RELATED WORK

A. Section 27 0500 - Basic Technology Systems Requirements.

B. Section 27 1100 - Communication Equipment Room (CER).

C. Section 27 1300 - Backbone Cabling Requirements.

D. Section 27 1500 Horizontal Cabling Requirements.

1.03 QUALITY ASSURANCE

A. Refer to Section 27 0500 for relevant standards.

1.04 SUBMITTALS

A. Under the provisions of Section 27 0500 and Division 1, prior to close of the project the Contractor shall submit:

1. A numbered certificate from the manufacturing company registering the installation.

PART 2 PRODUCTS

2.01 WARRANTY

A. A fifteen (15) year Product Installation Warranty shall be provided for the structured cabling system as described in the contract documents.

B. The Product Installation Warranty shall cover the replacement or repair of the defective product(s) and labor for the replacement or repair of such defective product(s).

C. Upon successful completion of the installation and subsequent inspection, the Owner shall be provided with a numbered certificate from the manufacturing company registering the installation.

PART 3 EXECUTION

3.01 WARRANTY REQUIREMENTS

A. This Contractor shall be responsible for providing, installing and testing a structured cabling system that will meet the manufacturer's warranty requirements.

END OF SECTION 27 1720

SECTION 27 5113

PAGING SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Ceiling Speaker

B. Wall-Mounted Speaker

C. Wall-Mounted Speaker, Weather Resistant

D. Conduit

E. Non-Continuous Cable Hangers and Supports

1.02 RELATED WORK

A. Section 26 0533 - Conduit and Boxes

B. Section 26 0535 - Surface Raceways

C. Section 26 0513 - Wire and Cable

D. Section 27 0500 - Basic Communications Systems Requirements

E. Section 27 0503 - Through Penetration Firestopping

F. Section 27 0526 - Communications Bonding

G. Section 27 0528 - Interior Communication Pathways

H. Section 27 1500 - Horizontal Cabling Requirements

I. Section 27 0553 - Identification and Administration

1.03 QUALITY ASSURANCE

A. Manufacturer: The manufacturer shall have five (5) years documented experience in the design and manufacture of paging system devices and equipment.

B. Installer: The Contractor shall have a minimum of three (3) years documented experience in paging system installation and must be a factory-authorized service and support company specializing in the selected manufacturer's product, with demonstrated prior experience with the selected manufacturer's system installation and programming.

1. The Contractor shall own and maintain all tools and equipment necessary for successful installation and testing of the system and have personnel adequately trained in the use of such tools and equipment.

C. The Contractor shall have acquired and maintained all certifications for a minimum of one (1) month prior to the posted bid date of this project.

D. Service: The installer must be factory certified to provide service on the installed manufacturer's equipment and must have local service representatives within 60100miles of the project site.

E. The entire installation shall comply with all applicable electrical and safety codes. All applicable devices, equipment, and cabling shall be listed by Underwriters' Laboratories, Inc.

1.04 REFERENCES

A. ADA - Americans with Disabilities Act

B. ADAAG - Americans with Disabilities Accessibility Guidelines

C. NFPA 70 (NEC) – National Electrical Code

D. UL 813 - Standards for Commercial Audio Systems

E. UL 1480 - Speakers for Fire Alarm, Emergency, and Commercial and Professional Use

F. ISO R 266-1997

G. ANSI S1.6-1984

1.05 SUBMITTALS

A. Submit product data under the provisions of Section 27 0500.

B. Provide materials documenting experience requirements of the manufacturer and installing contractor.

C. Product Data Submittal: Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:

1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item by item.
2. All component options and accessories specific to this project.
3. Manufacturer's installation instructions, indicating application conditions and limitations of use as stipulated by product testing agency and instructions for storage, handling, protection, examination, preparation, installation, and initiating usage of product.

D. Certification Documentation Submittal:

1. Provide documentation of all required certifications. All certifications shall be current and valid. Any certificate with expired dates will not be accepted. Submittal shall include documentation of the following:

a. System Equipment Manufacturer(s) dealer certification(s) and dealer number(s).
b. System Equipment Manufacturer(s) programmer certification(s).
c. All other applicable dealer, installation, and programming certifications.

E. Coordination Drawings:

1. Include all ceiling-mounted devices in composite electronic coordination files. Refer to Section 27 0500 for coordination drawing requirements.

F. Quality Assurance:

1. Provide system checkout test procedure to be performed at acceptance, including demonstration of specified performance and all required system features and functions listed herein and as further detailed on the drawings.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to the site under the provisions of Section 27 0500.

B. Store and protect products under the provisions of Section 27 0500.

1.07 SYSTEM DESCRIPTION

A. This specification section describes the furnishing, installation, commissioning and programming of paging system components integrated with existing campus paging system to be complete, turnkey paging system.

B. Performance Statement: This specification section and the accompanying design documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed or every equipment connection that must be made. Based on the equipment constraints described and the performance required of the system as presented in these documents, the vendor and the Contractor are solely responsible for determining all wiring, programming, and miscellaneous equipment required for a complete and operational system.

C. This Contractor shall furnish and install a paging system as hereinafter specified and further detailed on the drawings. System shall be completely wired and ready for use including, but not limited to, outlet boxes, conduit, wire, equipment, speakers, controls, and equipment cabinets.

1.08 PROJECT RECORD DOCUMENTS

A. Submit documents under the provisions of Section 27 0500.

B. Provide floor plans identifying actual locations of all installed overhead paging system equipment and devices.

C. Provide final system block diagram showing any deviations from shop drawing submittal. Block diagram shall include cable number documenting the numbers installed on both ends of the cable in the field.

D. Provide documentation of all test results and statement that system checkout test, as outlined in shop drawing submittal, is complete and satisfactory.

E. Warranty: Submit written warranty and complete all Owner registration forms.

F. Complete all operation and maintenance manuals as described herein.

1.09 OPERATION AND MAINTENANCE DATA

A. Submit data under provisions of Section 27 0500.

B. Operation and Maintenance data shall be submitted in hard copy and electronic .pdf format.

C. Operation data shall include:

1. Manufacturer's full operation instructions for each piece of equipment.
2. Complete documentation of all settings and programming.
3. Detailed, step-by-step instructions for system operation, including accessing, initiating, and performing all required system features and functions listed herein.

D. Maintenance data shall include:

1. Description of servicing procedures:

a. Documentation of all manufacturers' recommended preventive and remedial maintenance procedures to be performed by the Owner.
b. Troubleshooting flowcharts.

2. Spare parts list.

1.10 WARRANTY

A. Unless otherwise noted, provide warranty for a minimum of one (1) year after Substantial Completion, as defined by the Contract. Certain system components may require additional manufacturer's warranty as described herein.

B. The warranty shall:

1. Cover the replacement or repair of the defective product(s) and labor for the replacement or repair of such defective product(s).
2. Include emergency service and repair on-site, with response times of 24 hours from time of notification. The system shall be repaired and restored to operation within 24 hours of technician's arrival on site.

C. Refer to the individual product sections for further warranty requirements of individual system components.

PART 2 PRODUCTS

2.01 CEILING SPEAKER

A. Refer to the drawings for manufacturer and part number.

2.02 WALL-MOUNTED SPEAKER

A. Refer to the drawings for manufacturer and part number.

2.03 WALL-MOUNTED SPEAKER, WEATHER RESISTANT

A. Provide complete with necessary manufacturer's mounting accessories.

B. Refer to the drawings for manufacturer and part number.

2.04 PAGING SYSTEM CABLE

A. Refer to Section 27 0500 for plenum or non-plenum cable rating requirements.

1. Refer to Section 27 1500 for requirements.

2.05 CONDUIT

A. All conduit for paging system cabling shall be a minimum of 3/4" trade size.

B. Flexible conduit shall be used only for "fixture whip" type applications at speakers in accessible ceilings, between a speaker and nearby junction box. Flexible conduit for this application shall be no longer than four (4) feet. Flexible conduit shall not be installed for any other paging system cabling.

C. Refer to Division 26 for additional requirements.

2.06 NON-CONTINUOUS CABLE HANGERS AND SUPPORTS

A. Refer to Section 27 0528 for requirements.

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with all manufacturer's instructions and recommendations for installation of all equipment, devices, and materials.

B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.

C. Wiring:

1. Refer to Division 26 for conduit requirements and additional wiring requirements.

2. All cabling shall be run in conduit, "free-air" in non-continuous cable supports or cable tray above accessible ceilings, and in conduit or in a secured metal raceway in exposed areas. Supports shall be spaced at a maximum 4-foot interval. If cable "sag" at mid-span exceeds 6 inches, another support shall be used.
3. Manufacturer's minimum bend radius specifications for cables shall be observed in all instances.
4. All cable shall be installed at right angles and be kept clear of work by other trades. To reduce or eliminate EMI, the following minimum separation distances from £ 480V power lines shall be adhered to:

    a. 12 inches from power lines of 5-kVa
    b. 18 inches from high voltage lighting (including fluorescent)
    c. 39 inches from power lines of 5-kVa or greater
    d. 39 inches from transformers and motors

5. It shall be noted that all cables shall be installed in continuous lengths from endpoint to endpoint. No splices shall be allowed unless noted otherwise.
6. All cable shall be free of tension at both ends.
7. Both ends of all cables shall be clearly labeled. Refer to Section 27 0553 for requirements.
8. Provide all system wiring between all components as shown on project documents, as directed by the manufacturer, and/or required for proper system operation and to provide specified system functionality.

D. Equipment:

1. All necessary devices, sub-components, accessories, and incidental materials required to provide a complete, turn-key paging system that provides specified performance and all required system features and functions listed herein and as further detailed on the drawings shall be provided and installed as part of a complete system.
2. Install and tighten all connectors in accordance with manufacturer's instructions, using the appropriate purpose-designed tools recommended by the manufacturer for that purpose. Use caution to avoid stripping or damaging connectors, terminals, or equipment by over-tightening termination fasteners.

3.02 SYSTEM SETUP, PROGRAMMING, AND ADJUSTMENT

A. The Contractor shall provide all system programming, startup, balancing, tuning, and adjustment required as part of this project. This shall include all calibration and adjustments of equipment controls, troubleshooting, and final adjustments that may be required.

B. Complete all necessary programming to provide the indicated functionality.

C. Paging system shall be adjusted to provide 6 dBA of sound above the ambient sound level in the space in which they are installed measured at one (1) meter from each speaker when voice pages are made. Sound shall be clear, even, and undistorted and free of any hum, noise, or sonic anomalies.

3.03 TESTING

A. The Contractor shall conduct all system testing as part of the requirements of this project. This shall include all calibration and adjustments of equipment controls, troubleshooting, and final adjustments or corrective action that may be required to provide a complete system that provides the specified performance and all required system features and functions listed herein and as further detailed on the drawings.

B. At a minimum, the installer shall perform the following inspections and tests of the installed overhead paging system:

1. Verify that all features and functionality are operating properly.
2. Verify that the system receives signal from all sources and routes those signals as specified.
3. Verify that system output meets specified sound level at each speaker.
4. Verify that all controls are properly labeled and interconnecting wires and terminals are identified.

C. Document all test results and submit as part of final system documentation package.

END OF SECTION 27 5113

SECTION 27 5126

ASSISTIVE LISTENING SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

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

B. Section 27 05 00 – Basic Communication Requirements

1.02 SUMMARY

A. Provide Assistive Listening System per CBC requirements.

B. The minimum number of receivers shall be equal to 4% of the seating, but not less than two.

1.03 DEFINITIONS

A. ADA: Americans with Disabilities Act

B. CBC: California Building Code (Current Version)

1.04 QUALITY ASSURANCE

A. Manufacturer: The manufacturer of equipment shall have a complete service organization for all products in the manufacturer's line.

B. Integrator/Dealer: The Contractor shall be a factory-authorized and certified integrator/dealer specializing in each selected manufacturer's products, with demonstrated prior experience with the selected manufacturer's system installation and programming.

1.05 SUBMITTALS

A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:

1. The submittal shall include a list of all equipment submitted, listing out each product manufacturer and model number.

2. Product Data: Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:
    - Compliance with each requirement of these documents.
    - All component options and accessories specific to this project.
    - Electrical power consumption rating and voltage.
3. If an alternate manufacturer(s) is submitted, the equivalent certifications to the basis of design manufacturer(s) shall be required and submitted.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

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

1. Williams Sound (Basis of Design)
2. Listen Technologies

B. Source Limitations: Obtain materials and accessories from single source from single manufacturer.

2.02 SYSTEM DESCRIPTION

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

B. Assistive-listening systems shall be provided in accordance with CBC Section 11B-219 and shall comply with CBC Section 11B-706.

C. The minimum number of receivers to be provided shall be equal to 4% of the total number of seats, but in no case less than two. 25% minimum of receivers provided, but no fewer than two, shall be hearing-aid compatible in accordance with CBC Section 11B-706.3.

D. If the system provided is limited to specific areas or seats, then such areas or seats shall be within a 50-foot viewing distance of, and have a complete view of, the stage or playing area CBC Section 11B-219.4.

E. Receivers required to be hearing-aid compatible shall interface with telecoils in hearing aids through the provision of neckloops and shall be over-the-ear type headphones. Earbuds are not acceptable for this use.

F. Receivers shall include a 1/8" (3.2mm) standard mono output jack.

G. Portable kit shall include:

1. One (1) PPA T46 Transmitter
2. Four (4) PPA R37 Receivers
3. Four (4) HED 027 Headphones
4. Two (2) NKL 001 Neck Loop
5. One (1) MIC 090 Lavaliere Microphone
6. One (1) MIC 149 Desktop Conference Microphone
7. One (1) CCS 029 Carry Case
8. Five (5) BAT 001-2 AA Alkaline Batteries
9. One (1) IDP 008 ADA Wall Plaque

H. Provide auto-detection of channel interference for automated channel switching as needed.

I. Basis of Design: Williams Sound Model FM ADA KIT 37.

PART 3 EXECUTION

3.01 INSTALLATION

A. Perform this work in accordance with acknowledged industry and professional standards and practices, existing build conditions, and as specified herein. Provide and install all materials, devices, components, and equipment for complete, operational systems.

B. Maintain a competent supervisor and supporting technical personnel, acceptable to the Construction Manager, during the entire installation. Change of the supervisor during the project will not be acceptable without prior written approval from the Owner, the Construction Manager, and the Architect.

C. Coordinate all efforts with those of related trades. In the event of any conflicts, delayed or improper preparatory work by others, notify the Architect; the Architect's decision will be binding. Verify all field conditions.

END OF SECTION 27 5126

SECTION 28 0500

BASIC ELECTRONIC SAFETY AND SECURITY SYSTEM REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Basic Safety and Security System Requirements (herein referred to Security) specifically applicable to Division 28 sections, in addition to Division 1 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.02 REFERENCES

A. CCR California Code of Regulation

B. CBC California Building Code

C. CFC California Fire Code

D. CEC California Electric Code

E. CMC California Mechanical Code

F. CPC California Plumbing Code

G. California Title 24 - Building Energy Efficiency Standards

H. SCAQMD South Coast Air Quality Management District

1.03 SCOPE OF WORK

A. This Specification and the accompanying drawings govern the work involved in furnishing, installing, testing and placing into satisfactory operation the security systems as shown on the drawings and specified herein.

B. Each Contractor shall provide all new materials as indicated in the schedules on the drawings, and/or in these specifications, and all items required to make the portion of the security systems a finished and working system.

C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.

D. Description of systems include but are not limited to the following:

1. Electronic access control system
2. Electronic intrusion detection system
3. Rescue Assistance Communication System

4. Fire detection and alarm.
5. Low voltage security wiring (less than +120VAC) as specified and required for proper system control and communications.
6. All associated electrical backboxes, conduit, miscellaneous cabling, and power supplies required for proper system installation and operation as defined in the "Suggested Matrix of Scope Responsibility".
7. Firestopping of penetrations of fire-rated construction as described in Section 28 0503.

1.04 WORK SEQUENCE

A. All construction work that will produce excessive noise levels and interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during non-occupied hours. The Owner shall reserve the right to set policy as to when restricted construction hours will be required.

1.05 DIVISION OF WORK BETWEEN ELECTRICAL AND SECURITY CONTRACTORS

A. Division of work is the responsibility of the Prime Contractor. Any scope of work described in the contract document shall be sufficient for including said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the described scope. In no case shall the project be assessed an additional cost for scope that is described in the contract documents. The following division of responsibility is a guideline based on typical industry practice.

B. Definitions:

1. "Electrical Contractor" as referred to herein refers to the Contractors listed in Division 26 of this Specification.
2. "Electrical Contractor" shall also refer to the Contractor listed in Division 28 of this specification when the "Suggested Matrix of Scope Responsibility" indicates the work shall be provided by the EC. Refer to the Contract Documents for the "Suggested Matrix of Scope Responsibility".
3. "Security Contractor" as referred to herein refers to the Contractors listed in Division 28 of this Specification.
4. Low Voltage Security Wiring: The wiring (less than 120VAC) associated with the Security Systems, used for analog and/or digital signals between equipment.

C. General:

1. The purpose of these Specifications is to outline typical Electrical and Security Contractor's work responsibilities as related to security systems including back boxes, conduit, cable tray, power wiring and low voltage security wiring. The prime contractor is responsible for all divisions of work.

2. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals are approved. Therefore, only known wiring, conduits, raceways, and electrical power as related to such items, is shown on the Security Drawings. Other wiring, conduits, raceways, junction boxes, and electrical power not shown on the Security Drawings but required for the successful operation of the systems shall be the responsibility of the Security Contractor and included in the Contractor's bid.
3. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of Security systems, the final installation shall not begin until a coordination meeting between the Electrical Contractor and the Security Contractor has convened to determine the exact location and requirements of the installation.
4. Where the Electrical Contractor is required to install cable tray that will contain Low Voltage Security Wiring, the installation shall not begin until the Security Contractor has completed a coordination review of the cable tray shop drawing.
5. This Contractor shall establish Electrical and Security utility elevations prior to fabrication and installation. The Security Contractor shall cooperate with the Electrical Contractor and the determined elevations in accordance with the guidelines below. This Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:

    a. Lighting Fixtures
    b. Gravity Flow Piping, including Steam and Condensate
    c. Sheet Metal
    d. Electrical Busduct
    e. Cable Trays, including 12" access space
    f. Sprinkler Piping and other Piping
    g. Conduit and Wireway
    h. Open Cabling

D. Electrical Contractor's Responsibility:

1. Assumes all responsibility for all required conduit and power connections when shown on the "Suggested Matrix of Scope Responsibility" to be provided by the Electrical Contractor.
2. Assumes all responsibility for providing and installing cable tray.
3. Responsible for Security Systems grounding and bonding.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Security Contractor's Responsibility:

1. Assumes all responsibility for the low voltage security wiring of all systems, including cable support where open cable is specified.
2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being provided by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility."
3. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of security equipment which is required to be bonded to the telecommunications bonding system.

4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other contractors to determine a viable layout.

1.06 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

    a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
    b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    d. Maintenance clearances and code-required dedicated space shall be included.
    e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

    a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

    a. Scale of drawings:

        1) General plans: 1/4 Inch = 1 '-0" (minimum).
        2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
        3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
        4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1 '-0" (minimum).
        5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the A/E for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the A/E and Owner's Representative. The A/E will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.

7. The A/E reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the A/E.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

    a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
    b. Potential layout changes shall be made to avoid additional access panels.
    c. Additional access panels shall not be allowed without written approval from the A/E at the coordination drawing stage.
    d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the A/E and the Owner's Representative.
    e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain signoff of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.07 QUALITY ASSURANCE

A. Qualifications:

1. Only products of reputable manufacturers as determined by the Architect/Engineer will be acceptable.
2. Each Contractor and their subcontractors shall employ only workers who are skilled in their respective trades and fully trained. All workers involved in the installation, termination, testing, and placing into operation electronic security devices shall be individually trained by the manufacturer.
3. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.
4. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of electronic security devices and have personnel adequately trained in the use of such tools and equipment.

B. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of Lawndale Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all published standards of Lawndale Elementary School District.

3. In the event there are no local codes having jurisdiction over this job, the current issue of the National Electrical Code shall be followed.
4. If there is a discrepancy between the codes and regulations having jurisdiction over this installation, and these specifications, Architect/Engineer shall determine the method or equipment used.
5. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time to follow this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
6. Verify the installation environment prior to purchasing or installing any cable. Cable installed in a plenum environment shall be appropriately rated. Bring all discrepancies between the contract documents and installation conditions to the attention of the Architect/Engineer prior to purchase or installation.
7. All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.

C. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all applicable laws, regulations, ordinances, and other rules of the State or Political Subdivision wherein the work is done, or as required by any duly constituted public authority.
3. Pay all applicable charges for such permits or licenses that may be required.
4. Pay all applicable fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections due to codes, permits, licenses or as otherwise may be required by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized independent agency/consultant.
7. All equipment, and materials shall be as approved or listed by the following: (Unless approval or listing is not applicable to an item by all acceptable manufacturers.)

    a. Factory Mutual
    b. Underwriters' Laboratories, Inc.

D. Examination of Drawings:

1. The drawings for the Security Systems work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and the exact routing of cabling to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining this layout. Where a specific route is required, such route will be indicated on the drawings.
3. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.

4. If an item is either shown on the drawings, called for in the specifications or required for proper operation of the system, it shall be considered sufficient for including same in this contract.
5. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.
6. Where words "provide", "install", or "furnish" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and terminate completely ready for operation, the items mentioned.

E. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
4. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
5. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
6. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
7. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

F. Field Measurements:

1. Before ordering any materials, this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.

1.08 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item	Coordination Drawings

Referenced Specification Section	Submittal Item	Coordination Drawings
28 05 03	Through-Penetration Firestopping	
28 13 00	Electronic Access Control	
28 16 00	Intrusion Detection System	Yes
28 26 05	Rescue Assistance Communication System	

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

   a. Date
   b. Project title and number
   c. Contractor's name and address
   d. Division of work (e.g., plumbing, heating, ventilating, etc.)
   e. Description of items submitted and relevant specification number
   f. Notations of deviations from the contract documents
   g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

   a. Date
   b. Project title and number
   c. Architect/Engineer
   d. Contractor and subcontractors' names and addresses
   e. Supplier and manufacturer's names and addresses
   f. Division of work (e.g., plumbing, heating, ventilating, etc.)
   g. Description of item submitted (using project nomenclature) and relevant specification number
   h. Notations of deviations from the contract documents
   i. Other pertinent data
   j. Provide space for Contractor's review stamps

3. Composition:

   a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
   b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
   c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:

    a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
    b. Unstamped submittals will be rejected.
    c. The Contractor's review shall include, but not be limited to, verification of the following:

        1) Only approved manufacturers are used.
        2) Addenda items have been incorporated.
        3) Catalog numbers and options match those specified.
        4) Performance data matches that specified.
        5) Electrical characteristics and loads match those specified.
        6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
        7) Dimensions and service clearances are suitable for the intended location.
        8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
        9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

    d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
    e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:

    a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
    b. The Contractor shall clearly indicate the size, finish, material, etc.
    c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
    d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.

    a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.

16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. Submittal file name: 28 XX XX.description.YYYYMMDD
    b. Transmittal file name: 28 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.09 CHANGE ORDERS

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.

B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.

C. Change order work shall not proceed until authorized.

1.10 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

A. Exercise care in transporting and handling to prevent damage to fixtures, equipment and materials.

B. Store materials on the site to prevent damage.

C. Keep fixtures, equipment and materials clean, dry and free from harmful conditions.

1.11 NETWORK / INTERNET CONNECTED EQUIPMENT

A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.12 WARRANTY

A. At a minimum, provide a one (1) year warranty for all equipment, materials, and workmanship. Individual specifications sections within Division 28 may require additional warranty requirements for specific equipment or systems.

B. The warranty period for the entire installation described in this Division of the specifications shall commence on the date of substantial completion unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner or their representative.

C. Warranty requirements shall extend to correction, without cost to the final user, of all work and/or equipment found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from such defects or nonconformance with contract documents exclusive of repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.13 INSURANCE

A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.14 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required.

B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meets all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor bears full responsibility for the unnamed manufacturers' equipment adequately meeting the intent of design. The Architect/Engineer may reject manufacturer at time of shop drawing submittal. The Contractor assumes all costs incurred by other trades on the project as a result of changes necessary to accommodate the offered material, equipment or installation method.

D. Should this Contractor be unable to secure approval from the Architect/Engineer for other unnamed manufacturers as outlined above, this Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder. Should a voluntary alternate material be accepted, This Contractor shall assume all costs that may be incurred as a result of using the offered material, article or equipment necessitating extra expense on This Contractor or on the part of other Contractors whose work is affected.

PART 2 PRODUCTS

2.01 Refer to individual sections.

PART 3 EXECUTION

3.01 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Installation of all conduit and cabling shall comply with Sections 26 05 33 and 26 05 13. Additional conduit requirements described within this Division shall be supplemental to the requirement described in Section 26 0533. Should conflicts exist between the two Divisions the more stringent (more expensive material and labor) condition shall prevail until bidding addendum or construction clarification or RFI can be submitted and responded to. In no case shall the Contractor carry the least stringent condition in the pricing.

B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.

C. The Contractor shall be responsible for identifying and reporting to the Architect/Engineer any existing conditions including but not limited to damage to walls, flooring, ceiling and furnishings prior to start of work. All damage to interior spaces caused by this Contractor shall be repaired at this Contractor's expense to pre-existing conditions, including final colors and finishes.

D. All cables and devices installed in damp or wet locations, including any underground or underslab location, shall be listed as suitable for use in such environments. Follow manufacturer's recommended installation practices for installing cables and devices in damp or wet locations. Any cable or device that fails as a result of being installed in a damp or wet location shall be replaced at the Contractor's expense.

3.03 FIELD QUALITY CONTROL

A. General:

1. Refer to specific Division 28 sections for further requirements.
2. The Contractor shall conduct all tests required and applicable to the work both during and after construction of the work.
3. The necessary instruments and materials required to conduct or make the tests shall be supplied by the Contractor who shall also supply competent personnel for making the tests who has been schooled in the proper testing techniques.
4. In the event the results obtained in the tests are not satisfactory, This Contractor shall make such adjustments, replacements and changes as are necessary and shall then repeat the test or tests which disclose faulty or defective work or equipment, and shall make such additional tests as the Architect/Engineer or code enforcing agency deems necessary.

B. Protection of cable from foreign materials:

1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited, to overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.
2. Application of foreign materials of any kind on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

3.04 PROJECT CLOSEOUT

A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. The Architect/Engineer will not perform a final jobsite observation until the project is ready. This is not dictated by schedule, but rather by completeness of the project.

2. Refer to the end of Section 27 0500 for a "STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION."
3. The Contractor shall sign this form and return it to the Architect/Engineer so that the final observation can commence.

C. Before final payment will be authorized, this Contractor must have completed the following:

1. Submitted operation and maintenance manuals to the Architect/Engineer for review.
2. Submitted bound copies of approved shop drawings.
3. Record documents including edited drawings and specifications accurately reflecting field conditions, inclusive of all project revisions, change orders, and modifications.
4. Submitted a report stating the instructions given to the Owner's representative complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representative as having received the instructions.
5. Submitted testing reports for all systems requiring final testing as described herein.
6. Submitted start-up reports on all equipment requiring a factory installation inspection and/or start.
7. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site; submit receipt to Architect/Engineer prior to final payment being approved.

3.05 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.

4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. O&M file name: O&M.div28.contractor.YYYYMMDD
    b. Transmittal file name: O&Mtransmittal.div28.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

3.06 INSTRUCTING THE OWNER'S REPRESENTATIVE

A. Adequately instruct the Owner's designated representative or representatives in the maintenance, care, and operation of the complete systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representative or representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

D. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can be present if desired.

E. Refer to the individual specification sections for minimum hours of instruction time for each system.

F. Operating Instructions:

1. The Contractor is responsible for all instructions to the Owner and/or Owner's operating staff on the security systems.
2. If the Contractor does not have Engineers and/or Technicians on staff that can adequately provide the required instructions on system operation, performance, troubleshooting, care and maintenance, the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.07 SYSTEM STARTING AND ADJUSTING

A. The security systems included in the construction documents are to be complete and operating systems. The Architect/Engineer will make periodic job site observations during the construction period. The system start-up, testing, configuration, and satisfactory system performance is the responsibility of the Contractor. This shall include all calibration and adjustments of electrical equipment controls, equipment settings, software configuration, troubleshooting and verification of software, and final adjustments that may be required.

B. All operating conditions and control sequences shall be simulated and tested during the start-up period.

C. The Contractor, subcontractors, and equipment suppliers are expected to have skilled technicians to ensure that the system performs as designed. If the Architect/Engineer is requested to visit the job site for the purpose of trouble shooting, assisting in the satisfactory start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period through no fault of the design; the Contractor shall reimburse the Owner on a time and material basis for services rendered at the Architect/Engineer's standard hourly rates in effect at the time the services are requested. The Contractor shall be responsible for making payment to the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.08 RECORD DOCUMENTS

A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.

B. Mark specifications to indicate approved substitutions, change orders, and actual equipment and materials used.

C. This Contractor shall maintain at the job site, a separate and complete set of Security Drawings which shall be clearly and permanently marked and noted in complete detail any changes made to the location and arrangement of equipment or made to the Technology Systems and wiring as a result of building construction conditions or as a result of instructions from the Architect or Engineer. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should This Contractor fail to complete Record Documents as required by this contract, This Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.

D. Record actual routing of all conduits sized 2" or larger.

E. The above record of changes shall be made available for the Architect and Engineer's examination during any regular work time.

F. Upon completion of the job, and before final payment is made, This Contractor shall give the marked-up drawings to the Architect/Engineer.

3.09 ADJUST AND CLEAN

A. Contractor shall thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.

B. Contractor shall clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from equipment.

C. Contractor shall remove all rubbish, debris, etc., accumulated during the Contractor's operations from the premises.

3.10 SPECIAL REQUIREMENTS

A. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.

1. South Coast Air Quality Management District Rule 1168 - Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
2. South Coast Air Quality Management District Rule SCAQMD 1113 - Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

END OF SECTION 28 0500

SECTION 28 0503

THROUGH PENETRATION FIRESTOPPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Through-Penetration Firestopping.

1.02 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section.

B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.03 REFERENCES

A. UL 263 - Fire Tests of Building Construction and Materials

B. UL 723 - Surface Burning Characteristics of Building Materials

C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops

D. UL 2079 Tests for Fire Resistance of Building Joint Systems

E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)

F. Intertek / Warnock Hersey - Directory of Listed Products

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops

I. CBC California Building Code

J. The Building Officials and Code Administrators National Building Code

K. 1997 Uniform Building Code

L. 2021 International Building Code

M. NFPA 5000 - Building Construction Safety Code

1.04 SUBMITTALS

A. Submit under provisions of Section 28 0500.

B. Submit Firestopping Installers Certification for all installers on the project.

C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Intertek / Warnock Hersey Assembly number.

D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
4. F ratings for each firestop system.

E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

F. Submit VOC rating of firestopping material in g/L (less water) with documentation that it meets the limits set forth in SCAQMD Rule 1168.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.

B. Install material prior to expiration of product shelf life.

1.06 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

F. Adhesives and Sealants: All sealers, adhesives, and sealants shall comply with the low emitting material limits of the following standards:

1. CDPH Standard Method V1.1-2010 - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions VOC from Indoor Sources Using Environmental Chambers Version 1.1.
2. South Coast Air Quality Management District Rule 1168 - Adhesive and Sealant Applications. All adhesives and sealants wet-applied on site shall comply with the applicable chemical content requirements of SCAQMD Rule 1168.
3. South Coast Air Quality Management District Rule SCAQMD 1113 - Wet Applied Paints and Coatings. All paints and coatings wet-applied on site must meet the applicable VOC limits of SCAQMD Rule 1113.

1.07 WARRANTY

A. Provide one year warranty on parts and labor.

B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 PRODUCTS

2.01 THROUGH PENETRATION FIRESTOP SYSTEMS

A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.

B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.

C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.

D. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.

E. Provide firestopping systems allowing continuous insulation for all insulated pipes.

F. Any opening in walls or floors shall be coordinated with the firestopping manufacturer.

G. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 EXECUTION

3.01 EXAMINATION

A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.

C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.

D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.02 INSTALLATION

A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.

B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.

C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.03 CLEANING AND PROTECTING

A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.04 INSPECTION

A. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.

B. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.

END OF SECTION 28 0503

SECTION 28 1300

ELECTRONIC ACCESS CONTROL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Portal Devices

B. Interfaces and Integrations

1.02 RELATED WORK

A. Section 08 7100 - Door Hardware

B. Section 26 0513 - Wire and Cable

C. Section 26 0533 - Conduits and Boxes

D. Section 27 0526 - Communications Bonding

E. Section 27 0528 - Interior Communication Pathways

F. Section 27 0543 - Exterior Communication Pathways

G. Section 27 0553 - Identification and Administration

H. Section 27 1500 - Horizontal Cabling Requirements

I. Section 28 0500 - Basic Electronic Safety and Security System Requirements.

J. Section 28 0503 - Through Penetration Fire stopping.

1.03 QUALITY ASSURANCE

A. Contractor:

1. Shall be a factory-authorized installation, service and support company specializing in the selected manufacturer's product, with demonstrated prior experience of a minimum of three (3) years installing, programming and supporting the selected manufacturer's system.
2. Shall have been in business for a minimum of three (3) years and shall have installed a minimum of three (3) similar or larger sized systems. Contractor shall have a minimum of two (2) service technicians who are certified in the proposed manufacturer's system.

B. Material:

1. All material which is Contractor furnished shall be new, unused and free from defects.

2. Where more than one of any specified item of equipment or material is used, all such items shall be the same product from the same manufacturer.

1.04 REFERENCES

A. International Building Code

B. NFPA 70 - National Electrical Code.

C. The BOCA National Building Code

D. UL 294 - Standard for Access Control Systems.

1.05 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 28 0500.

B. Product Data Submittal: Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:

1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item-by-item.
2. All component options and accessories specific to this project.
3. Wiring requirements.
4. All network bandwidth, latency and reliability requirements.

C. IP Addresses: Contractor shall provide to Owner, in a documented transmittal and in Microsoft Excel format, the names and locations of devices which require an IP address. An authorized representative of the Owner shall furnish the addresses for the associated devices in Microsoft Excel format in a documented transmittal. Should Owner change the IP address structure after approval of the list, Owner may be responsible for additional fees involved with reprogramming.

D. Quality Assurance:

1. Provide materials documenting experience requirements of the manufacturer and Installing Contractor. Provide documentation of the training and other applicable certifications of the Contractor.
2. Provide system checkout test procedure to be performed at acceptance. Test procedures shall include all external alarm events.

1.06 SYSTEM DESCRIPTION

A. This section describes the furnishing, installation, programming and commissioning of additional components for existing access control system. The terms "access control system" and "security management system", or SMS, may be used interchangeably herein.

B. The company, manufacturer, and product names used in this section are for identification purposes only. All trademarks and registered trademarks are the property of their respective owners.

C. Performance Statement: This section and the accompanying access control-specific design documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment constraints described and the performance required of the system, as presented in these documents, the vendor and the Contractor are solely responsible for determining all wiring, programming, and miscellaneous equipment required. The Contractor shall be responsible for determining quantities of materials required for a complete and operational system. Floor plan drawings and schedules have been developed to aid the Contractor in determining device quantities and installation locations, but, where discrepancies between floor plans and schedules arise, the greater number shall govern.

1.07 OWNER FURNISHED MATERIAL

A. Data circuit / internet service

B. Active computer network equipment:

1. Switches
2. Wireless access points
3. Uninterruptible power supplies for Owner furnished products

C. Active computer equipment:

1. SMS server
2. SMS workstation(s)
3. SMS badging station(s)
4. Uninterruptible power supplies for Owner furnished products

D. Credentials:

1. Badges

1.08 LICENSING REQUIREMENTS

A. All user licenses required for system operation shall be included in the Contractor's bid. User licenses shall include server and workstation software, network controllers, card readers, printers, badging stations, and any other licensing that is required by the manufacturer for operation of any system component.

1. Licenses shall be provided on a one-to-one basis. One license shall be provided for each device requiring a license. In the event the manufacturer requires the purchase of a block of licenses, license blocks provided shall be no greater than what is required for the number of devices in this project. Contractor shall document the number of remaining licenses in the project record documents and Operations and Maintenance data.
2. The system described herein is an extension of an existing WAMS Software system. All licensing shall be new for each installed device. The Contractor shall not use any of the Owner's existing (spare) licenses for any new components.

1.09 PROJECT RECORD DOCUMENTS

A. Submit documents under the provisions of Section 28 0500.

B. Provide final system block diagram showing any deviations from shop drawing submittal.

C. Provide statement that system checkout test, as outlined in the shop drawing submittal, is complete and satisfactory.

D. Provide schedules documenting:

1. Controller installation locations including specific door numbers being controlled.
2. All terminal block wiring, including cable numbers.

E. Warranty: Submit written warranty and complete all Owner registration forms.

F. Complete all operation and maintenance data manuals as described below.

1.10 OPERATION AND MAINTENANCE DATA

A. Submit documents under the provisions of Section 28 0500.

B. Manuals: Final copies of the manuals shall be delivered within 30 days after completing the installation test. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the contractor responsible for the installation and maintenance of the system, and the factory representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation test shall include all modifications made during installation, checkout, and acceptance testing. Manuals shall be submitted in electronic format only, Adobe PDF. The manuals shall consist of the following:

1. Hardware Manual: The manual shall describe all equipment furnished including:

   a. General description and specifications.
   b. Installation and check out procedures.
   c. System and equipment layout and electrical schematics to the control board and field device level. For multiple devices wired identically, only one wiring diagram is required per door configuration, to be labeled "TYPICAL".
   d. Alignment and calibration procedures.
   e. Manufacturers repair parts list indicating sources of supply.

2. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, cleaning, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

1.11 WARRANTY

A. Unless otherwise noted, provide warranty for one (1) year after date of Substantial Completion for all materials and labor.

B. Operation: Upon the completion of any scheduled adjustments or repairs, Contractor shall verify operation of the SMS.

C. Service: The Owner will initiate service calls when the SMS is not functioning properly. If requested by the Owner, the Contractor shall respond or remain at the site after normal business hours, and the Owner shall reimburse the Contractor for the incremental cost difference between premium labor rates and standard labor rates. This reimbursement applies to premium labor rates that do not exceed time-and-one-half rates after normal business hours and double-time rates for Sundays and holidays. The Owner shall be furnished with telephone number(s) where service personnel can be reached 24/7/365. Qualified service personnel shall be at the site within 24 hours after receiving a request for service.

D. Records, Logs and Work Requests: Contractor shall keep records and logs of each task completed under and outside of warranty. These logs shall be maintained in Microsoft Word or Excel. The log shall include the model and serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, description of work performed, the amount and nature of the material used, and the time and date of commencement and completion of the work. Complete logs shall be kept and shall be available for review on site, demonstrating that planned and systematic adjustments and repairs have been accomplished for the SMS. The Contractor shall deliver a record of the work performed within three (3) business days after work is completed. Defective items that have been replaced shall be given to the Owner. Should the replacement item be a temporary replacement until the removed item is repaired, Contractor shall retain possession of the defective item for repair and subsequent re-installation.

E. System Modifications: Modifications by the Contractor are allowed after system acceptance. Contractor shall make recommendations for system modification in writing to the Owner. No system modifications shall be made without prior, written approval of the Owner. Any modifications made to the system shall be incorporated into the Operations and Maintenance Manuals, and other documentation affected. The Owner shall be provided with electronic restorable versions of all configurations prior to the modifications being made.

F. Software: At no charge, the Contractor shall provide to Owner all updates released by the manufacturer during the period of the warranty and verify operation of the system upon installation. These updates include system software updates, patches, bug fixes and revisions, as well as firmware updates. These updates shall be accomplished in a timely manner, fully coordinated with SMS administrators and operators, shall include training for the new changes/features, and shall be incorporated into the Operations and Maintenance Manuals and software documentation.

G. Refer to the individual product sections for further warranty requirements of individual system components.

PART 2 PRODUCTS

2.01 PORTAL DEVICES

A. Credential Readers:

1. Manufacturers:

a. Dormakaba PKP Proximity Keypad Reader integrated with door hardware. Refer to specification 08 71 00 - Door Hardware for additional information.

2. Card readers manufactured specifically for non-access control applications shall not be acceptable.

B. Cable:

1. Composite cable is allowed, although sufficient conductors may not be available in composite cables for all portal configurations. Contractor shall be responsible for additional required cables beyond one composite cable to each portal to meet functional requirements of the system.

a. Reader: 18 AWG, 3 pair, stranded, overall shield. Shield shall be grounded at control panel end only.

C. Locks and Door Hardware:

1. Electric/electronic locks shall be furnished and installed by the door hardware provider.
2. Access Control Contractor shall coordinate with door hardware provider for specified sequences of operation at the various portals.
3. Refer to architectural specifications and/or the architectural door schedule.

2.02 INTERFACES AND INTEGRATIONS

A. Elevator Interface

1. The SMS shall provide a relay based interface to the elevator system consisting of:

a. The credential reader shall be located on the outside of the cab. The car call button shall not be operational until a valid credential is presented to the reader. After valid credential presentation, the car call button shall be functional for a period of time programmed in the SMS. This functionality does not prevent tailgating.

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with the manufacturer's instructions and recommendations for installation of all products.

B. Provide all system wiring between all components as shown on the project drawings or as directed by the manufacturer, whichever is the more stringent requirement.

C. Network controllers shall be installed centralized in the nearest telecommunications room(s). Mount controllers to the structural walls in a location coordinated with other utilities. Coordinate exact location with Owner prior to installation. Provide dedicated +120 VAC power circuit to the controllers using #12 AWG wiring from the nearest electrical power distribution panel board.

D. Provide wiring and connection to all electrified locking hardware devices. Complete programming and testing of all electrified locking hardware devices.

E. Install all credential readers in accordance with manufacturer's instructions where shown on floor plans, in accordance with the Americans with Disabilities Act (ADA) requirements. Provide wiring and connection to all credential readers. Complete programming, adjustment, and testing of all credential readers.

F. Install, wire, configure, adjust, program, and test all specified interfaces and integrations between access control and other systems. Contractor shall provide all cabling, wiring, terminations, components, devices, accessories, hardware, software and other material and accessories necessary to complete all specified interfaces and integrations and make them fully operational.

G. All low voltage access control cabling shall be installed in conduit from end to end.

H. Electronic access control system cabling shall not be spliced.

I. Flexible conduit is not allowed except with prior approval. Refer to Section 26 0533 for conduit requirements. Refer to Section 27 0528 for cable hanger and support requirements.

J. Each cable shall be appropriately identified, as defined on the record documents, at each end's termination point using pressure sensitive label strips.

K. The conductor color code used in terminating system cabling at system devices shall remain consistent from device to device for each unique device type throughout the project.

L. Install and tighten all connectors in accordance with manufacturer's instructions using the appropriately designed tools recommended by the manufacturer for that purpose. Do not strip or damage connectors, terminals, or equipment by over tightening termination fasteners.

M. Grounding and Bonding Requirements:

1. Provide a minimum of 6AWG bonding conductor from each electronic access control system control panel, power supply and surge suppression device to the nearest telecommunications grounding busbar. Actual bonding conductor size is determined by its length; refer to Section 27 0526 for grounding and bonding conductor sizing criteria.
2. Cables containing shields shall not have the shields grounded at conduits, boxes, racks, etc. Ground the shield only at the control panel end.

N. Coordinate installation of all devices with other trades and utilities in the vicinity.

O. Cabling shall be plenum rated when installed outside conduit in plenum ceilings.

3.02 FIELD QUALITY CONTROL

A. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product that meets the requirements of the specifications as supplied and warranted by the system manufacturer. If the product or assembly is not available from the system vendor, provide product or assembly as recommended by the system manufacturer.

B. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the contract documents.

C. Furnish products listed and classified by Underwriters Laboratories, Inc. (UL) as suitable for purpose specified and indicated.

3.03 MANUFACTURER AND INTEGRATOR COMBINED FIELD SERVICES

A. Installation shall be performed by a factory-trained and certified Contractor.

B. The Contractor shall provide a comprehensive, site-specific customer planning guide for the system. The Contractor shall conduct conference(s) with the Owner prior to any installation to discuss the programming and configuration options of the system and the planning guide.

C. The Contractor shall include labor for all planning and all programming activities required to implement the Owner's access policies for each system point and each operator and administrator. Any software programmable access policy, within the bounds of the hardware specified, shall be included.

D. It shall be the responsibility of the Contractor to provide a complete, functional system as described by the design documents. These responsibilities include:

1. Complete hardware setup, installation, wiring and software configuration of the system server, all workstations and all peripheral hardware.
2. Configuration of the network software for operation of the system. Templates shall be established representative of all user access right levels.
3. Complete system diagnostic verification.

E. The SMS Installation Contractor shall be present at meetings to coordinate all door hardware requirements with the door hardware vendor.

3.04 SYSTEM DOCUMENTATION

A. Complete documentation shall be provided for the system. The documentation shall describe:

1. All operational parameters of the system
2. Complete documentation of programming and access policies
3. Complete operating instructions for all hardware and software

B. The following sections shall be provided in the system documentation:

1. System Administrator Manual: Provides an overview and a step-by-step guide and instructions detailing all system administrator responsibilities and functions.
2. User Manual: A step-by-step guide and instructions detailing all system user functions.
3. Alarm Monitoring Manual: A step-by-step guide and instructions detailing all alarm monitoring system functions and responsibilities.
4. Technical Maintenance Manual: A comprehensive document providing all maintenance actions, system testing schedules, troubleshooting flowcharts, functional system layout, wiring diagrams, block diagrams and schematic diagrams.
5. Refer to Part 1 for details.

3.05 SYSTEM ACCEPTANCE

A. The SMS vendor shall submit for review a formal acceptance and system checkout program. The system checkout procedures shall include all system components, software and functionality. The Contractor shall perform the tests and document all results under the supervision of the manufacturer's systems engineer.

B. All operational scenarios, as defined by the customer planning guide, shall be tested to simulate the actual use of the system in the normal operating environment. The successful completion of these operational scenarios shall be documented.

C. The system shall not be accepted until all requirements of system documentation have been completed.

END OF SECTION 28 1300

SECTION 28 1600

INTRUSION DETECTION SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Security Control Panel.

B. Initiation Devices.

1.02 RELATED WORK

A. Section 26 0533 - Conduit and Boxes

B. Section 26 0513 - Wire and Cable

C. Section 28 0500 - Basic Electronic Safety and Security System Requirements

D. Section 28 3100 - Fire Detection and Alarm Systems

1.03 QUALITY ASSURANCE

A. Manufacturer: The access control system shall be a single-source manufacturer such that the single vendor distributes, supports, warranties and services all components. The manufacturer shall have a minimum of five (5) years documented experience.

B. Installer: The installing dealer must be a factory-authorized service and support company specializing in the selected manufacturer's product, with demonstrated prior experience with the selected manufacturer's system installation and programming.

C. Servicing Contractor: The manufacturer of the system must have local service representatives within 100 miles of the project site.

1.04 REFERENCES

A. NFPA 70 - National Electrical Code.

B. UL 294 - Standard for Access Control Systems.

1.05 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 28 0500.

B. Product Data Submittal: Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:

1. Compliance with each requirement of these documents. The submittal shall acknowledge each requirement of this section, item-by-item.
2. All component options and accessories specific to this project.

3. Electrical power consumption rating and voltage.
4. Wiring requirements.

C. System Drawings: Project-specific system CAD drawings shall be provided as follows:

1. Provide a system block diagram noting system components and interconnection between components. The interconnection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration (i.e., multiple identical controllers), the diagram may show one device and refer to the others as "typical" of the device shown.
2. Provide schedules describing each system input location by an architecturally familiar reference (i.e., Door 312A). The architectural door schedule shall be used as the basis.

D. Submit detailed description of Owner training to be conducted at project end, including specific training times.

E. Quality Assurance:

1. Provide materials documenting experience requirements of the manufacturer and Installing Contractor.
2. Provide system checkout test procedure to be performed at acceptance. Test procedures shall include all external alarm events.

F. Coordination Drawings:

1. Include all ceiling-mounted devices in composite electronic coordination files. Refer to Section 28 0500 for coordination drawing requirements.

1.06 SYSTEM DESCRIPTION

A. This specification section describes the furnishing, installation, commissioning and programming of a complete, turnkey security management system.

B. Performance Statement: This specification section and the accompanying access control-specific design documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment constraints described and the performance required of the system, as presented in these documents, the Vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.

C. Basic System Description: The security management system shall provide an integrated hardware and software solution for access control.

1.07 PROJECT RECORD DOCUMENTS

A. Submit documents under the provisions of Section 28 0500.

B. Provide final system block diagram showing any deviations from shop drawing submittal.

C. Provide statement that system checkout test, as outlined in the shop drawing submittal, is complete and satisfactory.

D. Provide schedules documenting:

1. Controller installation locations including specific door numbers being controlled.
2. All terminal block wiring, including cable numbers.

E. Warranty: Submit written warranty and complete all Owner registration forms.

F. Complete all operation and maintenance manuals as described below.

1.08 OPERATION AND MAINTENANCE DATA

A. Submit documents under the provisions of Section 28 0500.

B. Operation Data: Provide full system operation instructions for each piece of equipment.

C. Maintenance Data: Document any manufacturer's recommended preventative maintenance procedures to be performed by the Owner.

1.09 WARRANTY

A. Unless otherwise noted, provide warranty for one (1) year after Date of Substantial Completion for all materials and labor.

B. The warranty shall include emergency service and repair on-site, with acknowledgment response time of one (24) hour from time of notification and on-site response within four (24) hours. The system shall be repaired and restored to operation within twenty-four (48) hours of notification.

C. Refer to the individual product sections for further warranty requirements of individual system components.

PART 2 PRODUCTS

2.01 INTRUSION DETECTION SYSTEM MANUFACTURERS

A. DMP

2.02 SECURITY CONTROL PANEL

A. Control Panel: Modular construction with surface wall-mounted enclosure.

B. Power Supply: Adequate to serve control panel modules ,remote detectors and alarm signaling devices.

1. Include battery operated emergency power supply with capacity for operating system in standby mode for 24 hours.

C. System Supervision: Provide electrically-supervised system, with supervised alarm initiating and alarm signaling circuits. Component or power supply failure places system in alarm mode.

D. Initiating Circuits: Supervised zone module with alarm and trouble indication.

E. Remote Station Signal Transmitter: Electrically supervised, capable of transmitting alarm and trouble signals over telephone lines to central station receiver.

F. Auxiliary Relays: Provide sufficient SPDT auxiliary relay contacts to provide accessory functions specified.

G. Entry and Exit Time Delays.

H. Alarm Sequence of Operation: Actuation of Intrusion Detecting device places system in alarm mode, which causes the following operations:

1. Sound and display local alarm signaling devices with non-coded signal.
2. Transmit zone-coded signal to central station.
3. Indicate location of actuated device on control panel and on remote annunciator panel.
4. Zone Bypass Switch.
5. Alarm Reset: Key-accessible reset function resets alarm system out of alarm if alarm initiating circuits have cleared.

I. Lamp Test: Manual lamp test function causes alarm indication at each zone at control panel and at annunciator panel.

2.03 INITIATION DEVICES

A. Motion Detectors:

1. Passive infrared, ceiling mounted, 12 VDC.
2. Adaptive technology for humidity and temperature stability.
3. 360-degree coverage, 60' coverage range.
4. Fresnel pattern lens with a minimum of a 30-zone pattern.

PART 3 EXECUTION

3.01 INSTALLATION

A. Comply with the manufacturer's instructions and recommendations for installation of all products.

B. Provide all system wiring between all components as directed by the manufacturer.

3.02 FIELD QUALITY CONTROL

A. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product that meets the requirements of the specifications, as supplied and warranted by the system vendor. If the product or assembly is not available from the system vendor, provide product or assembly as recommended by the system vendor.

B. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the Contract Documents.

3.03 MANUFACTURER'S FIELD SERVICES

A. Installation shall be performed by a factory-trained and certified Contractor Installer.

B. It shall be the responsibility of the Contractor/Installer to provide a complete, functional system as described by the Contract Documents. These responsibilities include:

1. Complete hardware setup, installation and wiring, and software configuration of the system.
2. Complete programming of all operator software in accordance with the Owner's access policies determined by the planning guide conference.
3. Manual data entry of cardholders based on a printed roster provided by the Owner.
4. Complete system diagnostic verification.

3.04 SYSTEM ACCEPTANCE

A. The SMS Vendor shall submit for review a formal acceptance and system checkout program. The system checkout procedures shall include all system components and software, including but not limited to all system computers, field controllers, card reader devices, biometric readers and remote system interfaces. The Contractor shall perform the tests and document all results under the supervision of the manufacturer's system engineer.

B. All operational scenarios, as defined by the customer planning guide, shall be tested to simulate the actual use of the system in the normal operating environment. The successful completion of these operational scenarios shall be documented.

3.05 SYSTEM DOCUMENTATION

A. Complete documentation shall be provided for the system. The documentation shall describe:

1. All operational parameters of the system.
2. Complete documentation of programming and access policies.
3. All data sets.
4. Complete operating instructions for all hardware and software.

B. The following sections shall be provided in the system documentation:

1. User Manual: A step-by-step guide and instructions detailing all system user functions.
2. Technical Maintenance Manual: A comprehensive document providing all maintenance actions, system testing schedules, troubleshooting flowcharts, functional system layout, wiring diagrams, block diagrams and schematic diagrams.

3.06 SYSTEM TRAINING

A. All labor and materials required for on-site system training by a certified representative of the system manufacturer shall be provided. Training shall be conducted at the project site using the project equipment.

B. Provide two weeks advanced notice of training to the Owner.

C. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.

D. At a minimum, the following training shall be conducted:

1. Alarm Monitoring Users: Provide a detailed course outlining the operational features of all aspects of the user interface. Topics shall include alarm monitoring functions, reports, error handling, alarm handling, output relay control and general overview of the report hardware.

E. Minimum on-site training times shall be:

1. Alarm Monitoring Users: One day.

END OF SECTION 28 1600

SECTION 28 2605

RESCUE ASSISTANCE COMMUNICATION

PART 1 GENERAL

1.01 DESCRIPTION

A. General:

1. Furnish all labor, materials, tools, equipment and services for a complete area of Rescue Assistance Communication System as indicated in Contract Documents and as required by the American with Disabilities Accessibility Guidelines (ADAAG).
2. Completely coordinate with work of all other trades.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

1.02 QUALITY ASSURANCE

A. Transistors, capacitors, resistors, integrated circuits and other components shall not be operated to exceed their rated values. Design systems for 24-hour continuous operation.

1.03 SUBMITTALS (REFER TO SECTION 28 0500)

A. Product Data:

1. Technical data on each product including finishes.
2. Description of system operation.
3. Riser diagrams and system data.
4. Equipment design considerations for future expansion when indicated.
5. Materials list and backbox schedule (including unique backboxes).

B. Project Data:

1. Operating and Maintenance Data: Refer to Section 28 0500.

    a. Factory-prepared operation and service manual for each system.
    b. Include operation details, schematics, wiring diagrams, color coding, terminal numbers and component values for printed-circuit boards.
    c. Owner Instruction Reports: Refer to Section 28 0500.

1.04 OPERATION

A. General: Provide two way audible/visual communication between a master annunciator station and the area of rescue assistance communication stations.

1.05 SYSTEM OPERATION

A. The master annunciator panel shall be located as defined by the Authority Having Jurisdiction. Calls placed between rescue assistance stations and the master annunciator panel shall be identifiable at the master annunciator panel to indicate which station has placed a call. The master annunciator panel shall include both a handset and a speakerphone to allow two-way communication to each station. Upon activation of an emergency pushbutton at call stations, a call will automatically be placed to the master annunciator panel. If no one answers the call, it shall automatically dial a secondary location to a continuously manned location.

B. Rescue assistance stations shall be located on each level above and below the first floor of the building within elevator lobbies.

C. Call stations shall provide audible and visual indication that a call has been placed.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Rath IP Series

2.02 EQUIPMENT

A. Master Remote Annunciator shall consist of a modular arrangement of intercom 'ON' and flashing red zone LED indicators in multiples of four zones. The annunciator panel shall include a "push to talk" and an audible alarm device with a sound level of not less than 90 dB at 30 cm. The panel shall be constructed of 0.125" thick clear anodized aluminum. Permanent silk-screened zone designations shall be provided on the panel as well as a designation strip. Backbox and panel dimensions will vary depending upon system configuration and number of zones required.

B. Power source shall be a transformer rated for total system devices with an optional battery-backed DC power supply with battery supply for continuous operation of 4 hours.

C. Wiring to call station shall be supervised. In the event of a wire fault, a yellow LED zone indicator on the annunciator shall illuminate and a repeating audio alarm shall sound.

D. Remote rescue assistance call station shall consist of one momentary switch with LED, incandescent lamp not acceptable, and one audible alarm device with a minimum sound level of not less than 70 dB at 30 cm all mounted on a one gang stainless steel plate. Permanent silk-screened designations shall be provided on the plate.

E. Wiring shall consist of 22 gauge (minimum) wire or as indicated on drawings. Three conductors plus one shielded pair are required between each rescue assistance call station and the annunciator panel not to exceed 3,000 feet. Power wire shall be 12 gauge (minimum). Two conductors are required between the power supply or transformer and the annunciator panel.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install all components and complete system as indicated and in accord with manufacturer's recommendations and instructions.

B. All cabling shall be installed to meet the applicable requirements for pathway survivability. Cabling installation shall consist of the following:

1. 2-hour fire rated circuit integrity (CI) cable
2. 2-hour fire rated cable system
3. 2-hour fire rated enclosure or protected area

C. Contractor is to provide and install a typewritten list in a Plexiglas frame permanently fastened to the wall next to the master rescue assistance annunciator panel to indicate the building location of each of the remote area of rescue assistance call stations and to which annunciator zone and LED they correspond.

D. Contractor is to provide a typewritten list of area of rescue assistance communication instructions in a Plexiglas frame permanently fastened to the wall next to each remote switch and the annunciator panel to explain the operation of the system.

E. Provide code-required signage acceptable to the Authority Having Jurisdiction at each call station location.

3.02 SYSTEM TESTING

A. Test each component and complete system for proper operation, including all modes. Perform correctional work when required. Testing shall be done in the presence of the Owner's Representative(s).

3.03 OWNER PERSONNEL INSTRUCTION

A. Instruct maintenance and staff personnel in complete operation, including actual staff use of system, by authorized distributor personnel. Arrange timing of the session in writing to best coordinate with Owner's working hours. Allow four (4) hours of training. This training session shall be videotaped by the Contractor.

3.04 SPARE PARTS

A. Provide one spare remote station.

END OF SECTION 28 2605

SECTION 28 3100 - FIRE ALARM AND DETECTION SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire alarm and detection systems.

1.02 RELATED WORK

A. Section 26 0553 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.03 QUALITY ASSURANCE

A. Manufacturer: Company specializing in smoke detection and fire alarm systems with ten years' experience.

B. Installer: A factory-authorized Electrical or Security Contractor licensed with the State and local jurisdiction with five years' experience in the design, installation, and maintenance of fire alarm systems by that manufacturer.

C. Qualifications: The person managing/overseeing the preparation of shop drawings and the system installation/programming/testing shall be trained and certified by the system manufacturer and shall be Fire Alarm Certified by NICET, minimum Level 2. This person's name and certification number shall appear on the start-up and testing reports.

1.04 REFERENCES

A. ASME A17.1 - Safety Code for Elevators and Escalators

B. **NFPA 70 - National Electrical Code (NEC)**CEC California Electrical Code

C. NFPA 72 - National Fire Alarm and Signaling Code

D. NFPA 101 - Life Safety Code

E. UL 2017 - General Purpose Signaling Devices and Systems

F. UL 217 / 268 - Standard for Smoke Alarms / Smoke Detectors for Fire Alarm Systems

G. UL 2572 - Control and Communication Units for Mass Notification Systems

H. Fire Code (CFC)

1.05 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 26 0500 and as noted below.

1. Failure to comply with all the following and all the provisions in 26 05 00 will result in the shop drawing submittal being rejected without review.
2. Failure to submit the fire alarm without all requirements fulfilled in a single comprehensive submittal will be grounds to require a complete resubmittal.

B. Provide product catalog data sheets as shop drawings.

1. Provide a product catalog data sheet for each item shown on the Electrical Symbols List and for each piece of equipment that is not shown on the drawings, but required for the operation of the system.
2. Where a particular Electrical Symbols List item has one or more variations (such as those denoted by subscripts, etc.) a separate additional product catalog data sheet shall be provided for each variation that requires a different part number to be ordered. The corresponding Electrical Symbols List symbol shall be shown on the top of each sheet.
3. Where multiple items and options are shown on one data sheet, the part number and options of the item to be used shall be clearly denoted.

C. Submit CAD Floor Plans as Shop Drawings:

1. The complete layout of the entire system, device addresses, auxiliary equipment, and manufacturer's wiring requirements shall be shown.
2. Indicate the precise routing of notification appliance circuits under the provisions of circuit survivability. Refer to "Wiring" under Part 3 - Execution of this specification section for requirements.
3. A legend or key shall be provided to show which symbols shown on the submittal floor plans correspond with symbols shown on the Contract Documents.

D. About all fire alarm circuits, provide the following: manufacturer's wiring requirements (manufacturer, type, size, etc.) and voltage drop calculations.

E. Provide installation and maintenance manuals under provisions of Section 26 0500.

F. Submit manufacturer's certificate that system meets or exceeds specified requirements.

G. Provide information on the system batteries as follows: total battery capacity, total capacity used by all devices on this project, total available future capacity.

1.06 EXTRA MATERIALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Provide quantity equal to 2 percent (2%) of amount of each type installed, but no less than two (2) units of each type.

a. Smoke and heat detectors, manual pull stations, duct smoke detectors, monitor modules, control modules and relays.
b. Notification Appliances: Speakers, speaker strobes, and strobes.

2. Keys: The installing contractor shall collect all equipment spare keys provided with each lockable or resettable device/cabinet minimum of one (1) set each and shall turn over to the Owner upon completion.
3. All spare parts shall be housed in metal cabinet labeled "Fire Alarm Spare Parts."

1.07 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 26 0500.

B. Store and protect products under provisions of Section 26 0500.

1.08 REGULATORY REQUIREMENTS

A. System: UL or FM Global listed.

B. Conform to requirements of NFPA 101.

C. Conform to requirements of Americans with Disabilities Act (ADA).

D. Conform to UL 864 Fire Alarm, UL 1076 Security, UL2017 General Signaling, and UL 2572 Mass Notification Communications.

1.09 SYSTEM DESCRIPTION

A. Performance Statement: This specification section and the accompanying fire alarm specific design documents describe the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment described and the performance required of the system, as presented in these documents, the Vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.

B. This section of the specifications includes the furnishing, installation and connection of the microprocessor controlled, intelligent reporting, fire alarm equipment required to form a complete coordinated system that is ready for operation. It shall include, but is not limited to, alarm initiating devices, emergency communication systems, control panels, auxiliary control devices, annunciators, power supplies, and wiring as indicated on the drawings and specified herein.

C. Extending the Existing GAMEWELL-FCI Fire Alarm System: The existing control panel shall remain and shall be operational throughout construction. The system shall only be disabled to make new connections and to modify the programming. A fire watch shall be provided for all areas affected during outages. All system outages must be scheduled with the Owner at least one week prior. Individual devices may be disabled as needed based on construction activities to reduce the potential for false alarms, but all devices must be operational when the Contractor is not physically on site. New initiating devices may be connected to the existing signaling line circuits where capacity is available. Provide additional signaling line circuits as needed based on existing and new device quantity, including replacement of existing panel components. Provide new notification circuits to serve the new devices, including all necessary power supplies, amplifiers, batteries, and 120-volt input circuits. All new devices shall be programmed to provide the same sequence of operation as the existing devices of the same type, unless noted otherwise.

D. Fire Alarm System: NFPA 72; Automatic and manual fire alarm system, non-coded, analog-addressable with automatic sensitivity control of certain detectors, multiplexed signal transmission.

E. Firefighter Phone System: A two-way talk path shall be provided for the fire department's use from the voice command center to the secondary fire alarm attack entrances, elevator lobbies, primary and backup power rooms and the entrance to all enclosed stairways.

F. System Supervision: Provide electrically supervised system, with supervised Signal Line Circuit (SLC) and Notification Appliance Circuit (NAC). Occurrence of single ground or open condition in initiating or signaling circuit places circuit in TROUBLE mode. Component or power supply failure places system in TROUBLE mode.

G. Alarm Reset: Key-accessible RESET function resets alarm system out of ALARM if alarm initiating circuits have cleared.

H. Lamp Test: Manual LAMP TEST function causes alarm indication at each zone at fire alarm control panel and at annunciator panels.

I. Drawings: Only device layouts and some equipment have been shown on the contract drawings. Wiring and additional equipment to make a complete and functioning system has not been shown, but shall be submitted on the shop drawings.

1.10 PROJECT RECORD DOCUMENTS

A. Submit documents under the provisions of Section 26 0500.

B. Include location of end-of-line devices.

C. Provide a CAD drawing of each area of the building (minimum scale of 1/16" = 1'-0") showing each device on the project and its address. The devices shall be shown in their installed location and shall be labeled with the same nomenclature as is used in the fire alarm panel programming.

D. Submit test results of sound pressure level (dBA) and intelligibility (STI) with the rooms tested designated on the floor plan. Notification devices shall have the tap wattage designated.

1.11 OPERATION AND MAINTENANCE DATA

A. Submit data under provisions of Section 26 0500.

B. Include operating instructions, and maintenance and repair procedures.

C. Include results of testing of all devices and functions.

D. Include manufacturer's representative's letter stating that system is operational.

E. Include the CAD floor plan drawings.

F. Include shop drawings as reviewed by the Architect/Engineer and the local Authority Having Jurisdiction.

1.12 DOCUMENT STORAGE CABINET

A. The cabinet shall have all fire alarm system documents, including record drawings, wiring diagrams, operation manuals, etc. A legend sheet permanently attached to the door shall contain system passwords and inspection logs. The enclosure shall also provide two (2) key ring holders for system keys and a location for a standard size business card with service contact information.

1. The cabinet will have, permanently and securely mounted inside, a digital flash memory device with a minimum of 4 GB of storage capacity and a standard USB B connector for uploading and downloading electronic versions of record documents and system programming information.

B. The cabinet shall be red in color with an identification label reading "FIRE ALARM DOCUMENTS". Refer to Identification Section 26 0553. The cabinet shall be lockable. Minimum cabinet size shall be 14" x 14" x 48".

C. The final version of the system database program shall be stored within the cabinet.

D. Locate cabinet in the Fire Command Room electrical room..

1.13 WARRANTY

A. Provide one (1) year warranty on all materials and labor from Date of Substantial Completion.

B. Warranty requirements shall include furnishing and installing all software upgrades issued by the manufacturer during the one (1) year warranty period.

1.14 ANNUAL INSPECTION/TESTING AND SERVICE CONTRACT

A. Provide cost to furnish service, inspect, and test all devices of the fire alarm system per the requirement of NFPA for one (1) year, starting one year after the Date of Substantial Completion. Submit written reports of inspection testing per NFPA 72, Chapter 14.

B. Provide an alternate cost for a complete inspection/testing and service/maintenance contract for the fire alarm system for one (1) year two (2) years, starting one year after the Date of Substantial Completion. Submit sample contract terms and conditions for review with shop drawings.

C. The Owner may enter into a contract directly with the vendor after shop drawing submittals. This specification is not a contract between the Owner and the vendor to perform these services.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Gamewell - FCI (compatible to existing campus FA system)

2.02 FIRE ALARM PATHWAY CLASS AND SURVIVABILITY LEVEL

A. Pathway Class:

1. Pathway Class A: Circuits capable of transmitting an alarm signal during an open or a non-simultaneous single ground fault on a circuit conductor wiring system. Wiring of outgoing and return conductors shall be physically separated by a minimum of 50 feet or by a 2-hour rated enclosure.
2. Pathway Class: SLC for addressable devices with less than 50 devices can be Class A or B, and more than 50 devices shall be Class A.

2.03 FIRE ALARM TERMINAL CABINET (FATC)

A. Fire Alarm Terminal Cabinet with locked hinged door. Provide as an extension of the main fire alarm system.

2.04 SIGNALING LINE CIRCUIT DEVICES

A. Combination Devices: Subscripts identify combination type devices when applicable. Contractor shall provide the combination device or provide multiple device(s) to meet the functionality when the manufacturer does not offer the required functionality with a single device.

B. Signal Line Device(s):

1. Subscripts: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

a. Device type as follows:

1) W = Weather Proof
2) WG = Wire guard is required
3) Candela Ratings:

a) ## = 15 Candela, 30 Candela; 75 Candela; 110 Candela; 177 Candela
b) CD = NICET designer shall select Candela rating as required to provide full coverage of the space.

b. Sequence of operation as follows:
1) E = Elevator Recall
2) D = HVAC Control
3) DH = Door Hold Release
4) FD = Fire Door Release
5) SW = Stairwell

C. Smoke Detectors:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

a. Device types as follows:

1) Blank = Photoelectric
2) AT = Attic (located in)
3) BR = Beam Receiver
4) BT = Beam Transmitter
5) CO = Combination Smoke / Carbon Monoxide
6) COH = Combination Smoke / Carbon Monoxide / Heat
7) COS = Combination Smoke / Carbon Monoxide / Strobe
8) H = Combination Smoke / Heat Detectors
9) ION = Ionization Type
10) ID = In-Duct Detector
11) SA = Stand Alone with Sounder
12) SB = Sounder Base
13) SV = Stand Alone with Sounder and 177 Candela Strobe

2. (BLANK) Analog Photoelectric Type Sensor: Shall use the photoelectric principle to measure smoke density and send data to the control panel representing the analog level of smoke density measured.

3. (ION) Analog Ionization Type Sensor: Shall use the dual chamber ionization principle to measure smoke density and send data to the control panel representing the analog level of smoke density measured.
4. (IN) In-Duct Smoke Detectors:

a. Analog Photoelectric Type Sensor: Shall use the photoelectric principle to measure smoke density and send data to the control panel representing the analog level of smoke density measured.

b. Analog Ionization Type Sensor: Shall use the dual chamber ionization principle to measure smoke density and send data to the control panel representing the analog level of smoke density measured.
c. Low Flow Type: Listed for use in duct with 0-2000 feet per minute velocity.
d. Each smoke detector shall connect directly to an SLC loop.
e. Each detector shall be mounted, where shown on the drawings, on a twist-lock base with all mounting hardware provided to match the duct application. Provide a two-piece head/base design.
f. Each detector shall have a manual switching means to set the internal identifying code (address) of that detector, which the control panel shall use to identify its address with the type of sensor connected.
g. Provide a remote LED indicator device (FA-240/241), mounted in ceiling directly below detector with a single-gang faceplate labeled: Duct Smoke Detector.

5. (SB) Analog Photoelectric Type Sensor with Sounder Base

6. Each smoke detector shall connect directly to an SLC loop, unless listed as stand alone.
7. Each detector shall be mounted, where shown on the drawings, on a twist-lock base with all mounting hardware provided. Provide a two-piece head/base design.
8. Each detector shall have a manual switching means to set the internal identifying code (address) of that detector, which the control panel shall use to identify its address with the type of sensor connected.
9. Dual alarm and power indicators shall be provided that flash under normal conditions and remain continuous under alarm or trouble conditions. Remote indicator terminals shall be provided. Provide a remote LED indicator device if detector is not visible from a floor standing position.
10. A test means shall be provided to simulate an alarm condition.
11. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location with maintained temperatures between 32°F and 120°F.

D. Duct Smoke Detectors, Sampling Tube Type:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

a. Device types as follows:

1) # = Equipment or system

b. Duct-type smoke detectors shall use the same analog photoelectric sensor technology, with the same features specified for standard smoke detectors, except with additional features as specified below.
c. Provide sampling tubes and mounting hardware to match the duct to which it is attached. Where the detector housing is larger than the duct height, Contractor shall fabricate a mounting bracket for the detector and attach according to the fire alarm manufacturer's recommendations.

d. Provide a remote alarm LED indicator device (FA-241) or (FA-242) if detector is not visible from a floor-standing position. If detector is located above a suspended ceiling, mount remote indicator in ceiling directly below detector with a white single-gang faceplate labeled: Duct Smoke Detector.

E. Heat Detectors:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

   a. Device types as follows:

      1) Blank = Combination Rate of Rise / Fixed Temp
      2) F = Fixed Temp
      3) RC = Rate Compensated

2. (BLANK) Combination rate of rise and 135°F fixed temperature analog thermal type sensor. Factory programmed to alarm at 135°F and at 15°F per minute rate-of-rise. Sensor shall measure heat level and send data to the control panel representing the analog level of thermal measurement and rate-of-rise.
3. Heat detectors shall connect directly to SLC loops. Where fixed temperature or explosion proof detectors are used, one monitor module may be used to monitor all detectors in one room/area as shown on the drawings.
4. Detectors shall be mounted, where shown on the drawings, on a twist-lock base with all mounting hardware provided.
5. Provide a remote LED indicator device if detector is not visible from a floor-standing position.
6. A test means shall be provided to simulate an alarm condition.
7. Where operation is noted as required below 32°F and/or above 120°F, a conventional device shall be installed with a unique monitor module located in the nearest available location with maintained temperatures between 32°F and 120°F.

F. Monitor Modules:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

   a. Device types as follows:

      1) Blank = Refer to Plans
      2) KB = Knox Box Monitor

2. Monitor Module shall connect directly to an SLC loop and receive power from a separate 24 VDC circuit. It shall interface initiating devices with the control panel using Style D or Style B circuits. Contractor Option: Use an interface module (2-wire operation) for Style B circuits connected to normally-open dry contacts, such as a flow switch.
3. The module shall be mounted in an enclosure located in an accessible service location as near as possible to the device(s) being monitored, or where shown on the drawings. All mounting hardware shall be provided.
4. The module shall supply the required power to operate the monitored device(s).

5. The module shall provide address setting means using rotary decimal or DIP switches.

G. Addressable Control Module:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

a. Device types as follows:

1) Blank = Refer to Plans
2) DH = Door Hold Open
3) PD = Hold Open Override

2. Relay that represents an addressable control point used primarily for the control of auxiliary devices as indicated on the drawings. Contractor to provide additional child relay(s), as required, rated for the electrical load being controlled (Contractor to match voltage, amps, etc.).
3. Relay shall connect directly to an SLC loop and receive power from a separate 24 VDC circuit.
4. The relay shall be mounted in an enclosure located in an accessible service location as near as possible to the device(s) being controlled, unless otherwise shown on the drawings. All mounting hardware shall be provided.
5. The relay shall supply 24 VDC power to the device(s) being controlled, unless otherwise indicated on the drawings.

2.05 NOTIFICATION APPLIANCE DEVICES

A. Combination Devices: Subscripts identify combination type devices when applicable. Contractor shall provide the combination device or provide multiple device(s) to meet the functionality when the manufacturer does not offer the required functionality with a single device.

B. Notification Appliance Device(s):

1. Subscripts: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

a. Device types as follows:

1) W = Weather Proof
2) WG = Wire guard is required
3) Candela Ratings:

a) ## = 15 Candela; 30 Candela; 75 Candela; 110 Candela; 177 Candela
b) CD = NICET designer shall select Candela rating as required to provide full coverage of the space.

C. Notification Device(s):

1. Wall Mounted: Red housing with white lettering or pictogram.
2. Ceiling Mounted: Red housing with white lettering or pictogram.

D. Visual Alarm Devices:

1. Wall or ceiling mounted, refer to plans.
2. High intensity (Candela rating as scheduled on the drawings) xenon strobe or equivalent under a lens. Candela rating shall be visible from exterior of the device.
3. The maximum pulse duration shall be 0.2 seconds with a maximum duty cycle of 40%. The flash rate shall be 1 Hz. Where more than two strobes are visible from any one location, the fire alarm visual devices shall be synchronized.
4. Device, housing, and backbox shall be UL listed for fire alarm/emergency applications.
5. (W) Weatherproof Visual Notification Device: High intensity strobe, square housing, 75 Candela rating, suitable for wet locations. Provide with weatherproof back box.

    a. Mounting: Semi-flush wall.
    b. Conduit shall not be exposed.

E. Combination Audio Horn and Visual Alarm Device:

1. Wall or ceiling mounted, refer to plans.
2. Combine audio and visual components into a single device. Refer to the corresponding paragraphs above for requirements of each component.
3. (W) Weatherproof Audio/Visual Notification Device: Electronic horn with high intensity strobe, square housing, 75 Candela, suitable for wet locations. Provide with weatherproof back box.

    a. Mounting: Semi-flush wall.
    b. Conduit shall not be exposed.

F. Emergency Visual Alarm Device:

1. Wall or ceiling mounted, refer to plans.
2. High intensity xenon strobe or equivalent shall have a clear lens for fire alarm annunciation strobe and an amber lens for the alert strobe. Candela rating shall be visible from exterior of the device.
3. The maximum pulse duration shall be 0.2 seconds with a maximum duty cycle of 40%. The flash rate shall be 1 Hz. Where more than two strobes are visible from any one location, the fire alarm visual devices shall be synchronized.
4. Device, housing, and backbox shall be UL listed for fire alarm/emergency applications.
5. (W) Weatherproof Visual Notification Device: High intensity strobe, square housing, 75 Candela rating, suitable for wet locations. Provide with weatherproof back box.

    a. Mounting: Semi-flush wall.
    b. Conduit shall not be exposed.

2.06 ELEVATOR SHAFT DAMPER CONTROL

A. Smoke detectors in the hoistway or elevator lobbies shall open the elevator hoistway vent automatic damper upon detection of smoke.

B. Hoistway Damper (Elevator Shaft Damper):

1. Motorized type, 120 VAC, furnished and installed by MC. Fire alarm control and power connections by EC. A subscript is used to identify a hoistway damper with a specific elevator or bank of elevators.

C. Hoistway damper switch for manual control of elevator shaft damper. 2-position selector switch for open/close control, maintained operator, NEMA ICS 5-1 contact block. Provide normally open contact for fire alarm interface. Nameplate shall identify associated elevator and open/close damper position. Surface mount enclosure provided by fire alarm vendor to match control panel.

1. Manufacturers:

a. Allen Bradley 800T-H2A
b. Square D

2.07 WIRING

A. Fire alarm wiring/cabling shall be furnished and installed by the Contractor in accordance with the manufacturer's recommendations and pursuant to National Fire Codes. Cabling shall be UL listed and labeled as complying with the Electrical Code for power-limited fire alarm signal service.

B. Fire Alarm Cable:

1. Manufacturers:

a. Comtran Corp.
b. Helix/HiTemp Cables, Inc.
c. Rockbestos-Suprenant Cable Corp.
d. West Penn Wire/CDT.
e. Radix.

PART 3 EXECUTION

3.01 SEQUENCES OF FIRE ALARM OPERATION

A. General:

1. Refer to the Fire Alarm Operation Matrix on the drawings for basic requirements and system operation.

2. The GUI/graphic annunciator shall display audible and visual alarms. The device activated shall be immediately displayed on a CAD floor plan at approximately 1/8" scale. Visual indication shall further indicate the device by utilizing an easily recognized color change of the symbol. The use of flashing symbols is encouraged.
3. All system output programs assigned via control-by-event equations to be activated by the particular point in alarm shall be executed, and the associated system outputs (alarm notification appliances and/or relays) shall be activated.

B. Audible Alarms Sequence:

1. Audible alarms throughout the building shall sound.
2. Audible alarms within the floor or fire/smoke compartment where the emergency signal originated floors shall sound.
3. Separate voice announcements shall be played in different fire compartments depending on proximity to the device that initiated the alarm. Refer to the requirements above for the Voice Command Center programming.

C. Visual Alarms Sequence:

1. Visual alarms throughout the building shall flash.
2. Visual alarms within the floor or fire/smoke compartment where the emergency signal originated and in adjacent areas shall flash.

D. Double Interlocked Preaction Sprinkler Activation Sequence:

1. The fire alarm system shall utilize an addressable relay to signal the double-interlock preaction sprinkler system to allow filling with water upon initiation of alarm in zone of sprinkler coverage.
2. Where there are multiple zones to the preaction system, a separate addressable relay shall be provided for each zone and the system shall be programmed to signal only the zone that is in the area of the fire. Coordinate with the fire protection system installer.
3. The fire alarm system shall utilize addressable monitor modules to monitor the control panel supervisory and trouble conditions.

E. Smoke Damper Control Sequence:

1. The fire alarm system shall utilize an addressable relay to open the power connection to smoke or fire/smoke dampers and allow them to close. Coordinate other requirements with damper installer.
2. Where a damper is in a main air duct, where closure of that single damper will entirely block airflow in the duct system, the smoke damper sequence shall also initiate the AHU and mechanical fan shutdown sequence for the affected unit.
3. The AHU and mechanical fan shutdown sequence shall be initiated only when ALL the dampers associated with that unit or mechanical fan are closed. Otherwise, the AHU or mechanical fan shall continue to serve other areas.
4. Smoke and fire/smoke dampers located in branch ductwork shall be closed individually or in groups, as identified on the plans.
5. All smoke and fire/smoke dampers shall be closed throughout the building.

F. AHU and Mechanical Fan Shutdown Sequence:

1. The fire alarm system shall utilize addressable relays to de-energize all AHU motor controllers and mechanical fans. Coordinate other requirements with HVAC installer.
2. The fire alarm system shall directly shut down the AHU or mechanical fan through the local HVAC control device (i.e., variable frequency drive or motor starter).
3. Where a facility has more than one AHU or mechanical fan, each shall be shutdown individually based on input from initiation devices in the area served by the unit or designated for each air distribution system.
4. All AHUs and mechanical fans shall be shutdown simultaneously throughout the building.

G. Elevator Recall Sequence:

1. Elevator recall sequences shall meet the requirements of ASME/ANSI A17.1 and NFPA 72.
2. Upon signal from a smoke detector in the machine room, hoistway, or any elevator lobby other than the "designated level" the fire alarm shall utilize an addressable relay to signal the elevator to recall to the designated level as determined by the Authority Having Jurisdiction.
3. Upon signal from a smoke detector in the elevator lobby of the "designated level," the fire alarm system shall utilize an addressable relay to signal the elevator to recall to the "alternate level" as determined by the Authority Having Jurisdiction.
4. All elevators, throughout the building, shall be recalled simultaneously.
5. All elevators that share the same hoistway, machine room or lobby shall be recalled simultaneously. Elevators served by different machine rooms, hoistways and lobbies shall continue to operate.

H. Elevator Shutdown Sequence:

1. Elevator shutdown shall meet the requirements of ASME/ANSI A17.1.
2. All elevators that share the same hoistway, machine room, or lobby shall be shut down simultaneously. Elevators served by different machine rooms, hoistways, and lobbies shall continue to operate.
3. The fire alarm system shall utilize an addressable relay to energize the shunt trip of the main elevator breaker, disconnecting power to the elevator.
4. The fire alarm system shall utilize an addressable relay to de-energize the relay on the elevator power module, disconnecting power to the elevator.

I. Elevator Hoistway Damper Sequence:

1. Provide control of each elevator shaft damper in accordance with ASME/ANSI A17.1, as indicated on the drawings.
2. The fire alarm system shall utilize an addressable relay to open or close the elevator shaft vent damper from a manually operated switch.
3. The hoistway vent damper shall open automatically when the hoistway or elevator lobby smoke detectors activate.

4. When the damper is in the open position, the fire alarm system shall provide status indication (e.g., "Elevator 2-3 damper open") on the fire alarm panels and annunciators. Once the damper is closed, the status indication shall automatically return to the normal state.

J. Access Control Override Sequence:

1. The fire alarm shall use addressable output relay(s) to signal the access control panel.
2. Refer to the access control specifications for requirement upon fire alarm signal. T

3.02 INSTALLATION

A. Install system in accordance with manufacturer's instructions and referenced codes.

B. Devices:

1. General:

a. All ceiling-mounted devices shall be located where shown on the reflected ceiling and floor plans. If not shown on the reflected ceiling or reflected floor drawings, the devices shall be installed in the relative locations shown on the floor drawings in a neat and uniform pattern.
b. All devices shall be coordinated with luminaires, diffusers, sprinkler heads, piping and other obstructions to maintain a neat and operable installation. Mounting locations and spacing shall not exceed the requirements of NFPA 72.
c. Where the devices are to be installed in a grid type ceiling system, the detectors shall be centered in the ceiling tile.
d. The location of all fire alarm devices shall be coordinated with other devices mounted in the proximity. Where a conflict arises with other items or with architectural elements that will not allow the device to be mounted at the location or height shown, the Contractor shall adjust location of device so that new location meets all requirements in NFPA 72 and all applicable building codes

2. Per the requirements of NFPA, detector heads shall not be installed until after the final construction cleaning unless required by the local Authority Having Jurisdiction (AHJ). If detector heads must be installed prior to final cleaning (for partial occupancy, to monitor finished areas or as otherwise required by the AHJ), they shall not be installed until after the fire alarm panel is installed, with wires terminated, ready for operation. Any detector head installed prior to the final construction cleaning shall be removed and cleaned prior to closeout.
3. Protection of Fire Alarm System:

a. A smoke detector shall be installed within the vicinity of the main fire alarm panel and every NAC extender panel per NFPA 72. A heat detector may be substituted when a smoke detector is not appropriate for the environment of installation.

4. Analog Smoke and Heat Detectors:

    a. In elevator shafts and elevator equipment rooms, provide a heat detector for elevator shutdown within 2' of every sprinkler head. Coordinate with fire protection contractor.

5. Duct-type Analog Smoke Detectors:

    a. Duct-type analog smoke detectors shall be installed on the duct where shown on the drawings and details. The sampling tubes shall be installed in the respective duct at the approximate location where shown on the electrical drawings to meet the operation requirements of the system.
    b. All detectors shall be accessible.
    c. Duct-type detectors shall be installed according to the manufacturer's instructions.

6. In-Duct Analog Smoke Detectors:

    a. In-duct analog smoke detectors shall be installed in the duct where shown on the drawings and details. The devices shall be installed in the respective duct at the approximate location where shown on the electrical drawings to meet the operation requirements of the system.
    b. All detectors shall be accessible.

7. Heat Detector, Linear Wire Type:

    a. Install detection wire within 20 inches of the underside of building roof, floor, or as recommended by the manufacturer.
    b. The protected area shall not exceed 4,000 square feet per zone. Provide a separate zone for areas divided by fire/smoke rated walls.

8. Manual Pull Stations:

    a. Stations shall be located where shown and at the height noted on the drawings.

9. Addressable Relays and Monitor Modules:

    a. Modules shall be located as near to the respective monitor or control devices as possible, unless otherwise indicated on the drawings.
    b. All modules shall be mounted in or on a junction box in an accessible location.
    c. Where not visible from a floor standing position, a remote indicator shall be installed to allow inspection of the device status from a local floor standing location.

10. SLC Loop Isolation Modules:

    a. Isolation modules shall be installed to limit the number of addressable devices that are incapacitated by a circuit fault.

b. Install all Isolation Modules within the fire alarm control panel, unless otherwise indicated on the drawings. Refer to the fire alarm riser diagram for requirements. Refer to the floor plans for areas served by separate isolation modules.

11. Notification Appliance Devices:

a. Devices shall be located where shown on the drawings.
b. Wall-mounted audio, visual and audio/visual alarm devices shall be mounted as denoted on the drawings.
c. Where ceiling mounted visual alarm devices or combination audio/visual alarm devices are shown where the ceiling is greater than 30'-0" high, they shall be stem mounted so that the entire unit is below 30'-0". This does not apply to audio-only alarm devices.

C. Wiring:

1. Fire alarm wiring/cabling shall be provided by the Contractor in accordance with the manufacturer's recommendations and pursuant to National Fire Codes.
2. Wiring shall be installed in conduit. Refer to Identification Section 26 0513 for color and identification requirements.
3. Wiring shall be installed in conduit from device to above accessible ceilings. Exposed plenum-rated cable (FPLP) shall be used above accessible ceilings supported every 4 feet or run in cable trays (if applicable) maintaining a minimum of 5-inches clearance from all lighting ballasts. Fire alarm cabling shall not be installed in the same bridle rings or cable trays designated for the cabling of other systems.
4. All junction boxes with SLC and NAC circuits shall be identified on cover. Refer to Identification Section 26 0513 for color and identification requirements.
5. Partial evacuation or relocation of occupants is the standard operating procedure for this facility in the event of an alarm. Therefore, all notification appliance circuits (NAC), including circuits serving NAC extender panels and other network communication circuits, must be installed and protected in accordance with the "circuit survivability" requirements described in NFPA 72. Contractor shall maintain the following:

a. NACs serving separate evacuation signaling zones shall be routed separately such that they are no less than 4 feet apart when run horizontally and 1 foot apart when run vertically. They may come simultaneously only within 10 feet of the control panel. Evacuation signaling zones are identified on the drawings.
b. NACs passing through other evacuation signaling zone(s) shall be installed in conduit and routed through the 2-hour fire-rated chase(s) or enclosure(s) identified on the drawings.
c. NACs passing through other evacuation signaling zone(s) shall be Electrical Code classified CIC cable (Fire Alarm Circuit Integrity) installed in conduit. Provide CIC cable meeting UL requirements for 2-hour listing.

1) The CIC cable system shall be installed in a conduit system meeting all requirements of its UL-listed installation system (conduit, boxes, connectors, etc.).

6. Fire Alarm Power Branch Circuits: Building wiring as specified in Section 26 0513.
7. Notification Appliance Circuits shall provide the features listed below. These requirements may require separate circuits for visual and audible devices.

    a. Fire alarm temporal audible notification for all audio appliances.
    b. Synchronization of all visual devices where two or more devices are visible from the same location.
    c. Ability to silence audible alarm while maintaining visual device operation.
    d. Emergency communication alert and textual visible appliance notification.

8. Notification Appliance Circuits shall not span floors or smoke compartments. Refer to architectural drawings for smoke compartments
9. Signal line circuits connecting devices shall not span floors or 2-hour smoke compartments.
10. Signal line circuits connecting devices shall be provided with an isolation module at each floor separation or as otherwise shown on the drawings.
11. No wiring other than that directly associated with fire alarm detection, alarm or auxiliary fire protection functions shall be in fire alarm conduits. Wiring splices shall be avoided to the extent possible, and if needed, they shall be made only in junction boxes, and enclosed by plastic wire nut type connectors. Transposing or changing color coding of wires shall not be permitted. All conductors in conduit containing more than one wire shall be labeled on each end, in all junction boxes, and at each device with "E-Z Markers" or equivalent. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite to its terminal. Cabinet terminals shall be numbered and coded, and no unterminated conductors are permitted in cabinets or control panels. All controls, function switches, etc. shall be clearly labeled on all equipment panels.

D. Fire Alarm Cabling Color Code: Provide circuit conductors with insulation color coding as follows, or using colored tape at each conductor termination and in each junction box.

1. Power Branch Circuit Conductors: In accordance with Section 26 0553.
2. Signaling Line Circuit: Overall red jacket with black and red conductors.
3. DC Power Supply Circuit: Overall red jacket with violet and brown conductors.
4. Notification Appliance Circuit: Overall red jacket with blue and white conductors.
5. Door Release Circuit: Gray conductors.
6. Central Station Trip Circuit: Orange conductors.
7. Central Station Fire Alarm Loop: Black and white conductors.

E. Devices surface mounted in finished areas shall be mounted on surface backboxes furnished by fire alarm equipment supplier. Backboxes shall be painted to match device, shall be the same shape and size as the device shall not have visible knockouts.

F. Make conduit and wiring connections to door release devices, sprinkler flow and pressure switches, sprinkler valve monitor switches, fire suppression system control panels, duct analog smoke detectors and all other system devices shown or noted on the Contract Documents or required in the manufacturer's product data and shop drawings.

3.03 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 26 0500.

B. Test in accordance with NFPA 72, Chapter 14 and local fire department requirements. Submit documentation with O & M manuals in accordance with Section 14.6 of the Code.

C. Contractor shall test and adjust the fire alarm system as follows:

1. Speaker taps shall be adjusted to the lowest tap setting which achieves a sound level higher than or equal to the greatest of the following:

    a. 70dBA.
    b. 15 dBA above ambient levels as indicated in NFPA 72 Table A.18.4.3.
    c. 15 dBA above measured ambient. 5 dBA above the maximum measured sound level with duration of more than 60 seconds.
    d. As specified on the drawings.

2. Sound level measurement procedure shall meet the following requirements:

    a. All measurements shall use the 'A' weighted, dBA, sound measurement scale.
    b. All measurements shall be taken after furnishings, wall coverings and floor coverings are in place.
    c. All measurements shall be taken after fixed equipment (HVAC units, etc.) producing ambient noise is installed and is in operation.
    d. Final ambient sound measurements shall be taken during occupancy and the units shall be re-adjusted at that time, if necessary.
    e. All sound level measurements shall be taken at a height of 5' above the finished floor level.
    f. Measurements shall be taken in every unique room. If there are multiple rooms, which have the identical dimensions and function, 10%, or a minimum of two (2) rooms shall be tested. The results from the rooms tested shall be averaged and the remaining rooms may be adjusted per the average.
    g. Measurements shall be taken on a 20' x 20' grid and the results for all points taken shall be averaged. If the room is smaller than 20' x 20' a minimum of two measurements are required.
    h. Measurements shall be taken halfway between speakers or halfway between a speaker and the wall. No measurements shall be taken at the extreme edges of the room, nor directly under speakers.

D. Additionally, test the voice alarm communication system intelligibility per IEC 60849:
1. Utilize equipment designed to test per IEC 60849 per the equipment manufacturer's instructions. This equipment includes a signal generator, which is input to the fire alarm system and a portable measurement device. This equipment is available from Simplex Grinnell or Gold Line.
2. Testing equipment that can simulate 'crowd babble' shall be used in rooms with occupancy of greater than 200.
3. Wide-area notification intelligibility shall be tested in acoustically distinguishable spaces and areas as designated by the Owner.

4. When testing for intelligibility, the quantity and location of the measurement points shall be the same as the points used for measurement of dBA level.
5. Provide a room by room report, showing the average dBA level and STI for each room tested, the number and location of. The report shall be presented to the Architect/Engineer in an Excel .xls file.

3.04 MANUFACTURER'S FIELD SERVICES

A. Provide manufacturer's field services under provisions of Section 26 0500.

B. Include services of the manufacturer's software programmer to write initial custom-user program

C. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

D. Note that room numbers depicted on the architectural/engineering drawings will not necessarily reflect the actual room (signage) numbers that the Owner selects. Contractor and fire alarm manufacturer shall coordinate the actual room numbers as the Owner directs to identify each device. This list shall be a part of the floor plan record drawing to be turned in at the project closeout.

E. Include the services to train up to three of the Owner's staff in operation, maintenance, and programming of the fire alarm system at the manufacturer's factory. Airfare and lodging expenses for the Owner's staff will be by the Owner.

F. System Occupancy Adjustments: When requested by Owner within 12 months of date of Substantial Completion, provide on-site system adjustments to suit actual occupied conditions. For this purpose, provide up to two (2) site visits, four (4) hours each visit, outside normal occupancy hours.

3.05 SYSTEM TRAINING

A. System training shall be performed under provisions of Section 26 0500.

B. Minimum on-site training times shall be:

1. System Operators: One (1) day.
2. GUI Operation and Editing: One (1) day.
3. Emergency Communication System: Four (4) hours.

END OF SECTION 28 3100

SECTION 31 0000

EARTHWORK

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Materials, equipment, and labor required to provide grading and fine grading as indicated on Drawings and as specified.
2. Work includes, but may not be limited to:
   a. Excavation, compacted engineered fill, and preparing of subgrade for building footings, slabs, walks, and pavements.
   b. Excavating and backfilling of trenches and excavations.
3. Geotechnical Data reference and information.

B. Related Sections:
~~1. Section 01 4100: Regulatory Requirements; current Code edition.~~
~~2. Section 01 4500: Quality Control; soil testing requirements~~
~~3. Section 01 5000: Temporary Facilities and Controls; barriers and temporary controls.~~
~~4.~~1. Section 01 5713: Temporary Erosion and Sedimentation Controls
~~5. Section 02 4113: Selective Site Demolition~~
~~6.~~2. Section 32 0117: Asphalt Paving Repair
~~7. Section 32 0129: Concrete Paving Repair~~
~~8.~~3. Section 32 1100: Base Course; base material under paving.
~~9.~~4. Section 32 1216: Asphalt Paving
~~10.~~5. Section 32 1313: Concrete Paving

C. Related Requirements:
1. Excavating and Backfilling for Utility Work:
   a. Refer to Division 26 Sections for excavation and backfill required for underground electrical utilities and related buried appurtenances.
   b. Refer to Division 33 Sections for additional trenching and backfilling requirements for underground site utilities piping and related buried appurtenances.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, current edition of California Building Code (CBC), Part 2, Volumes 1 and 2.

B. ASTM International (ASTM):
1. ASTM D 448 – Standard Classification for Sizes of Aggregate for Road and Bridge Construction
2. ASTM D 1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))

3. ASTM D 2487 – Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
4. ASTM E 699 – Standard Practice for Evaluation of Agencies Involved in Testing, Quality Assurance, and Evaluating of Building Components

C. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO – Standard Specifications for Highway Materials and Methods of Sampling and Testing.

D. State of California Department of Transportation (Caltrans):
1. Standard Specifications:
   a. Division IV – Subbases and Bases
      1) Section 26 – Aggregate Bases.

E. Public Works Standards, Inc.:
1. Standard Specifications for Public Works Construction (SSPWC):
   a. The "Greenbook"; current edition.
2. Standard Plans for Public Works Construction (SPPWC); current edition.

1.03 DEFINITIONS

A. Excavation:
1. Consists of removal of material encountered to subgrade elevations indicated and subsequent use of excavated material as fill, disposal off-site, or stockpiled for future use of materials removed.

B. Unauthorized Excavation:
1. Consists of removal of materials beyond indicated subgrade elevations or dimensions without specific direction of Architect.
2. Unauthorized excavation, as well as remedial work directed by Civil Engineer upon receipt of written authorization from Architect, will be at Contractor's expense.
3. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom, without altering required top elevation.
   a. Lean concrete fill may be used to bring elevations to proper position, when acceptable to Civil Engineer.
4. In locations other than those above, backfill and compact unauthorized excavations as specified by Civil Engineer for authorized excavations of same classification, unless otherwise directed by Architect.

C. Additional Excavation:
1. When excavation has reached required subgrade elevations, notify Architect, who will notify Civil Engineer to make inspection of conditions.
2. Should Civil Engineer determines that bearing materials at required subgrade elevations are unsuitable, continue excavation until suitable bearing materials are encountered and replace excavated material specified by Civil Engineer and directed by Architect.
3. Contract sum may be adjusted by appropriate Contract modification.

4. Removal of unsuitable material and its replacement as directed will be paid on basis of General Conditions of the Contract relative to changes in Work.

D. Subgrade:
   1. Undisturbed earth or compacted soil layer immediately below granular sub-base, drainage fill, or topsoil materials.

1.04 SUBMITTALS

A. Test Reports:
   1. Submit following reports directly to Architect from testing services, with copy to Contractor:
   2. Test reports on borrow material.
   3. Verification of suitability of each footing subgrade material, in accordance with specified requirements.
   4. Field Reports:
      a. In-place soil density tests.

1.05 QUALITY ASSURANCE

A. Codes and Standards:
   1. Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

B. Testing and Inspection Service:
   1. Owner will employ and pay for qualified independent geotechnical testing laboratory to perform soil testing and inspection service during earthwork operations.

C. Testing Laboratory Qualifications:
   1. To qualify for acceptance, geotechnical testing laboratory must be Division of the State Architect (DSA) approved and demonstrate to Architect's satisfaction, based on evaluation of laboratory-submitted criteria conforming to ASTM E 699, that it has experience and capability to conduct required field and laboratory geotechnical testing without delaying progress of Work.

D. Foundation Soils:
   1. Excavate for foundations to sizes indicated, clean and leave in condition recommended by Civil Engineer.
   2. Prior to placement of forms, reinforcing or concrete, obtain approval of Civil Engineer and DSA Project Inspector as required, for proper conditions and suitable bearing materials.

1.06 PROJECT CONDITIONS

A. Noise and Dust Abatement:
   1. Exercise reasonable and necessary means to abate dust, dirt rising and undue noise.
      a. Perform necessary sprinkling and wetting of construction site to allay dust.

B. Existing Utilities:
   1. Locate existing underground utilities in areas of excavation work.
   2. Where utilities are indicated to remain in place, provide adequate means of support and protection during earthwork operations.
   3. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for direction.

4. Cooperate with Owner and utility companies in keeping respective services and facilities in operation.
   a. Repair damaged utilities to satisfaction of utility owner.
5. Do not interrupt existing utilities serving facilities occupied by Owner or others, during occupied hours, except when permitted in writing by Architect and then only after acceptable temporary utility services have been provided.
   a. Provide minimum of forty-eight hour notice to Architect and Owner and receive written notice to proceed before interrupting utility.
6. Demolish and completely remove from Project Site existing underground utilities indicated to be removed.
   a. Perform backfilling for abandoned underground utilities conforming to Articles 2.01 – Soil Materials and 3.05 – Backfill and Fill of SSPWC.
   b. Coordinate with utility companies for shutoff of service if lines are active.

C. Protection of Subgrade:
1. Do not allow equipment to pump, rut or disturb subgrade, stripped areas, or other areas prepared for backfill or paving operations.

1.07 GEOTECHNICAL INVESTIGATION DATA ~~*[Edit A & B as necessary to suit Project*~~

A. Soil, geologic, and seismic investigations were conducted at Project Site, and results are to be found in following report:
1. Report No. ~~350~~57083.22, dated ~~January 13~~November 18, ~~2016~~2022
2. Report: Report of Geotechnical Investigation
~~Mayfair Middle/High School~~
Proposed ~~Two-Story Stream~~New Classroom Building
~~Lakewood, California~~Will Rogers Middle School
~~Prepared for Bellflower Unified School District~~4110 West 154th Street, City of Lawndale, California
Prepared for Lawndale Unified School District c/o The Toth Group
3. Report Addendum: Addendum regarding AC and PCC Pavement Recommendations, dated September 28, 2023

B. Report Prepared By: ~~John R. Byerly~~Associated Soils Engineering, Inc.
~~2257 South Lilac Avenue~~2860 Walnut Avenue, Signal Hill, CA-90755
~~Bloomington, CA 92316-2903~~
(T) ~~909.877.1324~~562.426.7990

C. Geotechnical investigation data is not part of Contract Documents, but is made available by Owner as "Information Available to Bidders".
1. Bidders are strongly urged to examine entire geotechnical investigation data and make their own examination of Site prior to bidding.
2. Bidders must make their own determination of conditions which affect performance of Work.

D. Report data on indicated subsurface conditions is not intended as representations or warranties of accuracy or continuity between soil borings.
1. It is expressly understood that Owner, Architect, and Geotechnical Consultant will not be responsible for interpretations or conclusions drawn therefrom by

Bidder.

2. Owner, Architect, and Geotechnical Consultant further disclaim responsibility for interpretation of data by bidders, as in projecting soil-bearing values, rock profiles, soil stability and presence, level and extent of underground water.

E. Additional Test Borings and Other Exploratory Operations:
   1. Prior to bidding, bidders may request permission to make their own subsurface investigations to satisfy themselves as to site and subsurface conditions at no cost to Owner.
      a. Such investigations may be performed only under time schedules and arrangements approved in advance by Owner and Architect.
   2. Upon completion of additional exploratory work, restore Site as directed by Owner.
      a. Backfill test holes and pits using removed material.
      b. When removed material is not sufficient, provide additional compatible material of similar character to native soil.
      c. Compact backfill to same density as adjacent soil.
   3. Contractor shall be fully responsible for deductions or conclusions made on basis of information or data collected from additional exploratory work.

F. Project Geotechnical Engineer will be retained by Owner to observe performance of Work in connection with excavating, trenching, filling, backfilling, and grading, and to perform compaction tests.

G. Readjust Work performed that does not meet technical or design requirements, but make no deviation from Contract Documents without specific and written approval from Architect.

H. In addition to complying with requirements of governmental agencies having jurisdiction, comply with directives of Project Geotechnical Engineer at Project Site during earthwork operations.
   1. Notify Architect of discrepancies in specifications and actual site conditions, or of discrepancies between Project Geotechnical Engineer's directives and Contract Documents.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

A. Imported Soil and Suitable on-site soil Materials:
   1. Imported Soils (~~F~~Fill soil imported to Project Site):
      a. Shall consist of predominantly “Very Low” to “Low” expansive soils exhibiting an EI not greater than 50
      ~~a. Granular, with expansion index of less than twenty.~~
      b. ~~Classified as SM, SW, and SP in accordance with ASTM D 2487~~Exhibits a relatively uniform gradation, free of debris, particles greater than 4 inches in maximum dimension, organic matter or other deleterious materials.
      c. Shall comply with the soil corrosivity criteria per Geotechnical Report on Article 1.07

b.

2. Suitable on-site SoilsImport Fill:

2.

a. Free of rock and lumps of soil larger than three four inches in diameter, organic matter, or other deleterious materials.

b. Be at least sixty percent finer than 1/4 inch sieve.

B. Utility Trench Backfill:

1. Provide material for use in backfilling trenches consisting of hard, durable, clean sand, gravel, or crushed stone.

a. Free from organic material, clay balls, or other deleterious substancesFree of debris, particles greater than 4 inches in maximum dimension, organic matter or deleterious materials.

b. Not environmentally contaminated.

a.c. Adequately moisture conditioned to permit achieving the required compaction. No nesting of large particles (2 to 4-inch size) shall be permitted during backfilling operations.

C. Engineered Fill:

1. Imported soil as discussed in Article 2.01.A.1.

2. Blending imported soil to suitable on-site soils

a. Excavated on-site soils that are to be blended such that the resultant EI is not exceeding 50, blend one part of excavated site soils with four parts of imported “Very Low” (EI≤20) expansive soils.

3. On-site soils treated with quicklime or cement. Blend 5 to 8 percent of quicklime (by weight of dry on-site soils) into suitable excavated on-site soils. Guidelines and procedures for lime treatment of soils stipulated in Section 301-5 of the Greebook shall be followed.

C.

1. Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand:

a. With at least 90 percent passing 1-1/2-inch sieve and not more than 12 percent passing No. 200 sieve.

b. Comply with Caltrans Standards where applicable.

2.02 BASE MATERIALS

A. Subbase:

1. Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand:

a. With at least 90 percent passing 1-1/2 inch sieve and not more than 12 percent passing No. 200 sieve.

b. Comply with Caltrans Standards where applicable.

B. Base:

1. Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand:

a. With at least 95 percent passing 1-1/2 inch sieve and not more than 8 percent passing No. 200 sieve for Class II Base.

C. Bedding:
1. Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand:
a. Except with 100 percent passing 1 inch sieve and not more than 8 percent passing No. 200 sieve.
~~a.~~2. For bedding or shading of utilities, on-site soils are not considered suitable. Imported soils for pipe bedding shall consist of non-expansive grabular soils having a tested Sand Equivalent (SE) (per ASTM D 2419-14 test Method testing) value not less than 30.

D. Drainage Course:
1. Washed, narrowly graded mixture of crushed stone, or crushed or uncrushed gravel:
2. Complying with ASTM D 448:
a. Coarse-aggregate gradation:
b. Size:
1) No. 57 with 100 percent passing 1-1/2 inch sieve and 0 to 5 percent passing No. 8 sieve.

PART 3 EXECUTION

3.01 EXCAVATION

A. Excavation Classifications:
1. Following classifications of excavation will be made when rock is encountered:
a. Earth excavation includes excavation of pavements and other obstructions visible on surface, including but not necessarily limited to:
1) underground structures and utilities
2) Other items indicated to be demolished and removed.
a) Along with with earth and other materials encountered that are not classified as rock or unauthorized excavation.

3.02 STABILITY OF EXCAVATIONS

A. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction.
1. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
2. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

3.03 STORAGE OF EXCAVATED MATERIALS

A. Stockpile excavated materials acceptable for backfill and fill where directed.
1. Place, grade and shape stockpiles for proper drainage.
2. Locate and retain soil materials horizontally away from edge of excavations equal to depth of excavation.
3. Do not store within drip line of trees indicated to remain.
4. Dispose of excess excavated soil materials not acceptable for use as backfill or fill.

3.04 TRENCH EXCAVATION FOR PIPES AND CONDUIT

A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and minimum of six to nine inches of clearance on both sides of pipe or conduit.

B. Excavate trenches and conduit to depth indicated or required to establish indicated slope and invert elevations and to support bottom of pipe or conduit on undisturbed soil.
   1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.
   2. Where rock is encountered, carry excavation six inches below required elevation and backfill with six inch layer of crushed stone or gravel prior to installation of pipe.
   3. For pipes or conduit less than six inches in nominal size, and for flat-bottomed, multiple-duct conduit units, do not excavate beyond indicated depths.
      a. Hand-excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
   4. For pipes and equipment six inches or larger in nominal size, shape bottom of trench to fit bottom of pipe for ninety degrees (bottom 1/4 of circumference).
      a. Fill depressions with tamped sand backfill.
      b. At each pipe joint, dig bell holes to relieve pipe bell of loads to ensure continuous bearing of pipe barrel on bearing surface.

3.05 BACKFILL AND FILL

A. Fill Material and Backfill Material:
   1. Consisting of satisfactory soil material, ~~ or~~ imported or blended soil materials as specified in Part 2 of this section.
      a. Place in maximum ~~six~~ eight inch thick compacted layers to required subgrade elevations, except as follows:
         1) Under Walks:
            a) Upper ~~four~~ eighteen (18) inches of fill shall consist of sub-base as defined in Article 2.01 C. 1, or base material as defined in Section ~~_____~~32 1100.
         2) Under Interior Building Slabs:
            a) Upper ~~four inches~~three feet of fill shall consist ~~_____~~ of ~~compactable sand or rock as~~ engineered fill or competent fill layer specified in Article 2.~~01A~~01C.1, 2.01C.2, or 2.01C.3.
      b. Under Piping and Conduit and Equipment:
         1) Use sub-base materials where required over rock bearing surface and for correction of unauthorized excavation.
         2) Shape excavation bottom to fit bottom ninety degrees of cylinder.
      c. Backfill trenches with concrete where trench excavations pass within eighteen inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings.
         1) Place concrete to level of bottom of adjacent footing.
         2) Concrete is specified in Section 03 3000.
         3) Do not backfill trenches until tests and inspections have been made and backfilling is authorized by Architect.

4) Use care in backfilling to avoid damage or displacement of pipe systems.

B. Backfill excavations as promptly as Work permits, but not until completion of following:
1. Acceptance of construction below finish grade.
2. Inspection, testing, approval, and recording locations of underground utilities have been performed and recorded.
3. Removal of:
   a. Concrete formwork.
   b. Shoring and bracing, and backfilling of voids with satisfactory materials.
   c. Trash and debris from excavation.
4. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

3.06 PLACEMENT AND COMPACTION

A. Ground Surface Preparation:
1. Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills.
2. Plow strip or break up sloped surfaces steeper than one vertical to four horizontal (1:4) so that fill material will bond with existing surface.
3. When existing ground surface has density less than that specified under "Compaction" for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content or slightly above, and compact to required depth and percentage of maximum density.
4. Where unsuitable material described above, is greater than twelve inches thick, material will have to be removed and recompacted as directed by Civil Engineer.

B. Place backfill and fill materials in layers not more than eight inches in loose depth for material compacted by heavy compaction equipment, and not more than four inches in loose depth for material compacted by hand-operated tampers.

C. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content or slightly above.
1. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification.

D. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations.
1. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

E. Control soil and fill compaction, providing minimum percentage of density specified for each area classification indicated below.
1. Correct improperly compacted areas or lifts as directed by Architect if soil density tests indicate inadequate compaction.
2. Percentage of Maximum Density Requirements:

~~a.~~ Compact soil to not less than the following percentages of maximum density, in accordance with ASTM D 1557:

a.

b. Under ~~Foundations,~~ Building Slabs and Steps:
   1) Compact top ~~eighteen inches~~three feet of subgrade and each layer of backfill or fill material at ninety percent maximum density.
c. Under Pavements:
   1) Compact top ~~twelve~~ eighteen inches of subgrade and each layer of backfill or fill material at ninety percent maximum density.
d. Under Lawn or Unpaved Areas:
   1) Compact top six inches of subgrade and each layer of backfill or fill material at eighty percent maximum density.
e. Under Walkways:
   1) Compact top ~~twelve~~ eighteen inches of subgrade and each layer of backfill or fill material at ninety percent maximum density.

3. Moisture Control, under direction of Civil Engineer:
   a. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material.
   b. Apply water in minimum quantity as necessary to prevent free water from appearing on surface during or subsequent to compaction operations.
   c. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
   d. Stockpile or spread soil material that has been removed because it is too wet to permit compaction.
   e. Assist drying by disking, harrowing or pulverizing until moisture content is reduced to satisfactory value.

3.07 GRADING

A. Uniformly grade areas within limits of grading under this section, including adjacent transition areas.
   1. Smooth finished surface within specified tolerances, compact with uniform levels or slopes between points where elevations are indicated, or between such points and existing grades.

B. Grading Outside Building Lines:
   1. Grade areas adjacent to building lines to drain away from structures and to prevent ponding.
   2. Finish surfaces free from irregular surface changes and as follows:
      a. Lawn or Unpaved Areas:
         1) Finish areas to receive topsoil to within not more than 0.10 foot above or below required subgrade elevations.
      b. Walks:
         1) Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 0.10 foot above or below required subgrade elevation.
      c. Pavements:
         1) Shape surface of areas under pavement to line, grade, and cross-section, with finish surface not more than 1/2 inch above or below required subgrade elevation.

3.08 EROSION CONTROL

A. Provide erosion control methods in accordance with requirements of authorities having jurisdiction.
   1. Comply with additional requirements specified in Section 01 5713,

3.09 MAINTENANCE

A. Protection of Graded Areas:
   1. Protect newly graded areas from traffic and erosion and keep free of trash and debris.

B. Repair and reestablish grades in settled, eroded, and rutted areas to specified tolerances.

C. Reconditioning Compacted Areas:
   1. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

3.10 DISPOSAL OF EXCESS AND WASTE MATERIALS

A. Removal from Owner's Property:
   1. Remove waste materials, including unacceptable excavated material, trash, and debris, and legally dispose of it off Project Site.
   2. Comply with requirements specified in Section 01 7419.

END OF SECTION 31 0000

SECTION 31 1000

SITE CLEARING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes: ~~*[Edit list to suit Project]*~~
   1. Removal of organic materials, including but not necessarily limited to:
      a. Vegetation such as:
         1) Grass and grass roots.
         2) Shrubs
         3) Trees, tree roots, tree stumps, and upturned stumps.
         4) Weed growth.
         5) Brush.
      b. ~~Additioal~~ Additional items not included elsewhere, such as:
         1) Rubbish, debris, and other objectionable materials, within limits of Work.
      c. Provide dust control measures.
         1) As required by authorities having jurisdiction.
   2. Conform to work restrictions for archaeology, endangered species, and hazardous materials, when required.
      a. Provide dust control measures conforming to requirements of Section 01 5000.
   3. Protection of existing materials to remain.
      a. Includes tree protection fences.

B. Related Sections:
   ~~1. Section 01 4100: Regulatory Requirements; current Code edition.~~
   ~~2. Section 01 5000: Temporary Facilities and Controls; barriers and temporary controls.~~
   ~~3.~~1. Section 01 5713: Temporary Erosion and Sediment Controls; maintenance of controls during site clearing operations.
   ~~4.~~2. Section 31 0000: Earthwork

C. Related Requirements:
   1. Refer to Division 32 Landscaping Sections for additional requirements.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.

B. ASTM International (ASTM):
   1. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).

C. Public Works Standards, Inc.:

1. Standard Specifications for Public Works Construction (SSPWC):
   a. The "Greenbook"; current edition.
2. Standard Plans for Public Works Construction (SPPWC); current edition.

1.03 SUBMITTALS

A. Shop Drawings:
   1. When requested, provide site plan indicating extent of site clearing.

1.04 QUALITY ASSURANCE

A. Comply with SSPWC “Greenbook” as minimum requirement.

PART 2 PRODUCTS *(Not Applicable)*

PART 3 EXECUTION

3.01 TREE AND PLANT PROTECTION – GENERAL

A. Preserve and protect existing trees and plants at Project Site that are designated to remain, and those adjacent to Project Site.
   1. Perform clearing without damage to undergrowth, and ground surfaces which occur outside of areas indicated to be cleared as indicated on Drawings and are to remain undisturbed.

B. Protect individual trees which lie within areas to be cleared, which are banded and identified to remain, from damage.
   1. Provide temporary barriers around each, or around each group of trees or plants.

C. Trenching Near Trees:
   1. Where utility trenches are required near trees, excavate under or around tree roots by hand or with air spade.
   2. Do not cut main lateral tree roots or taproots.
      a. Cut only smaller roots that interfere with installation of utilities.
      b. Do not allow exposed roots to dry out before placing permanent backfill.

D. Damaged Trees:
   1. Existing trees or permanent planting indicated to remain that are damaged or destroyed by construction operations or storage of material or equipment are to be trimmed and reshaped by tree surgeons, or replaced, each at Contractor's expense and as directed by Architect.
   2. Perform trimming and reshaping to satisfaction of Architect/Landscape Architect.
   3. Species and size for replacement trees and plantings will be selected by Architect/Landscape Architect.

3.02 TRIMMING OF EXISTING TREES TO REMAIN

A. Trim roots of trees where uncovered, making clean cuts.

1. Cover cut roots with 4 inches of soil

B. Prevent damage to tree limbs which project within work areas.
   1. Trim or cut only with specific prior approval of Architect or Landscape Architect.
   2. Remove dead branches and shape living branches as directed by Landscape Architect.
      a. Make flush cuts leaving no stubs
      b. Cut back to living tissue where necessary, smooth and shape surfaces to shed water.

C. Apply tree wound paint on cut surfaces 1 inch diameter and larger when directed by Landscape Architect.

3.03 TREE PROTECTION FENCES

A. Fence Locations:
   1. Provide and maintain following:
      a. Tree protection fences around individual trees and groups of trees which are to remain in place.
      b. Intermittent or continuous tree protection fences, in general, along “Limit of Work” lines indicated.
   2. Locate tree protection fences at outer limit of branch spread of protected trees

B. Fence Construction:
   1. Materials:
      a. Lumber:
         1) Sound, clean material, new or used, in good condition.
      b. Fence Posts:
         1) 4 inches x 4 inches x 7 feet – 0 inch minimum length
      c. Fence Rails:
      d. 1 inch x 8 inches square edge stock x lengths to suit post spacings.
   2. Set posts 3 feet – 0 inches into ground, spaced at maximum of 10 feet – 0 inches on center, unless indicated otherwise.
      a. Set one rail along top front face of posts
      b. nail rails securely to each post
   3. Maintain fences as required, including replacing damaged or destroyed portions, throughout entire period of Work.
   4. Fences are to be removed upon completion of Work, or when directed by Architect
   5. Upon removal of fences, backfill post holes to grade and remove fence material from Project Site.

3.04 CLEARING AND GRUBBING

A. Clearing:
   1. Cut trees and undergrowth within cleared areas as indicated.
   2. Confine equipment and operations to areas to be cleared
   3. Fell trees only into areas to be cleared
   4. Cut tree stumps and undergrowth roots flush with existing ground surface outside of construction areas and paved areas.

a. Where indicated, completely remove tree stumps as specified.

B. Grubbing:
1. Grub in cleared areas required to perform construction work
2. Perform grubbing to completely remove stumps, roots, and organic materials

3.05 TREE AND STUMP REMOVAL

A. Remove trees and stumps indicated or required to be removed.
   1. Remove trees, together with bulk of roots, to minimum depth of 4 feet below required grade, and within radius of approximately 7 feet beyond perimeter of trunk at grade.

B. Fill and compact excavation from tree and stump removal.
   1. Fill in 6 inch layers, each compacted to 90 percent of maximum density in accordance with ASTM D 1557.
   2. Do not commence back filling until excavation is inspected and tested.

3.06 REMOVAL OF TOPSOIL

A. When required, perform removal of topsoil in accordance with requirements as indicated on Drawings..

3.07 TRIMMING OF EXISTING TREES TO REMAIN

A. Trim roots of trees where uncovered, making clean cuts.
   1. Cover cut roots with 4 inches of soil

B. Prevent damage to tree limbs which project within work areas.
   1. Trim or cut only with specific prior approval of Architect or Landscape Architect.
   2. Remove dead branches and shape living branches as directed by Landscape Architect.
      a. Make flush cuts leaving no stubs
      b. Cut back to living tissue where necessary, smooth and shape surfaces to shed water.

C. Apply tree wound paint on cut surfaces 1 inch diameter and larger when directed by Landscape Architect.

3.08 CLEANING

A. Material Disposal:
   1. Remove cleared and grubbed materials, rubbish, debris, and other waste materials and legally dispose of them off Project Site.

B. Chipping:
   1. Chipping of tree materials and disposal by distribution or dispersal on Project Site:
      a. May be permitted, where and in manner as directed, subject to available space on-site.
   2. Chipping of tree materials Is permitted, however, disposal by distribution or dispersal is not permitted on Project Site.
      a. Remove chipping materials and legally dispose of them off Project Site.

END OF SECTION 31 1000

SECTION 32 0117

ASPHALT PAVING REPAIR

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Asphalt surfacing repair consisting of:
      a. Areas removed for utility trenches.
      b. Areas heaved by tree roots.
      c. Cracked areas
      d. Protruding areas where pavement meets hard surfaces.
      e. Depressed areas and holes
      f. Areas around new structures.
      g. Raveled asphalt pavement.
   2. Cold milling/planing portions of existing asphalt pavement surface course.
      a. Including hauling of removed material.
   3. Material and installation for following:
      a. Asphalt (bituminous) surfacing.
      b. Seal coat for asphalt (bituminous) surfacing.

B. Related Sections:
   ~~1. Section 01 4500: Quality Control; soil testing requirements.~~
   ~~2. Section 01 5000: Temporary Facilities and Controls; barriers and temporary controls.~~
   ~~3.~~1. Section 01 5713: Temporary Erosion and Sedimentation Controls
   ~~4.~~2. Section 31 0000: Earthwork
   ~~5. Section 32 0116: Cold Milling Asphalt Pavement; removal of portion of existing asphalt pavement surface course.~~
   ~~6.~~3. Section 32 1100: Base Course
   ~~7.~~4. Section 32 1216: Asphalt Paving
   ~~8.~~5. Section 32 1313: Concrete Paving
   ~~9. Section 33 0513: Utility Grade Adjustment; adjustment/removal of utility structures including frames, covers, and gutter drainage grilles.~~

1.02 REFERENCES

A. ASTM International (ASTM):
   1. ASTM D 1188 – Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples.

B. American Association of State Highway and Transportation Officials (AASHTO):
   1. AASHTO Standard Specifications for Highway Materials and Methods of Sampling and Testing.

C. Public Works Standards, Inc.:

1. Standard Specifications for Public Works Construction (SSPWC):
   a. The "Greenbook"; current edition.
      1) Section 302 – Roadway Surfacing.
2. Standard Plans for Public Works Construction (SPPWC); current edition.

1.03 DEFINITIONS

A. Cold Milling/Planing of Asphalt Pavement:
   1. Process of removing existing pavement from designated areas to lines and dimensions shown on Drawings or as directed by Architect.

B. Reclaimed Asphalt Pavement (RAP):
   1. Material produced as result of cold milling.

1.04 SUBMITTALS

A. Product Data:
   1. Bituminous Materials:
      a. Manufacturer’s technical data for materials and products
      b. Site plan indicating extent of paving and accessories.

B. Seal Coat:
   1. Manufacturer's product information and application procedures for seal coating.

C. Weighmaster Certificates:
   1. Furnish licensed weighmaster certificates with each load of asphalt (bituminous) surfacing delivered to Project.
   2. Yield of Asphalt Material: 24 pounds per square foot of paving area based on 2 inch thickness after rolling.
   3. 5 percent tolerance will be allowed between total calculated weight and actual weight incorporated in Work.
   4. Deliver certificates to Owner's representative, who will collect certificates and ensure that material represented by each certificate is actually incorporated in Work.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery of Sealer Material:
   1. Agitate bulk materials during transport.

1.06 PROJECT CONDITIONS

A. Environmental Conditions:
   1. In event of rain or other inclement weather, suspend cold milling operations.
   2. Make necessary allowances for drainage of water that may pond in areas where milled sections have not been paved.
   3. Do not place asphalt (bituminous) surfacing when atmospheric temperature is below 40 degrees F, or during unsuitable weather.

B. Grade Control:

1. Establish and maintain required lines and elevations.

PART 2 PRODUCTS

2.01 MATERIALS

A. Cold milled/planed asphalt pavement to provide RAP of nominal one inch maximum size.
   1. Tolerance of five percent in material retained on one inch sieve will be permitted, provided material passes 1-1/2 inch sieve.

B. Ownership of RAP:
   1. Contractor will assume ownership of RAP material and responsibility to haul it from Project Site to his own storage site or otherwise legally dispose of it.

C. Headers and Stakes:
   1. Headers: "Construction Heart" Grade redwood as graded by Redwood Inspection Service.
      a. Size: 2 x 6, unless otherwise indicated.
   2. Stakes: 2 x 4 redwood or 2 x 3 Douglas fir, Construction Grade.
   3. Nails: Common, galvanized, 12d minimum.

D. Asphalt Surface Course:
   1. Vehicle Traffic: Provide materials of class, grade, or type indicated, conforming to SSPWC, Section 203-6.4 – Asphalt Concrete Mixtures.
      a. Class and Grade: C2-PG 64-10 per SSPWC Section 203-6.4.1

E. Seal Coat:
   1. Provide seal coat materials conforming to SSPWC Section 203-9 by one of following or approved equal:
      a. Guard-Top, Division of Western Emulsions Inc.
      b. OverKote by Diversified Asphalt Products
      c. Park Top by Western Colloid Products

~~**2.02 COLD MILLING/PLANING EQUIPMENT** *[Review with Project Civil Engineer]*~~

~~A. Milling Machines:~~
~~1. Specially designed for cold milling of asphalt pavement.~~
~~2. Use milling machines for large asphalt paved areas, conforming to following:~~
~~a. Cutting Drum:~~
~~1) Minimum of 60 inches wide, equipped with carbide-tipped cutting teeth placed in variable pattern to produce desired finish.~~
~~2) Capable of tilting to allow feathering of edges to zero cut.~~
~~b. Self-propelled and capable of removing pavement to depth shown on Drawings.~~
~~c. Equipped with conveyor system that will immediately convey milled material into transport vehicle for disposal as specified.~~
~~d. Have capability of spraying water at cutting drum to minimize dust.~~
~~e. Designed so that operator can observe milling operation continuously without leaving controls.~~
~~f. Adjustable for slope and depth.~~

~~g. Able to deep cut, in one pass, to maximum depth recommended by manufacturer, without producing fumes or smoke.~~

~~B. Planing Machines:~~
~~1. Where areas required to be cold milled are too small or inaccessible to larger machines, use skid steer type machine with planer attachment of type required to provide surface specified.~~

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas of asphalt pavement indicated to be removed or repaired.

B. Examine areas of asphalt pavement indicated to be cold milled.
1. Verify presence of one or more of following materials that would impact performance of cold milling:
   a. Pavement fabric.
   b. Rubberized material.

3.02 PAVEMENT REMOVAL – GENERAL

A. Remove asphalt pavement in accordance with applicable provisions of Section 31 2300 or Section 300 - Earthwork of SSPWC and following:
1. Pavement Heaved by Roots:
   a. Remove pavement to limits of distortion and expose roots.
   a. Trim roots to provide at least 12 inches clearance to pavement.
2. Remove protruding asphalt surfaces flush with surrounding grade using suitable tool or equipment so that adjacent finishes are not blackened.
3. Remove raveled and depressed asphalt pavement to limits indicated or required.
4. Saw cut existing improvements, trim holes and trenches in asphalt pavement to permit mechanical hand tampers to compact fill.

3.03 EXCAVATING, BACKFILLING, AND COMPACTING

A. After pavement removal, fill depressions left by removal, regrade, and compact subgrade or base.
~~1. Conform to requirements in Section 31 2300, as required.~~

B. Where subgrade or base is deemed to be unstable or otherwise unsuitable, excavate such materials to firm earth, and replace with specified material.

C. Install and compact fill materials in accordance with requirements of related Specification Sections.

3.04 RESURFACING

A. Holes and Trenches:

1. Remove loose dirt and backfill with cement-sand slurry allowing for surfacing one inch thicker than existing.
2. Unless otherwise indicated on Drawings, resurface flush with existing adjoining pavement installing same type of materials and section provided in existing improvements.

B. Other Areas:
   1. Cut other surface improvements damaged or removed to neat even line and excavated one inch below bottom of existing pavement.
   2. Resurface by following original grades and installing same type of materials provided in existing improvements.

~~3.05 COLD MILLING/PLANING OF EXISTING ASPHALT PAVEMENT~~ ~~*[Verify with Civil]*~~

~~A. General:~~
   ~~1. Remove existing surface of asphalt pavement by milling/planing to depth, width, cross section and grade as specified or indicated on Drawings.~~
   ~~2. Provide cold milled or planed surfaces as follows:~~
      ~~a. Uniformly grooved or ridged.~~
      ~~b. Outside lines neat and uniform.~~
      ~~c. True to grade and cross section with uniform cross-slope and positive drainage across traveled way~~

~~B. Perform cold milling/planing in manner which prevents tearing and breaking of underlying and adjacent pavement and contamination of RAP with granular, sub-grade or other deleterious materials.~~
   ~~1. Remove existing asphalt pavement overlay from gutters adjacent to areas specified to be cold milled or planed, as directed by Architect.~~
   ~~2. Load RAP directly to trucks from milling machine and haul to Contractor's stockpile or legally dispose of off Project Site.~~
   ~~3. Whenever cold milling/planing occurs adjacent to existing Portland cement concrete curbs, gutters or pavement, protect these improvements from damage.~~
   ~~4. When necessary, "daylight" vertical cuts from cold milling/planing operations to outside edge of pavement to allow surface water to be drained off.~~

~~C. At point of daily termination of cold milling/planning operations, limit changes in surface profile or cross-section to 2 inches with longitudinal transitions maximum of 1 inch vertically per foot.~~

~~D. Cleaning of Cold Milled and planed Surfaces:~~
   ~~1. Immediately remove loose material resulting from milling and hauled to appropriate off-site location.~~
   ~~2. Thoroughly broom clean milled/planed surface of remaining loose material.~~
      ~~a. Employ methods to minimize dust, complying with local air quality requirements.~~
   ~~3. Leave milled/planed surface ready to receive new asphalt surfacing as specified.~~

~~3.06~~3.05 HEADER INSTALLATION

A. Install headers along edge of asphalt (bituminous) surfacing abutting turf, earth, or planting area, unless indicated otherwise.

B. Install headers so bottom surface has continuous bearing on solid grade.
   1. Where excavation for headers is undercut, thoroughly tamp soil under header.

2. Compact backfill on both sides of header to density of adjacent undisturbed earth.

C. Fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid grade minimum of 12 inches.
   1. Use stakes of sound material, neatly pointed, driven vertically, and securely nailed to headers.
      a. Space stakes, not to exceed 4 feet on centers with top of stakes set one inch below top of header.
      b. Provide minimum of 2-12d galvanized common nails through each stake.

D. Remove existing headers where new surfacing is installed adjacent to existing surfacing.

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

F. Provide additional stakes and anchorage as required to fasten headers in place.

~~3.07~~3.06 BASE COURSE

A. Refer to Section 32 1100 where new base course in required.

~~3.08~~3.07 CONSTRUCTION OF ASPHALT PAVING

A. Refer to Section 32 1216 for installation of new asphalt paving over base course.

~~3.09~~3.08 TOLERANCES

A. Smoothness:
   1. Provide surface of asphalt (bituminous) surfacing after rolling that is even, smooth, and uniform in texture with no voids or rock pockets
      a. Free of roller marks, or other irregularities
      b. Not varying by more than 0.03 foot, except at local depressions or raised areas as indicated, when 10 foot straightedge is placed on surface.

B. Grade:
   1. Do not allow finished grade to vary more than 0.02 foot above or below required grade.
   2. Provide compensating variations within prescribed tolerance so that average grade and cross-section are provided.

~~3.10~~3.09 REPAIRING AND RESEALING EXISTING SURFACES

A. Preparation of Surfaces:
   1. Prior to filling cracks, clean existing asphalt paving of loose and foreign materials and coat with film of asphalt emulsion.

B. Repair of Existing Surfacing:

1. Fill cracks 1/2 inch wide and less with RS-1 emulsion and silica sand or other required material.
2. Fill cracks larger than 1/2 inch wide with Type C2 Asphalt Concrete as specified.
   a. Fill cracks o level of adjacent surfacing.
3. Where low areas, holes, or depressions occur in existing surfacing, repair with emulsified asphalt.
   a. Install material; strike off emulsified asphalt with straightedge flush with adjoining surfacing.
   b. Finish with steel trowel, and after dehydration, compact by rolling or tamping.

~~3.11~~3.10 TESTING

A. Flood test completed asphalt (bituminous) surfacing in presence of Project Inspector after final lift of asphalt and prior to application of seal coat.
   1. Repair areas of standing water or puddles and flood test locally.
   2. Repair areas of ponding and retest as necessary.

~~3.12~~3.11 SEAL COAT

A. General:
   1. After asphalt (bituminous) surfacing has passed flood test, clear and allow to dry and cure for 30 days.
   2. Apply two coats of surface seal as specified.
   3. Where indicated, provide multiple coats of surface seal to existing asphalt (bituminous) surfacing.
   4. Where new asphalt (bituminous) surfacing joins existing asphalt (bituminous) surfacing, overlap surface seal minimum of 12 inches onto existing asphalt (bituminous) surfacing.

B. Surface Preparation:
   1. Thoroughly wash surfaces with water to remove dirt, debris, excessive oil and grease, or other foreign matter and allow to dry.

C. Application:
   1. Install seal coat in strict accordance with manufacturer's written directions and recommendations.
   2. Install 2 coats of seal coat to new asphalt (bituminous) surfacing.
      a. Apply first coat after flood testing.
      b. Clean surface and allow to dry before installing second coat.
      c. When first coat has dried, apply second coat and allow to dry before permitting traffic on surface.
   3. Where new asphalt (bituminous) surfacing is installed adjacent to existing asphalt (bituminous) surfacing, overlap surface seal minimum of 12 inches onto existing asphalt (bituminous) surfacing.
   4. Where existing asphalt (bituminous) surfacing is indicated to be patched and sealed.
      a. Apply 2 coats of surface seal after patching.

3.133.12 FIELD QUALITY CONTROL

A. When straightedge specified in SSPWC Section 302-5.6.2 is laid on finished surface parallel to centerline of area, surface is not to vary from edge of straightedge more than 3/8 inch at any point, or at changes of grade.
   1. Bring areas that are not within tolerance to grade within one working day following initial cold milling/planing.

B. Testing:
   1. Owner reserves right to obtain samples and perform tests to ensure compliance with Specifications, and to review weight slips and invoices of materials delivered to Project Site.

~~3.14~~3.13 CLEANING

A. Comply with requirements of Section 01 7423 and following:
   1. Immediately remove loose material resulting from asphalt removal and haul to appropriate off-site location.
   2. Thoroughly broom clean milled surface of remaining loose material.
      a. Employ methods to minimize dust, complying with local air quality requirements.
   3. Leave milled surface ready to receive new asphalt surfacing as specified.

B. Remove and legally dispose of rubbish, debris, and waste materials off Project Site.
   1. Comply with requirements of Section 01 7419.

~~3.15~~3.14 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury for 7 days or until surface temperature is less than 140 degrees F.
   1. Protect Work until Substantial Completion.

END OF SECTION 32 0117

SECTION 32 0523

CONCRETE FOR EXTERIOR IMPROVEMENTS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Portland cement concrete for miscellaneous site concrete items, including, but not necessarily limited to:
      a. Concrete footings for:
         1) Exterior signage posts.
   2. Cast-in-Place Concrete for Items Not Covered Elsewhere:
      a. Mow curbs
      b. Underground pipe and conduit bedding, encasements, thrust blocks, and similar structures.
      c. Yard and valve boxes.
      d. Vaults, and similar structures.
   3. Precast Concrete for:
      a. Wheel stops.
      b. Splash Blocks

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 01 5000: Temporary Facilities and Controls; for traffic control and project protection.
   3. Section 03 3000: Cast-in-Place Concrete; concrete footings for fence posts and gates.
   4. Section 07 6200: Sheet Metal Flashing and Trim; downspouts,
   5. Section 07 9200: Joint Sealants; traffic sealant
   6. Section 31 0000: Earthwork; excavation, backfilling, and grading requirements.
   7. Section 32 1216: Asphalt Paving
   8. Section 32 1313: Concrete Paving.
   9. Section 32 1723: Pavement Markings; painting of wheel stops.

1.02 REFERENCES

A. California Code of Regulations, Title 24, California Building Code (CBC), Part 2, Volumes 1 and 2, current edition.

B. ASTM International (ASTM):
   1. ASTM A 615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
   2. ASTM A 1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
   3. ASTM C 33 – Standard Specification for Concrete Aggregates
   4. ASTM C 94 – Standard Specification for Ready-Mixed Concrete
   5. ASTM C150 – Standard Specification for Portland Cement
   6. ASTM D 994 – Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)

C. American Concrete Institute (ACI):
   1. ACI 301 – Specification for Structural Concrete for Buildings.
   2. ACI 304 – Recommended Practice for Measuring, Mixing and Placing Concrete.
   3. ACI 347R – Guide to Formwork for Concrete.

D. Concrete Reinforcing Steel Institute (CRSI):
   1. Manual of Standard Practice.
   2. Recommended Practice for Placing Reinforcing Bars.

E. West Coast Lumber Inspection Bureau (WCLIB):
   1. Standard Grading Rules No. 17, current edition.

F. Public Works Standards, Inc.:
   1. Standard Specifications for Public Works Construction (SSPWC):
      a. The "Greenbook"; current edition.
   2. Standard Plans for Public Works Construction (SPPWC); current edition

1.03 SUBMITTALS

A. Shop Drawings:
   1. Plans, elevations and details of Site Concrete Work.

B. Product Data:
   1. Mix designs and manufacturer’s technical data for materials and products.

C. Material Sample:
   1. One concrete bumper to Project Inspector for destructive testing.

1.04 QUALITY ASSURANCE

A. Comply with pertinent sections of SSPWC and following:
   1. Formwork and Accessories:
      a. Design Criteria:
         1) Formwork conforming to ACI 347R.

B. Reinforcing:
   1. Welders' Qualifications:
      a. Qualify welders in accordance with AWS D1.4 and AWS D1.

C. Concrete:
   1. Requirements of ACI 301 govern Work, materials, and equipment related to this Section.

PART 2 PRODUCTS

2.01 MATERIALS

A. Formwork and Accessories:
   1. Forming Materials:
      a. Comply with requirements as specified and following:
         1) Wood Framing:
            a) WCLIB standard grade or better Douglas Fir.

2) Side Forms:
a) Douglas Fir, Construction Grade or Better or metal forms.
3) Stakes:
a) Douglas Fir, Construction Grade or Better, or metal stakes.

B. Reinforcing:
1. Bars:
a. New billet steel:
1) Conforming to ASTM A 615 Grade 60.
2) Conforming to ASTM A 706, Grade 60, where welded.
2. Tie Wires and Spirals:
a. Conforming to ASTM A 1064.
3. Bar Supports:
a. As required for assembling and supporting reinforcement in place.

C. Concrete and Related Materials:
1. Comply with applicable provisions of SSPWC, Section 201 - Concrete, Mortar, and Related Materials:
a. Concrete:
1) Ready-mixed concrete meeting requirements of ASTM C 94.
a) Provide 28 day compressive strength, minimum 3,000 psi, unless specified otherwise.
b) Cement:Conforming to ASTM C150, Type II / V, low alkali.
2) Aggregates:
a) Coarse Aggregate: Conforming to ASTM C 33, consisting of clean, hard, fine grained, sound crushed rock, or washed gravel, or combination of both.
b) Fines: Conforming to ASTM C 33, consisting of sand equivalent not less than 75 when tested per ASTM D 2419.
2. Concrete Admixtures:
a. Use of calcium chloride or admixtures containing calcium chloride is prohibited.

D. Expansion Joint Filler:
1. Preformed expansion joint filler, bituminous type, complying with ASTM D 994.

2.02 WHEEL STOPS

A. Precast, air-entrained concrete, smooth finish, 3,000 psi minimum compressive strength, with continuous steel reinforcing, approximately 5-1/2 inches high x 7 inches wide.
1. Provide minimum length of 48 inches, unless otherwise indicated on Drawings.
2. Provide chamfered corners and drainage slots on underside.
3. Provide holes for anchoring to substrate.
4. Anchor Rods: Solid steel rod or No. 5 reinforcing bar, galvanized.
a. Diameter: 5/8 inch (0.625 inch).
b. Minimum Length: 18 inches.

2.03 SPLASH BLOCKS

A. Reinforced, precast concrete, of size, profile, and thickness shown on Drawings.
1. Design Mix:
a. 2 parts concrete sand, and 1 part cement.

   b. Limit water content to make mix stiff.
2. Course Aggregate: Carefully graded and washed gravel or stone conforming to ASTM C 33.
   a. Mix gravel not to exceed 3/8 inch.
   b. Gradation may vary to achieve desired finish and texture.
3. Fine Aggregate: Carefully graded and washed natural concrete sand conforming to ASTM C 33.
   a. Gradation may vary to achieve desired finish and texture.
4. Water: Potable water free from impurities.
5. Admixtures: When required, conforming to ASTM C 494.
6. Reinforcing Steel: Conforming to ASTM A 615.
   a. No.4, Grade 60 rebar, and 1/4 inch HR round steel.
7. Strength: Comprehensive strength of 4,000 to 6,000 psi at 28 days depending on mixture and additives, as determined by tests of 6 inch cylinders.
8. Weight: 49 lbs.
9. Color: Manufacturer's standard Gray.
10. Manufacturer: Modern Precast, Inc., Salt Lake City, UT, or approved equal.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine areas where formwork will be constructed and verify that:
   1. Excavations are sufficient to permit placement, inspection and removal of forms.
   2. Excavations for earth forms have been neatly and accurately cut.
   3. Conditions are otherwise proper for formwork construction

3.02 PREPARATION

A. Obtain necessary information for coordination of formwork with items to be embedded in concrete and other related work.

3.03 INSTALLATION OF FORMWORK AND REINFORCING

A. Miscellaneous Exposed Concrete:
   1. Install yard boxes, vaults, and similar structures, in compliance with SSPWC, Section 303.

B. Underground conduit bedding, encasements, thrust blocks, and similar structures may be placed directly in excavations conforming to required sizes.

C. Construct forms to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb Work in finished structures.
   1. Maintain formwork construction tolerances complying with ACI 347.

D. Reinforcing Installation:
   1. Comply with applicable provisions of SSPWC, Section 303.

3.04 PLACING

A. Notify Project Inspector at least 48 hours before placing concrete.

B. Perform concrete placement, surface finishes, curing, and removal of forms in compliance with applicable provisions of SSPWC, Section 303.

3.05 FORM REMOVAL

A. Remove forms carefully to avoid damaging concrete, including corners and edges of exposed concrete.
   1. Do not remove formwork prior to concrete member attaining specified strength:

3.06 CONCRETE WHEEL STOP INSTALLATION

A. Provide wheel stops in locations indicated on Drawings.
   1. Set units level and flush.
   2. Drill holes in concrete paving for wheelstop anchor rods.
   3. Secure each unit with 2 steel anchor rods or rebar of type and size specified.
      a. Minimum Embedment of Stakes: 12-1/2 inches

3.07 SPLASH BLOCK INSTALLATION

A. Provide splash blocks in locations indicated on Drawings.
   1. Coordinate placement with location of downspouts.

3.08 CLEANING

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

3.09 PROTECTION

A. Protect Work until Substantial Completion.

END OF SECTION 32 0523

SECTION 32 1100

BASE COURSE

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Furnishing and installing base course material under paving.

B. Related Sections:
   1. Section 31 0000: Earthwork; other base materials.
   2. Section 32 0117: Asphalt Paving Repair
   ~~3. Section 32 0129: Concrete Paving Repair~~
   ~~4.~~3. Section 32 1216: Asphalt Paving.
   ~~5.~~4. Section 32 1313: Concrete Paving

1.02 REFERENCES

A. State of California Department of Transportation (Caltrans):
   1. Standard Specifications:
      a. Division IV – Subbases and Bases
         1) Section 26 – Aggregate Bases.

B. Public Works Standards, Inc.:
   1. Standard Specifications for Public Works Construction (SSPWC):
      a. The "Greenbook"; current edition.
   2. Standard Plans for Public Works Construction (SPPWC); current edition.

1.03 DEFINITIONS

A. Caltrans Class 2 Base:
   1. Comply with Section 26-1.02B of Caltrans Standard Specifications, current edition
      a. Aggregate Gradation:
         1) Conforming within percentage passing limits for sieve sizes shown in Aggregate Gradation Table.
      b. Aggregate Quality Characteristics:
         1) Complying with requirements shown in Aggregate Quality Characteristics Table

B. Crushed Aggregate Base:
   1. Consisting entirely of crushed rock and rock dust.
      a. Conforming to requirements of SSPWC Sections 200-1.1 and 200-1.2

1.04 SUBMITTALS

A. Product Data:

1. Include material source, technical information, and test data for base materials.
2. Gradation and quality certifications: Dated within 30 days of submittal.

B. Samples:
1. Minimum 5 pound container of proposed base course material.

1.05 QUALITY ASSURANCE

A. Comply with Caltrans Standard Specifications or SSPWC as minimum requirement, except where indicated otherwise.

PART 2 PRODUCTS

2.01 BASE COURSE MATERIALS

A. Caltrans Class 2 Base: :
1. Conforming to Caltrans Class 2 as defined in Article 1.05 B.

B. Crushed Aggregate Base:
1. Conforming to requirements of SSPWC as defined in Article 1.05 A.

2.02 MATERIAL APPROVAL

A. Provide Base material as inspected by Project Inspector prior to installation.
1. Owner may choose to have additional tests performed by geotechnical engineer, retained by Owner before installation.

PART 3 EXECUTION

3.01 BASE COURSE INSTALLATION

A. Install base course material in layers not exceeding 3 inches in thickness, unless otherwise required.
1. Grade and compact to indicated levels or grades
   a. Cut and fill.
   b. Water and roll until surface is hard and true to line, grade and required section.
   c. Provide relative compaction of at least 95 percent, unless otherwise required.
2. Grade base course to elevations indicated on Drawings, ready to receive specified surfacing.

3.02 CLEANING

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

3.03 PROTECTION

A. Protect Work until Substantial Completion.

END OF SECTION 32 1100

SECTION 32 1216

ASPHALT PAVING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
1. Material and installation for following:
a. Engineered stress-relieving paving mat fabric.~~ic.~~ ~~*[verify if required]*~~
b. Asphalt (bituminous) surfacing. ~~*[verify single or double course]*~~
1) Single course bituminous paving.
~~2) Double course bituminous paving.~~
c. Seal coat for asphalt surfacing

B. Related Sections:
~~1. Section 01 5000: Temporary Facilities and Controls; barriers and temporary controls~~
~~2.~~1. Section 01 5713: Temporary Erosion and Sediment Controls
~~3.~~2. Section 31 0000: Earthwork; compacted subgrade for paving.
~~4. Section 32 0116: Cold Milled Asphalt Pavement; pavement removal~~
~~5.~~3. Section 32 0117: Asphalt Paving Repair
~~6. Section 32 0523: Concrete for Exterior Improvements; precast concrete wheel stops.~~
~~7.~~4. Section 32 1100: Base Course
~~8.~~5. Section 32 1313: Concrete Paving
~~9. Section 32 1723: Pavement Markings~~
~~10. Section 33 0513: Utility Grade Adjustment; adjustment/removal of utility structures including frames, covers, and gutter drainage grilles.~~

1.02 REFERENCES

A. ASTM International (ASTM):
1. ASTM D 276 – Standard Test Methods for Identification of Fibers in Textiles
2. ASTM D 946 – Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction
3. ASTM D 1188 – Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples.
4. ASTM D 5035 – Standard Test Method for Breaking Force and Elongation of Textile Fabrics (Strip Method).
5. ASTM D 6140 – Standard Test Method to Determine Asphalt Retention of Paving Fabrics Used in Asphalt Paving for Full-Width Applications
6. ASTM D 6241 – Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe

B. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO Standard Specifications for Highway Materials and Methods of

Sampling and Testing.

C. The Asphalt Institute (AI):
   1. AI MS-2 – Mix Design Methods for Asphalt Concrete and Other Hot-Mix Types; current edition.
   2. AI MS-19 – A Basic Asphalt Emulsion Manual; current edition.

D. Public Works Standards, Inc.:
   1. Standard Specifications for Public Works Construction (SSPWC):
      a. The "Greenbook"; current edition.
   2. Standard Plans for Public Works Construction (SPPWC); current edition.

1.03 SUBMITTALS

A. Product Data:
   1. Base Materials:
      a. Refer to base course materials specified in Section 32 1100.
   2. Herbicide Treatment:
      a. Manufacturer’s technical data for products proposed for use.
      b. Certificate indicating compliance with EPA requirements.
   3. Bituminous Materials:
      a. Manufacturer’s technical data for materials and products
      b. Site plan indicating extent of paving and accessories.
   4. Engineered Stress-Relieving Paving Mat Fabric:
      a. Manufacturer's product information and installation procedures for engineered stress-relieving paving mat fabric
   5. Seal Coat:
      a. Manufacturer's product information and application procedures for seal coating.

B. Weighmaster Certificates:
   1. Furnish licensed weighmaster certificates with each load of asphalt (bituminous) surfacing delivered to Project.
   2. Yield of Asphalt Material:
      a. 24 pounds per square foot of paving area based on 2 inch thickness after rolling.
      b. 5 percent tolerance will be allowed between total calculated weight and actual weight incorporated in Work.
   3. Deliver certificates to Owner's representative, who will collect certificates and ensure that material represented by each certificate is actually incorporated in Work.

1.04 QUALITY ASSURANCE

A. Comply with SSPWC as minimum requirement asphalt (bituminous) surfacing materials and installation.

B. Pre-Construction Conference: Prior to installation of engineered paving mat, arrange meeting at Project Site with manufacturer’s representative and paving mat installer.

1. Notify Architect and Project Inspector of meeting minimum of 7 days in advance of time of meeting, or as specified in Section 01 3119.
2. Provide copy of manufacturer's specifications Project Inspector at meeting

3. Arrange for manufacturer's representative to be present, at minimum, for first day of installation of engineered paving mat and available thereafter upon request by Architect or installer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Delivery of Sealer Material:
   1. Agitate bulk materials during transport.

B. Store engineered paving mat per manufacturer's recommendations in dry covered condition free from dust, dirt, and moisture.

1.06 PROJECT CONDITIONS

A. Information on Drawings does not constitute guarantee of accuracy or uniformity of soil conditions over Project Site.

B. Grade Control:
   1. Establish and maintain required lines and elevations.

C. Field Conditions for Asphalt (Bituminous) Surfacing Placement:
   1. Place bitumen mixture when temperature is not more than 15 degrees F below bitumen supplier's bill of lading and not more than maximum specified temperature.
   2. Do not place asphalt (bituminous) surfacing when atmospheric temperature is below 40 degrees F, or during unsuitable weather.

1.07 MAINTENANCE

A. Extra Material:
   1. Furnish 10 gallons of sealer material in unopened containers.

PART 2 PRODUCTS

2.01 MATERIALS

A. Headers and Stakes:
   1. Headers:
      a. "Construction Heart" Grade redwood as graded by Redwood Inspection Service.
      b. Size: 2 x 6, unless otherwise indicated.
   2. Stakes:
      a. 2 x 4 redwood or 2 x 3 Douglas Fir, Construction Grade.
   3. Nails:
      a. Common, galvanized, 12d minimum.

B. Herbicide Treatment:
   1. Commercial chemical for weed control, registered by Environmental Protection Agency (EPA).
   2. Provide granular, liquid, or wettable powder form.

3. Manufacturers:
   a. Subject to compliance with specified requirements, provide products of one of following:
      1) Bayer
      2) Dow AgroSciences
      3) E.I. Du Pont du Nemours and Company
      4) FMC Corporation
      5) Monsanto Company
      6) U.S. Borax & Chemical Corporation.

C. Engineered Stress-Relieving Paving Mat Fabric: ~~*[verify if required on Project]*~~
   1. Engineered paving mat within pavement structure as shown on Drawings or directed by Project Inspector.
      a. Mat provides moisture barrier/stress relieving membrane and when placed beneath hot-mix asphalt overlay.
   2. Provide engineered paving mat material meeting following physical properties:

PHYSICAL PROPERTIES OF FIBERGLASS POLYESTER PAVING MAT			
Property	**Test Method**	**Units**	**MARV***
Asphalt Retention	ASTM D 6140	l/m2 (gal./yd2)	0.47 (0.10)
Mass per unit area	ASTM D 5261	g/m2 (oz/yd2)	136 (4.0)
Tensile strength, MD	ASTM D 5035	kN/m (lb/in)	25 min (140)
Tensile Strength, CD	ASTM D 5035	kN/m (lb/in)	25 min (140)
CBR Puncture**	ASTM D 6241	N	1112 (250)
Elongation at maximum load, MD	ASTM D 5035	percent	<5
Elongation at maximum load, CD	ASTM D 5035	percent	<5
Melting point	ASTM D 276	C (F)	>230 (>446)
* MARV = Minimum Average Roll Value ** Assess 360 degree tensile strength symmetry			

   3. Product and Manufacturer: GlasPave Paving Mat 25 as manufactured by Tensar International Corporation, Alpharetta, GA, or approved equal.

D. Base Course:
   1. Refer to Section 32 1100.

E. Miscellaneous Materials:
   1. Aggregate for Binder Course:
      a. In accordance with Caltrans specifications for Grade PG 64-10 Binder.
   2. Aggregate for Wearing Course:
      a. In accordance with Caltrans or SSPWC specifications.
   3. Fine Aggregate:
      a. In accordance with Caltrans or SSPWC specifications.
   4. Mineral Filler:
      a. Finely ground particles of limestone, hydrated lime or other mineral dust, free of foreign matter.
         1) Conforming to Caltrans or SSPWC specifications.
   5. Primer:

a. In accordance with SSPWC 203-2.4.

6. Tack Coat:
   a. In accordance with SSPWC specifications.

F. Bituminous Surface Course:
   1. Vehicle Traffic:
      a. Provide materials of class, grade, or type indicated, conforming to SSPWC, Section 203-6.4 – Asphalt Concrete Mixtures.
         1) Class and Grade: C2-PG 64-10 per SSPWC Section 203-6.4.1

G. Seal Coat:
   1. Provide seal coat materials conforming to SSPWC Section 203-9 by one of following or approved equal:
      a. Guard-Top, Division of Western Emulsions Inc.
      b. OverKote by Diversified Asphalt Products
      c. Park Top by Western Colloid Products

2.02 MIX DESIGNS FOR ASPHALT (BITUMINOUS) SURFACING

A. Design mixes conforming to Caltrans standards or SSPWC specifications.

B. Submit proposed mix design of each class of mix for review prior to beginning of Work.

2.03 SOURCE QUALITY CONTROL

A. Obtain materials from same source throughout Project.

B. Test mix design and samples in accordance with AI MS-2.

2.04 PERFORMANCE REQUIREMENTS

A. Design asphalt paving section and aggregate base course, as designated in Geotechnical Report.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.02 BASE COURSE INSTALLATION

A. Refer to Section 32 1100

3.03 HEADER INSTALLATION

A. Install headers along edge of asphalt (bituminous) surfacing abutting turf, earth, or planting area, unless indicated otherwise.

B. Install headers so bottom surface has continuous bearing on solid grade.

1. Where excavation for headers is undercut, thoroughly tamp soil under header.
2. Compact backfill on both sides of header to density of adjacent undisturbed earth.

C. Fasten headers in place with redwood or Douglas fir stakes of length necessary to extend into solid grade minimum of 12 inches.
   1. Provide stakes of sound material, neatly pointed, driven vertically, and securely nailed to headers.
      a. Space stakes, not to exceed 4 feet on centers with top of stakes set one inch below top of header.
      b. Provide minimum of 2-12d galvanized common nails through each stake.

D. Remove existing headers where new surfacing is installed adjacent to existing surfacing.

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

F. Provide additional stakes and anchorage as required to fasten headers in place.

3.04 PREPARATION

A. Primer: Apply primer in accordance with Greenbook Section 302-5.3.

B. Tack Coat:
   1. Apply tack coat in accordance with Caltrans Specifications Section 39 and following:
      a. Apply tack coat to asphalt concrete base course or sand asphalt base course.
      b. Apply emulsified asphalt tack coat between each lift or layer of full depth asphalt concrete and sand asphalt bases and on surface of bases where asphalt paving will be constructed.
      c. Apply tack coat to surfaces of previously constructed asphalt concrete base courses or Portland cement concrete surfaces abutting or projecting into asphalt pavement.
   2. Coat surfaces of curbs and gutters, and manhole, catch basin, and other structure frames with oil to prevent bond with asphalt pavement.
      a. Do not tack coat these surfaces.

3.05 ENGINEERED PAVING MAT INSTALLATION ~~*[omit if paragraph 2.02 C is not used]*~~

A. Tack Coat:
   1. Asphalt Binder for Application of Mat: PG 64–10.
   2. Application Rates:
      a. New Pavement Surface: 0.15 gallons per square yard.
      b. Aged Oxidized Surface: 0.17 gallons per square yard.
      c. Milled Surface: 0.2 gallons per square yard.

B. Placement – General:
   1. Examine surface on which the engineered paving mat is to be placed to ensure

it is reasonably free of dirt, water, vegetation, or other debris.

2. Do not place asphalt binder (tack coat) or engineered paving mat when in judgment of Project Inspector weather conditions are not suitable.
3. Ensure air and pavement temperatures are sufficient to allow tack coat to hold engineered paving mat in place.

a. Air Temperature:
1) 50 degrees F and rising for placement of asphalt tack coat.

C. Application of Tack Coat:
1. By calibrated distributor truck spray bar.
a. Emulsified asphalt is not allowed
2. Temperature of Tack Coat: Sufficiently high enough to permit uniform spray pattern.
a. Between 325 degrees F and 400 degrees F.
3. Target Width of Tack Coat Application:
a. Engineered paving mat material width plus 4 inches.
b. Wide enough to cover entire width of engineered paving mat material overlaps.
c. Apply only as far in advance of engineered paving mat material installation as is appropriate to ensure tacky surface at time of engineered paving mat material placement.
d. Do not allow pedestrian or vehicle traffic on tack coat.

D. Placement of Engineered Paving Mat:
1. Place engineered paving mat onto tack coat with minimum folds or wrinkles and before tack coat has cooled and lost tackiness.
2. Wrinkles or Folds in Excess of 1 inch: Slit and laid flat or pulled out and replaced as directed by Project Inspector.
3. In repaired areas, apply additional tack coat as needed to achieve sound bond to substrate.
4. Remove and replace damaged engineered paving mat per manufacturer's recommendations, at Contractor's expense with same type of material.
5. Use brooming, squeegee, or pneumatic tire rolling to remove air bubbles and to maximize engineered paving mat contact with pavement surface.
a. Perform in accordance with manufacturer's specifications
6. Counter excess tack coat that bleeds through engineered paving mat under normal construction traffic by broadcasting clean sand or hot mix asphalt to create bond break between excess tack and construction equipment tires.
a. Where sand is applied, remove excess sand from interlayer prior to placing hot mix asphalt overlay.
b. Do not use other materials, such as asphalt release agents or diesel, for this purpose.
7. Do not allow traffic, except necessary construction traffic to be driven on engineered paving mat.
8. Closely follow placement of engineered paving mat with placement of first lift of hot mix asphalt overlay.
9. Pave areas in which engineered paving mat has been placed during same day.
10. In event of rainfall on engineered paving mat prior to placement of first hot mix asphalt overlay lift, allow engineered paving mat to dry before hot mix asphalt is placed.
11. Compacted thickness of first lift of hot mix asphalt overlay on engineered paving mat: Not less than 1.5 inches.
a. Temperature of mix at placement not to exceed engineered paving mat melting point temperature.
b. Where total hot mix asphalt overlay thickness is less than 1.5 inches, do

not place engineered paving mat.

3.06 MIXING OF ASPHALT (BITUMINOUS) MATERIAL

A. Mix uniformly, using dry material to avoid foaming.

3.07 CONSTRUCTION OF ASPHALT PAVING

A. Provide engineered paving mat and asphalt (bituminous) surfacing material over base course as specified and in accordance with manufacturer's installation procedures.

B. Clean, dry, and uniformly coat with asphalt emulsion film, surfaces of walls, concrete, masonry, or existing asphalt (bituminous) surfacing indicated to be in direct contact with installed asphalt (bituminous) surfacing.

C. Thicken edges of asphalt (bituminous) surfacing that do not abut walls, concrete, or masonry, and edges joining existing asphalt (bituminous) surfaces.
   1. Remove headers at existing asphalt (bituminous) surfacing where new bituminous surfacing is to be installed.
   2. Thicken edges an additional 2 inches and taper to the indicated or specified thickness 6 inches back from such edges.

D. Provide adequate protection for concrete, planting areas, and other finish Work adjacent to areas indicated to receive asphalt (bituminous) surfacing.

E. Stakes or Screeds: Provide grade or screed stakes spaced not more than 15 feet apart in flow lines with grades of less than one percent.
   1. Continuous screeds may be provided instead of stakes

F. Placing – General:
   1. Do not install asphalt (bituminous) surfacing when atmospheric temperature is below 40 degrees F or when fog or other unsuitable weather conditions are present.
      a. Temperature of Mixture at Time of Installation:
         1) Not lower than 260 degrees F in warm weather or higher than 320 degrees F in cold weather.
   2. Where 2 inch or 3 inch thick asphalt (bituminous) surfacing is indicated or specified, install surfacing in one course.
   3. Where asphalt (bituminous) surfacing is indicated or specified 4 inches or more in thickness, except for thickened edges, install asphalt (bituminous) surfacing in courses of approximately equal thickness, with each course not exceeding 2-1/2 inches in thickness unless otherwise required by Architect.

G. Placing Single Course Asphalt Pavement:
   1. Install Work in accordance with Caltrans or SSPWC specifications.
   2. Place asphalt within 24 hours of applying primer or tack coat.
   3. Compact pavement by rolling to specified density.
      a. Do not displace or extrude pavement from position.
      b. Hand compact in areas inaccessible to rolling equipment.

4. Perform rolling with consecutive passes to achieve even and smooth finish without roller marks.

~~H. Placing Double Course Asphalt Pavement:~~
~~1. Place asphalt binder course within 24 hours of applying primer or tack coat.~~
~~2. Place wearing course within two hours of placing and compacting binder course.~~
~~3. Compact pavement by rolling to specified density.~~
~~a. Do not displace or extrude pavement from position.~~
~~b. Hand compact in areas inaccessible to rolling equipment.~~
~~4. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.~~

~~I.~~H. Spreading:
1. Install asphalt (bituminous) surfacing in manner to cause least possible handling of mixture
2. In open areas and wherever practicable:
   a. Install by mechanical means with self-propelled mechanical spreader.
3. In confined or restricted areas:
   a. Install mixture with hot shovels and rakes, and smooth with lutes.

~~J.~~I. Joints:
1. Provide vertical joints between successive runs.
   a. Install joints true to line, grade, and cross section.
   b. Lapped joints are not permitted.

~~K.~~J. Rolling:
1. Finish roll with self-propelled tandem roller weighing at least 8 tons.
   a. Break down roll with self-propelled roller weighing between 1-1/2 tons and 8 tons.
2. Roll in manner that preserves flow lines and established finished grades.
   a. Break down roll in areas adjacent to flow lines parallel to flow lines.
   b. Break down roll after bituminous surfacing is installed without shoving or cracking of mixture under roller.
   c. Continue finish rolling until surfacing is unyielding, true to grade, and meets requirements for specified smoothness.
   d. Areas inaccessible to finish roller may be finish rolled with breakdown roller or tamped with hot tamping irons and smoothed with hot smoothing irons or hand roller.
3. Where asphalt (bituminous) surfacing abuts concrete, masonry, and walks or paving, tamp joint smooth, when necessary, as described above to obtain uniformly even joint, true to line and grade.
   a. Tamp and smooth to properly compact.
4. Provide compacted asphalt (bituminous) surfacing with bulk specific gravity of at least 2.31 when tested in accordance with ASTM D 1188.

~~L.~~K. Pavement at Heavy Duty Asphalt Paving Areas:
1. Single course of 3 inch compacted thickness, sand seal coat.

3.08 TOLERANCES

A. Smoothness:
   1. Ensure that surface of asphalt (bituminous) surfacing after rolling:
      a. Is even, smooth, and uniform in texture with no voids or rock pockets
      b. Free of roller marks, or other irregularities
      c. Not varying by more than 1/8 inch, except at local depressions or raised areas as indicated, when 10 foot straightedge is placed on surface.

B. Grade:
   1. Finished Grade:
      a. Not vary more than 0.02 foot above or below required grade.
   2. Compensate for variations within prescribed tolerance so that average grade and cross-section are provided.

3.09 FLOOD TESTING

A. Flood test completed asphalt (bituminous) surfacing in presence of Project Inspector before seal coat has been installed.
   1. Repair areas of standing water or puddles and flood test locally.

3.10 SEAL COAT

A. General:
   1. Allow asphalt (bituminous) surfacing to cure for minimum of 30 days, then apply two coats of surface seal as specified
   2. Where indicated, provide multiple coats of surface seal to existing asphalt (bituminous) surfacing.

B. Surface Preparation:
   1. After asphalt (bituminous) surfacing has passed flood test, thoroughly wash surfaces with water to remove dirt, debris, excessive oil and grease, or other foreign matter and allow to dry before applying seal coat.
   2. Apply seal coat after asphalt (bituminous) surfacing has passed flood test.

C. Application:
   1. Install seal coat in strict accordance with manufacturer's written directions and recommendations.
   2. Install 2 coats of seal coat to new asphalt (bituminous) surfacing.
   3. Where new asphalt (bituminous) surfacing is installed adjacent to existing asphalt (bituminous) surfacing, overlap surface seal minimum of 12 inches onto existing asphalt (bituminous) surfacing.
   4. Where existing asphalt (bituminous) surfacing is indicated to be patched and sealed. Apply 2 coats of surface seal after patching.

3.11 FIELD QUALITY CONTROL

A. Additional Testing:
   1. Owner reserves right to obtain samples and perform tests to ensure compliance with Specifications, and to review weight slips and invoices of materials delivered to Project Site.

B. Provide field inspection and testing.
   1. Take samples and perform tests in accordance with AI MS-2.

3.12 CLEANING

~~A.~~ Remove and legally dispose of rubbish, debris, and waste materials off Project Site.

3.13 PROTECTION

A. Immediately after placement, protect pavement from mechanical injury for 7 days or until surface temperature is less than 140 degrees F.
   1. Protect Work until Substantial Completion.

END OF SECTION 32 1216

NEW 2-STORY CLASSROOM BUILDING
WILL ROGERS MIDDLE SCHOOL
LAWNDALE ELEMENTARY SCHOOL DISTRICT
~~[PROJECT NAME]~~
~~[PROJECT LOCATION]~~
~~[SCHOOL / COLLEGE DISTRICT]~~

SECTION 32 1313

CONCRETE PAVING

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Exterior concrete paving for:
      a. Walkways (sidewalks)
      b. Curbs and gutters
      c. Driveways
   2. Work Includes:
      a. Formwork
      b. Reinforcing
      c. Portland cement
      d. Integral colored finish *[when specified]*

B. Related Sections
   1. Section 01 3300: Submittal Procedures; general LEED submittal requirements
   2. Section 01 3329: Sustainable Design Reporting / LEED Requirements; specific LEED submittal requirements.
   3. Section 01 4500: Quality Control; testing and inspection of concrete.
   4. Section 01 5000: Temporary Facilities and Controls; barriers and temporary controls.
   5. Section 07 9200: Joint Sealants; traffic sealants.
   6.1. Section 31 0000: Earthwork; excavation, backfilling, and grading requirements.
   7. Section 32 0523: Concrete for Exterior Improvements; concrete for items other than paving.
   8.2. Section 32 1100: Base Course
   9.3. Section 32 1216: Asphalt Paving
   10. Section 32 1723: Pavement Markings
   11. Section 32 1726: Tactile Warning Surfacing

1.02 REFERENCES

A. ASTM International (ASTM):
   1. ASTM A 615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
   2. ASTM A767 – Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement
   3. ASTM A 1064 – Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete
   4. ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field
   5. ASTM C 33 – Standard Specification for Concrete Aggregates

6. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
7. ASTM C 94 – Standard Specification for Ready-Mixed Concrete
8. ASTM C143 – Standard Test Method for Slump of Hydraulic-Cement Concrete
9. ASTM C150 – Standard Specification for Portland Cement
10. ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete
11. ASTM C172 – Standard Practice for Sampling Freshly Mixed Concrete
12. ASTM C231 – Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
13. ASTM C 260 – Standard Specification for Air-Entraining Admixtures for Concrete
14. ASTM C 494 – Standard Specification for Chemical Admixtures for Concrete
15. ASTM C979 – Standard Specification for Pigments for Integrally Colored Concrete
16. ASTM C 1059 – Standard Specification for Latex Agents for Bonding Fresh To Hardened Concrete
17. ASTM C1064 – Standard Test Method for Temperature of Freshly Mixed Hydraulic-Cement Concrete
18. ASTM D 1751 – Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types)
19. ASTM D 1752 – Standard Specification for Preformed Sponge Rubber, Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction

B. American Concrete Institute (ACI):
1. ACI 211.1 – Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete
2. ACI 304R – Guide for Measuring, Mixing, Transporting and Placing Concrete.
3. ACI 305R – Specification for Hot Weather Concreting
4. ACI 306R – Guide to Cold Weather Concreting
5. ACI 308R – Guide to External Curing of Concrete.
6. ACI 309R – Guide for Consolidation of Concrete.

C. Concrete Reinforcing Steel Institute (CRSI):
1. CRSI Manual of Standard Practice.
2. CRSI Placing Reinforcing Bars

D. Public Works Standards, Inc.:
1. Standard Specifications for Public Works Construction (SSPWC):
   a. The "Greenbook"; current edition.
2. Standard Plans for Public Works Construction (SPPWC); current edition.

E. West Coast Lumber Inspection Bureau (WCLIB):
1. Standard Grading Rules No. 17, 2004.

F. South Coast Air Quality Management District (SCAQMD):
1. Rule 1113 – Architectural Coatings
   1) Concrete subcontractor.

1.03 SUBMITTALS

A. Product Data:
   1. For each type of manufactured material and product indicated.

B. Design Mixes:
   1. For each concrete pavement mix.
   2. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

1.04 QUALITY ASSURANCE

A. Concrete Standards:
   1. Comply with provisions of referenced standards, except where more stringent requirements are indicated.

B. Concrete Manufacturer Qualifications:
   1. Manufacturer of ready-mixed concrete products complying with ASTM C 94 requirements for production facilities and equipment.

C. Installer Qualifications:
   1. Experienced installer who has completed pavement work similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Concrete Testing Service:
   1. Engage qualified independent testing agency to design concrete mixes.

E. Field-Constructed Mockup:
   1. Cast 6 foot square mockup of each concrete type scheduled to demonstrate typical joints, surface finish, texture, color, and standard of workmanship.
      a. Construct mock-up slab panels for following finishes as applicable:
         1) Light Textured Broom Finish
         2) Medium Textured Broom Finish
         3) Heavy (Coarse) Textured Broom Finish
   2. Provide Control Joint (CJ) and Expansion Joint (EJ) in each mockup.
   3. Construct mockups in location and of size indicated or, when not indicated, as directed by Architect.
   4. Notify Architect seven days in advance of dates and times when mockups will be constructed.
   5. Obtain Architect's acceptance of mockups before starting construction.
   6. Should Architect determine that mockup does not meet requirements, demolish and remove it from Project Site, and cast another until mockup is accepted.
   7. Maintain accepted mockup undisturbed during construction as standard for judging completed pavement.
   8. Demolish accepted mockup and remove from Project Site when directed by Architect.
      a. Accepted mockups may become part of completed Work where undisturbed at time of Substantial Completion.

F. Preinstallation Conference:
1. Conduct conference at Project Site complying with requirements in Section 01 3119
2. Before submitting design mixes, review concrete pavement mix design and examine procedures for ensuring quality of concrete materials.
a. Require representatives of each entity directly concerned with concrete pavement to attend, including following:
1) Contractor's superintendent.
2) Independent testing agency responsible for concrete design mixes.
3) Ready-mix concrete producer.

1.05 PROJECT CONDITIONS

A. Traffic Control:
1. Maintain access for vehicular and pedestrian traffic as required for other construction activities.
2. Comply with other requirements specified in Section 01 5000.

B. Environmental Certifications:
1. Certificates for EQ Low-Emitting Materials:
a. Paints and Coatings

C. LEED Submittals:
1. Product Data for low emitting materials used for form coatings, and sealers/penetrating sealers.
a. Include printed statement of VOC content and manufacturer's receipts or proof of purchase.
b. Include documentation of compliance with requirements for low-emitting materials as specified in Section 01 3329.
c. Product Certificates and Laboratory Test Reports

1.06 REGULATORY REQUIREMENTS

A. General:
1. Construct walkways (sidewalks) to be stable, firm, and slip resistant in accordance with CBC Section 11B-302 and 11B-403 and as specified in this Section.
2. Refer to Article 3.06 for slip resistant finishes.

PART 2 PRODUCTS

2.01 GENERAL

A. Batch concrete in certified plant capable of achieving Waiver of Continuous Batch Plant and Materials Tests.

B. Produce each type and color of concrete in same batch plant.

C. Refer to Section 32 1100 for base course materials.

2.02 FORMWORK

A. Forms:
   1. Metal, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal and to provide full depth, continuous straight, smooth exposed surfaces.
   2. Use flexible or curved forms to form radius bends as required.
      a. Do not use notched and bent forms.

B. Form Release Agent:
   1. Provide commercial formulation form-release agent complying with local Volatile Organic Compound (VOC) limitations that will not bond with stain. or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

2.03 REINFORCING MATERIALS

A. Reinforcing Bars:
   1. Conforming to ASTM A 615, Grade 40, deformed.

B. Joint Dowel Bars:
   1. Plain Steel Bars:
      a. Conforming to ASTM A 615, Grade 60.
   2. Zinc coated (galvanized) after fabrication according to ASTM A 767, Class I coating
   3. Cut bars to length with ends square and free of burrs.
   4. Provide polyethylene closed-end sleeve or approved alternate at expansion joint dowels

C. Bar Supports:
   1. Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and dowels in place.
   2. Manufacture bar supports, according to CRSI Manual, from steel wire, plastic, or precast concrete or fiber reinforced concrete of greater compressive strength than concrete, and as follows:
      a. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.

2.04 CONCRETE MATERIALS

A. Use same brand and type of cementitious material from same manufacturer throughout Project.

B. Portland Cement:
   1. Conforming to ASTM C 150, [Type II] ~~[Type V] *[Verify type]*~~
   2. Color: **CP-1** – Natural Gray, for non-colored locations

C. Aggregate:
   1. Normal-Weight:
      a. Conforming to ASTM C 33, uniformly graded, from single source, with coarse aggregate as follows:
         1) Class: 1N.
   2. Maximum Aggregate Size: 1 inch nominal.
   3. Do not use fine or coarse aggregates containing substances that cause spalling.

D. Water:
   1. Conforming to ASTM C 94.

2.05 ADMIXTURES

A. Certified by manufacturer to contain not more than 0.1 percent water-soluble chloride ions by mass of cement and to be compatible with other admixtures.

B. Air-Entraining Admixture:
   1. Conforming to ASTM C 260.

C. Water-Reducing Admixture:
   1. Conforming to ASTM C 494, Type A.

D. Color Pigment:
   1. Conforming to ASTM C 979
      a. Synthetic mineral-oxide pigments or colored water reducing admixtures
   2. Color stable, nonfading, and resistant to lime and other alkalis.
   3. Minimum of one-fifth unit per sack of cement.
   4. Colors:
      a. As selected by Architect
      b. Manufacturer's full line, by Davis Colors or L.M Scofield, as indicated.

2.06 CURING MATERIALS

A. Moisture-Retaining Cover:
   1. Conforming to ASTM C 171
      a. Non-staining, reinforced, waterproof sheet.

B. Water: Potable.

C. Integrally Colored Concrete:
   1. Curing compound recommended by manufacturer of color admixture.

2.07 RELATED MATERIALS

A. Control Joint Material:
   1. Expansion Joint Filler Material:
      a. Fiber Type Expansion Joint Filler:
         1) Resilient, flexible, non-extruding, composed of cellular fibers securely bonded together and uniformly saturated with asphalt to
         2) Conforming to ASTM D 1751.
         3) Fibre Expansion Joint by W.R. Meadows, or approved equal.
      b. Cork Type Expansion Joint Filler:
   2. Plain or punched for dowels as required.

B. Bonding Agent:
   1. Conforming to ASTM C 1059, Type II
      a. Acrylic emulsion or styrene butadiene.

2.08 CONCRETE MIX DESIGN

A. Prepare design mixes for each type and strength of normal-weight concrete by either laboratory trial batch or field experience methods as specified in ACI 301.
   1. For trial batch method, use qualified independent testing agency for preparing and reporting proposed mix designs.
      a. Do not use Owner's field quality-control testing agency as independent testing agency.
   2. Limit use of fly ash to 15 percent of cement content by weight.

B. Proportion mixes according to ACI 211.1 and ACI 301 to provide normal-weight concrete with following properties:
   1. Compressive Strength:
      a. 3,000 psi at 28 days when tested in accordance with ASTM C39:
      b. Slump Range: 3 inches to 4 inches.
      c. Water-Cement Ratio: Maximum 50 percent by weight.

C. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having air content of 2.5 percent to 4.5 percent.

2.09 CONCRETE MIXING

A. Ready-Mixed Concrete:
   1. Comply with specified requirements and ASTM C 94 and following:.
      a. When air temperature is between 85 degrees F and 90 degrees F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes
      b. When air temperature is above 90 degrees F, reduce mixing and delivery time to 60 minutes.

2.10 LEED REQUIREMENTS

A. Credit EQ – Low Emitting Materials:
   1. Paints and Coatings

PART 3 EXECUTION

3.01 SURFACE PREPARATION

A. Proof-roll prepared subbase surface to check for unstable areas and verify need for additional compaction.
   1. Do not begin paving work until such conditions have been corrected and subbase is ready to receive paving.

B. Remove loose material from compacted subbase surface immediately before placing concrete.

3.02 EDGE FORMS AND SCREED CONSTRUCTION

A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for paving to required lines. grades, and elevations.
   1. Install forms to allow continuous progress of Work and so forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork and screeds for grade and alignment to following tolerances:
   1. Top of Forms:
      a. Not more than 1/8 inch in 10 feet.
   2. Vertical Face on Longitudinal Axis:
      a. Not more than 1/4 inch in 10 feet.

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

3.03 PLACING REINFORCEMENT

A. Follow CRSI recommended practice for placing and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, or other bond-reducing materials.

C. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement. Maintain minimum cover to reinforcement.

D. When specified or indicated, install welded wire fabric in lengths as long as practicable:
   1. Lap adjoining pieces at least one full mesh and lace splices with wire.
   2. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.04 JOINTS

A. Construct control, construction, and expansion joints and tool edgings true to line with faces perpendicular to surface plane of concrete.
   1. Construct transverse joints at right angles to centerline, unless indicated otherwise.
   2. When joining existing paving, place transverse joints to align with previously placed joints, unless indicated otherwise.

B. Tooled Control Joints (CJ):
   1. Form tooled control joints after initial floating by grooving and finishing each edge of joint with groover tool to radius as indicated or specified.
      a. Repeat grooving of control joints after applying surface finishes.
      b. Eliminate tool marks on concrete surfaces.
   2. Jointer Tool:
      a. 1/4 inch wide at surface, tapered, with top edges rounded to 1/4 inch radius.
   3. Location:
      a. As shown on Drawings, but not more than 15 feet on center both ways.
      b. Typical Sidewalk Joints:
         1) Make joints 5 feet on center, or as directed by Architect.

C. Sawed Joinls:
   1. Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades.

2. Cut 1/8 inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before developing random contraction cracks.
3. Prior approval of Architect is required for sawed joints.

D. Edging:
   1. Tool edges of pavement, gutters, curbs, and joints in concrete after initial floating with edging tool to specified radius.
   2. Repeat tooling of edges after applying surface finishes.
      a. Eliminate tool marks on concrete surfaces.
   3. Radius:
      a. 1/4 inch, unless indicated otherwise.

E. Construction Joints (CJ):
   1. Set construction joints at side and end terminations of paving and at locations where paving operations are stopped for more than 1/2 hour, unless paving terminates at isolation joints.
   2. Continue reinforcement across construction joints unless indicated otherwise.
   3. Do not continue reinforcement through sides of strip paving unless indicated.
   4. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.

F. Expansion Joints (EJ):
   1. Provide in exterior concrete paving on grade at maximum interval of 30 feet on center or as noted.
   2. Form expansion joints of preformed joint filler strips as follows:
      a. At intersections with vertical surfaces.
      b. At surfaces abutting concrete curbs, catch basins, manholes, inlets, structures, walks, other fixed objects, and where indicated
      c. At other penetrations through paving.
   3. Joint Fillers:
      a. Use fiber type expansion joint fillers typically and depress 1/4 inch unless otherwise noted.
      b. Use cork type expansion joint fillers at conditions with non-bituminous waterproofing, liquid waterproofing, or sealant systems.
      c. Where more than one length is required, lace or clip joint filler sections together.
      d. Do not leave gaps between ends of joint filler units.
      e. Protect top edge of joint filler during concrete placement with metal, plastic, or other temporary preformed cap.
         1) Remove protective cap after concrete has been placed on both sides of joint.
   4. Install dowel bars and support assemblies at joints where indicated.
      a. Lubricate or asphalt-coat one half of dowel length to prevent concrete bonding to one side of joint.

G. Installation of Sealants:
   1. Comply with requirements of Section 07 9200 and following:
      a. Install sealant to depths recommended by sealant manufacturer but within following general limitations, measured at center section of bead:
         1) For sidewalks, pavements, and similar joints sealed with elastomeric sealants and subject to traffic and other abrasion and indentation exposures, fill joints to depth equal to 75 percent of joint width, but not more than 1/2 inch deep or less than 3/8 inch deep.

b. Tool joints to form smooth, uniform beads with slightly concave surfaces, with finished joints straight, uniform, smooth and neatly finished.
c. Remove excess sealant from adjacent surfaces of joint, leaving Work in neat, clean condition.
d. Do not use tooling agents unless recommended by sealant manufacturer.

3.05 CONCRETE PLACEMENT

A. Inspection:
1. Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in.
2. Notify other trades to permit installation of their work.

B. Moisten subbase to provide uniform dampened condition at time concrete is placed.
1. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Comply with requirements and ACI 304R for measuring, mixing, transporting, and placing concrete.

D. Deposit and spread concrete in continuous operation between transverse joints.
1. Do not push or drag concrete into place or use vibrators to move concrete into place.
2. When concrete placing is interrupted for more than 1/2 hour, place construction joint.

E. Consolidate concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping.
1. Use equipment and procedures to consolidate concrete complying with ACI 309R.
2. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator.
3. Keep vibrator away from joint assemblies, reinforcement, or side forms.
4. Use only square-faced shovels for hand-spreading and consolidation.
5. Consolidate with care to prevent dislocating reinforcing, dowels, and joint devices.

F. Screed paved surfaces with straightedge and strike off.
1. Use bull floats or darbies to form smooth surface plane before excess moisture or bleed water appears on surface.
2. Do not further disturb concrete surfaces prior to beginning finishing operations.

G. Hot-Weather Placement:
1. Place concrete according to recommendations in ACI 305R and as follows when hot-weather conditions exist:
a. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90 degrees F.
1) Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water.

2) Using liquid nitrogen to cool concrete is Contractor's option.

2. Cover reinforcement steel with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
3. Fog-spray forms, reinforcement steel, and subgrade just before placing concrete.
4. Keep subgrade moisture uniform without standing water, soft spots, or dry areas.

3.06 CONCRETE FINISHING

A. Wetting of concrete surfaces during screeding, initial floating, or finishing operations is prohibited.

B. Float Finish:
1. Begin floating when bleed water sheen has disappeared and concrete surface has stiffened sufficiently to permit operations.
2. Float surface with power-driven floats, or by hand floating, where area is small or inaccessible to power units.
3. Finish surfaces to true planes within tolerance of 1/4 inch in 10 feet as determined by 10 foot long straightedge placed anywhere on surface in any direction.
4. Cut down high spots and fil1low spots.
5. Refloat surface immediately to uniform granular texture.

C. Broom Finish (Non-slip finish is required on all walk surfaces):
1. Light Textured Broom Finish:
   a. Provide light texture by drawing soft bristle broom lightly across concrete surface in one directions, as indicated on Drawings, to provide uniform fine line texture finish.
2. Medium Textured Broom Finish:
   a. For slopes less than 6 percent, provide medium texture by drawing soft bristle broom across concrete surface perpendicular to line of traffic to provide uniform fine line texture finish.
3. Heavy (Coarse) Textured Broom Finish:
   a. For slopes 6 percent and greater, provide coarse finish by striating surface 1/16 inch to 1/8 inch deep with stiff-bristled broom, perpendicular to line of traffic.

3.07 CURING AND PROTECTION

A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
1. Comply with ACI 306.1 for cold-weather protection and follow recommendations in ACI 305R for hot-weather protection during curing.

B. Evaporation Retarder:
1. Apply evaporation retarder to concrete surfaces when hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations.

2. Apply according to manufacturer's written instructions after placing, screeding. and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface.

D. Curing Methods:
1. Cure concrete by moisture curing, moisture-retaining-cover curing, curing compounds, or combination of following:
a. Moisture Curing:
1) Keep surfaces continuously moist for not less than seven days with following materials:
a) Water.
b) Continuous water-fog spray.
c) Absorptive cover, water saturated, and kept continuously wet.
2) Cover concrete surfaces and edges with 12 inch lap over adjacent absorptive covers.
b. Moisture-Retaining-Cover Curing:
1) Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches and sealed by waterproof tape or adhesive.
2) Immediately repair any holes or tears during curing period using cover material and waterproof tape. .

3.08 FIELD QUALITY CONTROL

A. Testing Services:
1. Perform testing according to following requirements:
a. Sampling Fresh Concrete:
1) Obtain representative samples of fresh concrete according to ASTM C 172, except as modified for slump to comply with ASTM C 94.
b. Slump Tests:
1) Conforming to ASTM C 143:
a) One test at point of placement for each compressive-strength lest, but not less than one test for each day's pour of each type of concrete.
2) Additional tests will be required when concrete consistency changes.
c. Compression Test Specimens:
1) Conforming to ASTM C 31:
a) One set of four standard cylinders for each compressive-strength test, unless directed otherwise.
2) Mold and store cylinders for laboratory cured test specimens except when field-cured test specimens are required.
d. Air Content:
1) Conforming to ASTM C 231 – Pressure Method:
a) One test for each compressive-strength test, but not less than one test for each day's pour of each type of air-entrained concrete.

e. Concrete Temperature:
   1) Conforming to ASTM C 1064:
      a) One test hourly when air temperature is 40 degrees F, and below and when 80 degrees F and above.
      b) One test for each set of compressive strength specimens.
f. Compressive-Strength Tests:
   1) Conforming to ASTM C 39:
      a) One set for each day's pour of each concrete class exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd.
   2) Test one specimen at 7 days and two specimens at 28 days
   3) Retain one specimen in reserve for later testing when required.
g. When frequency of testing will provide fewer than five compressive-strength tests for given class of concrete, conduct testing from at least five randomly selected batches or from each batch when fewer than five are used.
h. When total quantity of given class of concrete is less than 50 cu. yd., Architect may waive compressive-strength testing when adequate evidence of satisfactory strength is provided.
i. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, evaluate current operations and provide for corrective procedures for:
   1) Protecting and curing in-place concrete.
j. Strength level of concrete will be considered satisfactory when averages of sets of three consecutive compressive-strength test results equal or exceed specified compressive strength and no individual compressive-strength test result falls below specified compressive strength by more than 500 psi.

2. Report test results in writing to Architect, concrete manufacturer, and Contractor within 24 hours of testing.
   a. Submit Reports of compressive-strength tests containing following:
      1) Project identification name and number
      2) Date of concrete placement
      3) Name of concrete testing agency
      4) Concrete type and class
      5) Location of concrete batch in pavement
      6) Design compressive strength at 28 days
      7) Concrete mix proportions and materials
      8) Compressive breaking strength
      9) Type of break for both 7 and 28 day tests.
3. Nondestructive Testing:
   a. Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection.
4. Additional Tests by Testing Agency:
   a. Make additional tests of concrete when test results indicate slump, air entrainment, concrete strengths, or other requirements have not been met, as directed by Architect.

b. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed.

3.09 REPAIRS

A. Remove and replace concrete paving that is broken, damaged, or defective, or does not meet requirements of this Section.

B. Drill test cores where directed by Architect when necessary to determine magnitude of cracks or defective areas.
   1. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to paving with epoxy adhesive.

3.10 CLEANING

A. Sweep concrete pavement and wash free of stains, discolorations. dirt, and other foreign material just prior to final inspection.

3.11 PROTECTION

A. Protect concrete from damage.
   1. Exclude traffic from paving for at least 14 days after placement.
   2. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
      1) Protect the Work of this section until date of Substantial Completion.

END OF SECTION 32 1313

SECTION 32 1723

PAVEMENT MARKINGS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Parking lot striping:
      a. Includes markings and accessibility symbols, for accessible spaces as indicated.
      b. Fire lane identification
      c. Other curb identification and markings.
   2. Play court game striping and symbols as indicated on Drawings.

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 32 0523: Concrete for Exterior Improvements
   3. Section 32 1216: Asphalt Paving
   4. Section 32 1313: Concrete Paving
   5. Section 32 1726: Detectable Warning Surfaces

1.02 REFERENCES

A. California Code of Regulations, Title 24, current edition, Part 2, California Building Code (CBC), Volumes 1 and 2.
   1. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.

B. Federal Specifications (FS):
   1. FS TT-P-1952 – Paint, Traffic and Airfield Marking, Waterborne, current version.

C. Federal Standards (FED-STD):
   1. FED-STD 595C – Colors Used in Government Procurement, current version.

D. South Coast Air Quality Management District (SCAQMD):
   1. Rule 1113 – Architectural Coatings

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer’s product data on traffic paint products and material.

B. Shop Drawings:
   1. Indicating location, extent, color, and texture of markings.

C. Samples:
   1. Color samples of paint products.

1.04 PROJECT CONDITIONS

A. In-Service Surface Temperature Limits:
   1. Dry: 50 degrees F minimum.
   2. Do not apply when air, surface, or product temperatures are below 50 degrees F, or when adverse weather conditions are forecast.

B. Dry Time at 77 degrees F and 50 percent Relative Humidity:
   1. Drying times will vary depending on temperature, air circulation, and humidity.

1.05 REGULATORY REQUIREMENTS

A. Accessible Parking Spaces Serving Particular Building or Facility:
   1. When serving more than one accessible entrance, locate on shortest accessible route to entrance or multiple accessible entrances per CBC Section 11B-208.3.1
   2. Provide minimum number of required accessible parking spaces in accordance with CBC Section 11B-208.2
   3. Provide a least one van-accessible parking space for every six, or fraction thereof, of accessible parking spaces in accordance with CBC 11B-208.2.4
   4. Provide accessible parking spaces and access aisles comply with CBC Section 11B-502
      a. Dimension parking spaces to centerline of marked lines as follows:
         1) Mark parking spaces and access aisles according to CBC Figures 11B-502.2, 11B-502.3 and 11B-502.3.3
         2) Provide surfaces complying with CBC Section 11B-11B-302 and at same level with slopes not steeper than 1:48 in any direction per CBC Section 11B-502.4
   5. Parking Space Dimensions:
      a. Parking Spaces and Van Accessible Spaces: As indicated on Drawings.
      b. Place access aisles on either side of parking spaces.
         1) Locate on passenger side for van accessible parking spaces.
   6. Parking Space and Access Aisle Markings:
      a. Mark access aisles with blue painted borderline around their perimeter.
      b. Mark area within blue borderlines with hatched lines maximum of 36 inches on center with color contrasting to that of aisle surface.
         1) White on asphalt paving.
         2) Blue on concrete paving.
      c. Access aisle markings may extend beyond minimum required length per CBC Section 11B-502.3.3.
      d. Mark access aisles so as not to overlap vehicular way per CBC Section 11B-502.3.4.
      e. Provide vertical clearance of 8 feet-2 inches minimum for accessible parking spaces, access aisles, and vehicular routes serving them per CBC Section 11B-502.5.

B. Fire Lane Identification:
   1. Provide identification conforming to requirements of local fire authority.
   2. Fire Lane Entrance and No Parking Signs:
      a. Post each vehicle entrance to area containing red curbs with approved Fire Lane Entrance Sign.

3. Fire Lane Signs: Post “Fire Lane – No Parking” signs immediately adjacent to each designated fire lane and at intervals not to exceed 50 feet, unless directed otherwise by local fire authority.
4. Fire Lane Curb Markings: Paint curbs safety red.
   a. On top of curb, paint “**FIRE LANE – NO PARKING**” in white letters 3 inches high, at spacing of 30 feet on center, or portion thereof.

PART 2 PRODUCTS

2.01 MATERIALS

A. Traffic Marking Paint:
   1. 100 percent Acrylic Resin System:
      a. Ready-mixed, one–component, waterborne acrylic traffic line paint.
      b. High Solids formulated for hot and cold application to either asphalt concrete or Portland cement concrete pavements.
   2. Meets performance standards of FS TT-P-1952, Type II.
   3. VOC Content: Less than 100g/L
   4. Colors:
      a. Specified colors conforming to FED-STD 595C.
   5. Product and Manufacturer:
      a. Fast Dry Paint Series by American Traffic Products, Rialto, CA, or approved equal.

B. Play Court Striping:
   1. One Coat: VSZM10 VIN-L-STRIPE Interior/Exterior Zone Marking
      a. As manufactured by Dunn Edwards Paints, Los Angeles, CA, or approved equal.
   2. Allow surface to cure as required by paint manufacture before applying paint.
   3. Cleaning:
      a. Sweep and clean surface to eliminate loose material and dust.
   4. Apply paint with mechanical equipment to produce uniform straight edges.
      a. Use painting equipment, masking and templates specifically designed for this purpose.
      b. Protect adjoining Work from damage
   5. Layout play courts to exact requirements of Owner.
      a. Verify layout line widths and colors prior to painting

PART 3 EXECUTION

3.01 PAVEMENT MARKINGS

A. Application of Paint:
   1. Prior to application of paint, allow pavement to properly cure.
      a. Clean and prepare in accordance with paint manufacturer's written recommendations.
   2. Provide mechanical equipment to install paint in a uniform, straight or curved pattern, without holidays and other defects.
   3. Do not permit traffic until paint has completely cured.
   4. Install 2 coats in thickness recommended by manufacturer.

B. Marking Width and Color:
   1. Unless indicated otherwise, marking width and color are as follows:

	Width	Color
a. Parking stall lines	4 inches	
1) General		White
2) Accessible		Blue
b. Traffic markings	4 inches	Yellow
c. Striping	4 inches	
1) General		Yellow
2) Accessible		Blue
d. International Symbol of Accessibility (ISA)	2 inches	White on blue background
e. Fire Lanes:		
1) Curbs		Red
2) Lettering		White

3.02 CLEANING

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

3.03 PROTECTION

A. Protect Work:
   1. With barricades and signs until paint has completely dried.
   2. Until Substantial Completion

END OF SECTION 32 1723

SECTION 32 1726

DETECTABLE WARNING SURFACES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Cast In Place Detectable Warning Surface Tiles where indicated on Drawings.

B. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 32 0523: Concrete for Exterior Improvements; concrete for items other than paving or cast-in-place concrete.
   3. Section 32 1313: Concrete Paving
   4. Section 32 1723: Pavement Markings.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.
   1. Chapter 11B – Accessibility to Public Buildings, Public Accommodations, Commercial Buildings, and Public Housing.

B. ASTM International (ASTM):
   1. ASTM B117 – Standard Practice for Operating Salt Spray (Fog) Apparatus
   2. ASTM C 293 – Standard Test Method for Flexural Strength of Concrete (Using Simple Beam With Center-Point Loading)
   3. ASTM C1026 – Standard Test Method for Measuring the Resistance of Ceramic and Glass Tile to Freeze-Thaw Cycling
   4. ASTM D 543 – Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents
   5. ASTM D 570 – Standard Test Method for Water Absorption of Plastics
   6. ASTM D 638 – Standard Test Method for Tensile Properties of Plastics
   7. ASTM D 695 – Standard Test Method for Compressive Properties of Rigid Plastics
   8. ASTM D 790 – Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
   9. ASTM D 1037 – Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials
   10. ASTM D 1308 – Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
   11. ASTM E 84 – Standard Test Method for Surface Burning Characteristics of Building Materials
   12. ASTM G 155 – Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

C. Federal Standard (FS):
   1. Federal Standard 595C – Colors Used in Government Procurement, current version.

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's literature describing products, installation procedures and routine maintenance.

B. Shop Drawings:
   1. Show fabrication details for specified products, consisting of:
      a. Composite structural system
      b. Tile surface profile
      c. Sound on cane contact amplification feature.
   2. Include plans of tile placement including joints, and material to be used.
      a. Outline installation materials and procedure
   3. Design and show tile pattern between existing expansion joints with tile rib dimension used for cut size of panels.

C. Samples:
   1. Minimum of four samples, as Project Site mock-ups, of full cast in place detectable tile warning surface tiles of kind proposed for use.
   2. Minimum of four samples, as Project Site mock-ups, of full surface-mounted detectable warning surface tiles of kind proposed for use.

D. Material Test Reports:
   1. From qualified accredited independent testing laboratory indicating that materials proposed for use are in compliance with requirements and meet properties indicated.
   2. Conduct test reports on cast in place detectable warning surface tiles as certified by qualified independent testing laboratory.
   3. Do not include manufacturer’s MSDS sheets with this submittal.
      a. Furnish to Contractor only.

E. Maintenance Instructions:
   1. Copies of manufacturer's specified maintenance practices for cast-in-place detectable warning surface tiles

1.04 QUALITY ASSURANCE

A. Provide cast in place detectable warning surface tiles and accessories as produced by single manufacturer with minimum of three years experience in manufacturing of cast in place detectable warning surface tiles.

B. Installer's Qualifications:
   1. Engage experienced installer certified in writing by detectable warning surface tile manufacturer as qualified for installation, who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.
   2. Arrange for manufacturer's supervisor to be present at initial pour for cast-in-place tiles.
   3. Arrange for manufacturer's supervisor to be present at initial installation of surface-mounted tiles.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Suitably package or crate tiles to prevent damage in shipment or handling.
   1. Protect finished surfaces with sturdy wrappings, and identify tile type by part number.

B. Deliver tiles to designated location at Project Site for storage prior to installation.

1.06 PROJECT CONDITIONS

A. Environmental Conditions and Protection:
   1. Maintain minimum temperature of 40 degrees F in spaces to receive tiles for at least 24 hours prior to installations, during installation, and for not less than 24 hours after installation.
   2. Store tile material in spaces where they will be installed for at least 24 hours before beginning installation.
   3. After installation, maintain minimum temperature of 40 degrees F in areas where Work is completed.

B. Contain and control use of water for Work, cleaning, or dust control.
   1. Do not allow waste water to come into contact with public.
   2. Provide barricades or screens to protect public.

C. Conduct disposal of liquids or other materials of possible contamination in accordance with federal state and local laws and ordinances.

D. Use cleaning materials with code-compliant low VOC solvent content and low flammability when used on Project Site.

E. Coordinate phasing and flagging personnel operations as specified in Division 01.

1.07 REGULATORY REQUIREMENTS

A. Detectable Warning Surfaces:
   1. Provide tactile warning surfaces complying with CBC Section 11B-705.1
   2. Surfacing Color: No. 33538 “Federal Yellow” conforming to FS 595C.
      a. Exception:
         1) Provide colors used for locations at curb ramps, islands, or cut-through medians that contrast visually with color of adjacent walking surfaces.
      b. Provide either light-on-dark, or dark-on-light, in accordance with CBC Section 11B-705.1.1.3.
   3. Provide surfaces that differs from adjoining surfaces in resiliency or sound-on-cane contact in accordance with CBC Section 11B-705.1.1.4.

1.08 WARRANTY

A. Provide manufacturer’s minimum 5 year warranty in writing for period of five years from date of final completion complying with DSA Bulletin 10/31/02, revised 04/09/08.
   1. Warranty includes defective work, breakage, deformation, fading and chalking of finishes, and loosening of tiles.

PART 2 PRODUCTS

2.01 MANUFACTURERS/PRODUCTS

A. Provide detectable warning surface tile by one of following:
   1. Engineered Plastics, Inc. (Armor-Tile)
   2. ADA Solutions, Inc.
   3. Armorcast Products

B. Basis-of-Design Product:
   1. Vitrified Polymer Composite (VPC) Cast in Place Detectable Warning Surface Tiles specified is based on Armor-Tile as manufactured by Engineered Plastics Inc.
   2. Existing engineered and field tested products which are subject to compliance with requirements, may be incorporated in Work and provided they meet or exceed specified test criteria and characteristics.

2.02 MATERIALS

A. Tiles:
   1. Made of homogeneous vitrified polymer composite (VPC) material with ultraviolet stabilized coating, to minimize color wear
   2. Provide with slip-resistant surface, incorporating “truncated domes” of same material.
   3. Nominal thickness of detectable warning tile: 1/8 inch, exclusive of height of truncated domes.
   4. Provide tiles complying with applicable requirements of CBC, Chapter 11B.

B. Vitrified Polymer Composite (VPC) cast-in-place detectable warning surface tiles:
   1. Epoxy polymer composition with ultra violet coating employing aluminum oxide particles in truncated domes, conforming to following:
      a. Compressive Strength per ASTM D 695:
         1) Not less than 18,000 psi.
      b. Tensile Strength per ASTM D 638:
         1) Not less than 10,000 psi.
      c. Flexural Strength per ASTM C 293 or D 790:
         1) Not less than 24,000 psi.
      d. Water Absorption per ASTM D 570:
         1) Not to exceed 0.35 percent.
      e. Slip Resistance:
         1) Minimum 0.9 for combined wet/dry static co-efficient of friction when tested per ASTM C 1028
      f. Chemical Stain Resistance per ASTM D 543 or D 1038:
         1) Withstand without discoloration or staining minus 1 percent hydrochloric acid, urine, calcium chloride, stamp pad ink, gum and red aerosol paint.
      g. Fire-Resistance per ASTM E 84:
         1) Flame Spread Index: Less than 15.
      h. Accelerated Weathering per ASTM G 155:
         1) Exhibit following result for 3000 hours:
            a) Delta E, less than 4.5: No deterioration, fading or chalking of surface of tile.

i. Accelerated Aging and Freeze Thaw Test per ASTM D 1037 or C1026:
   1) Show no evidence of cracking, delamination, warpage, checking, blistering, color change, loosening of tiles, or other defects.
j. Salt and Spray Performance of Tile per ASTM B 117:
   1) Not show deterioration or other defects after 200 hours of exposure.

C. Pattern/Dimension:
1. Provide detectable warning surface tile incorporating “in-line” pattern of truncated domes 0.2 inch in height, 0.9 inch minimum and 0.092 inch maximum diameter at base, and 0.45 inch minimum and 0.47 inch maximum diameter at top of dome.
2. Space domes at 2.3 inches minimum to 2.4 inches maximum center-to-center, measured “in-line”
3. Wheelchair Safety:
   a. Provide field area of detectable warning surface consisting of non-slip surface with minimum of 40 degree to 90 degree raised points, 0.045 inch high, per square inch

D. Color:
1. Unless otherwise indicated, provide detectable warning surface tiles in color specified in Article 1.07 A
2. Provide color integral with detectable warning device tiles and not surface applied.
3. Do not use paints or other surface coatings.

E. Furnish following for installation of surface-mounted tiles:
1. Fasteners:
   a. Flat-head drive anchors made of corrosion-resistant material, 1/4 inch in diameter x 1-3/4 inches long.
2. Adhesives:
   a. Urethane elastomeric adhesive material, as required by manufacturer’s specifications.

F. Sealants:
1. Gray epoxy, two-component sealant.
   a. Manufactured by Sika, Bostik or approved equal.
   b. Complying with requirements of Section 07 9200.
2. As supplied by tile manufacturer.

PART 3 EXECUTION

3.01 INSTALLATION OF CAST-IN-PLACE TILES

A. During concrete pouring and tile installation procedures, ensure adequate safety guidelines are in place and are in accordance with applicable industry and government standards.

B. Prior to placement of cast in place detectable warning surface tiles, review manufacturer's shop drawings and layout drawing prepared by installation contractor to resolve issues related to pattern repeat, tile cuts, expansion joints, control joints, curves, end returns and surface interferences.
1. Refer discrepancies to Architect.

C. Physical Characteristics of Concrete:
   1. Consistent with Section 32-1313 specifications while maintaining slump range of 4 to7 inches to permit solid placement of cast in place detectable warning surface tiles.
   2. Overly wet mix will cause tiles to float.
      a. Furnish suitable weights such as concrete blocks or sandbags (25 lbs.)
         1) Place on each tile.

D. Concrete pouring and finishing operations require typical mason's tools.
   1. Four foot long level with electronic slope readout, 25 lb. weights, and large non-marring rubber mallet are specific to installation of cast-in-place detectable warning surface tiles.
   2. Vibrating mechanism may be employed.
      a. Fix vibrating unit to soft wood base at least 1 foot square.

E. Pour and finish concrete true and smooth to required dimensions and slope prior to tile placement.
   1. Immediately after pouring concrete, use electronic level to check that required slope is achieved
   2. Place tile square and true to curb edge in accordance with approved shop drawings.
   3. Tamp or vibrate Tiles into fresh concrete to ensure that field level of tile is flush to adjacent concrete surface.
      a. Do not attempt to accomplish embedment process by stepping on tiles as this may cause uneven setting which can result in air voids under tile surface
   4. Shop drawings indicate that tile field level (base of truncated dome) is flush to adjacent surfaces to permit proper water drainage and eliminate tripping hazards between adjacent finishes.
      a. Tolerance for elevation differences between tile and adjacent surface is 1/16 inch.

F. Immediately after tile placement, tile elevation is to be checked to adjacent concrete.
   1. Set tile elevation consistent with shop drawings to permit water drainage to curb as design dictates.
   2. Ensure field surface of tile is flush with surrounding concrete and back of curb so that no ponding of possible on tile at back side of curb

G. While concrete is workable, use 3/8 inch edging tool to create finished edge of concrete.
   1. Use steel trowel to finish concrete around tile perimeter, flush to field level of Tile.

H. During and after tile installation and concrete curing stage, do not allow walking, leaning, or external forces placed on tile to rock tile, causing void between underside of tile and concrete.

I. Following tile placement, review installation tolerances to shop drawings and adjust tile before concrete sets.
   1. Place suitable weights of 25 lbs. on each tile and additional weights at tile to tile assemblies as necessary to ensure solid contact of tile underside to concrete.

J. Following curing of concrete, remove protective plastic wrap from tile face by cutting plastic with sharp knife tight to concrete/tile interface.
   1. Where concrete bleeding occurs between tiles, soft brass wire brush will clean residue without damage to tile surface.

K. Individual tiles may be bolted together with 1/4 inch bolts or equivalent hardware to help ensure adjacent tiles are flush to each other during installation process.
   1. Place tape or sealant on underside of bolted edge to prevent concrete from rising up between tiles during installation
      a. Replace protective plastic wrap peeled back to facilitate bolting or cutting by taping to ensure tile surface remains free of concrete during installation process
   2. Replace sound-amplifying plates on underside of tile dislodged during handling or cutting and secure with construction adhesive
      a. Air gap created between plates and bottom of tile is important in preserving sound on cane audible properties of tiles.
   3. Applications of Sealant:
      a. Install level to adjacent surface and straight line formed to tile edge.
      b. Mask off tile faces with duct tape to ensure clean definition of sealant to adjacent surfaces.

3.02 PAVEMENT MARKINGS

A. Refer to Section 32 1723 for coordination of pavement markings with tactile warning surface locations.

3.03 CLEANING AND PROTECTING

A. Protect panels against damage during construction period to comply with tile manufacturer's specification.

B. Protect tiles against damage from rolling loads following installation by covering with plywood or hardboard.

C. Clean tactile tiles not more than four days prior to date scheduled for inspection intended to establish date of Substantial Completion in each area of Project.
   1. Clean tile by method specified by manufacturer.

D. Comply with manufacturer's maintenance manual for cleaning and maintaining tile surface.
   1. Perform recommended annual inspections for safety and tile integrity

E. Remove and legally dispose of rubbish, debris, and waste materials off Project Site.

F. Protect Work until Substantial Completion.

END OF SECTION 32 1726

SECTION 32 3113

CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Chain link fencing for:
      a. Exterior installation, where indicated on Drawings.
   2. Finish for Chain Link Fences and Gates:
      a. Hot dipped galvanized.
   3. Chain Link Gates:
      a. Pedestrian Swing Gates.
      b. Double Swing Gates.
   4. Gate Operation:
      a. Manually operated.
   5. Gate hardware and related accessories.

B. Items Not Included:
   1. Padlocks:
      a. Padlocks where required, will be provided by Owner.

C. Related Sections:
   1. Section 01 4100: Regulatory Requirements; current Code edition.
   2. Section 03 3000: Cast-in-Place Concrete; fence post footings.

1.02 REFERENCES

A. California Code of Regulations (CCR), Title 24, Part 2, California Building Code (CBC), Volumes 1 and 2, current edition.

B. ASTM International (ASTM):
   1. ASTM A 123 – Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   2. ASTM A153 – Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   3. ASTM A 392 – Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric
   4. ASTM A641 – Standard Specification for Zinc–Coated (Galvanized) Carbon Steel Wire
   5. ASTM A 780 – Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings
   6. ASTM C 1107 – Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink)
   7. ASTM F 567 – Standard Practice for Installation of Chain-Link Fence
   8. ASTM F 1043 – Standard Specification for Strength and Protective Coatings on Steel Industrial Fence Framework
   9. ASTM F 1083 – Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures

C. Chain Link Fence Manufacturer's Institute (CLFMI):
   1. Product Manual
   2. WLG2445 – Chain Link Fence Wind Load Guide for the Selection of Line Posts and Line Post Spacing.

D. Federal Specifications (FS):
   1. RR-F-191/3E - Fencing, Wire and Post, Metal (Chain-Link Fence Posts, Top Rails and Braces) (Detail Specification)

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's data, specifications, and installation instructions for chain link fence and gates.

B. Shop Drawings:
   1. Site Plan showing layout of fence locations and indicate following:
      a. Dimensions.
      b. Location of gates and opening size.
      c. Cleared area.
      d. Elevation of fence, gates, and footings.
      e. Details of attachments.
   2. Include accessories, fittings, hardware, anchorages, and schedule of components.

C. Samples:
   1. Gate Hardware and Components:
      a. Galvanized finish, when requested by Architect.

PART 2 PRODUCTS

2.01 FABRIC

A. Zinc-Coated Steel Fabric:
   1. Conforming to ASTM A 392, Class 1, galvanized before weaving (GBW).
      a. Top and bottom selvages knuckled.
   2. Provide 11 gage wires in 2 inch mesh, unless noted otherwise.
   3. Provide one piece fabric, full height.

2.02 POSTS, RAILS, AND ASSOCIATED ITEMS

A. Posts:
   1. Round steel pipe and rails complying with ASTM F 1043.
      a. Material Design Group IA, Table 3 – Heavy Industrial Fence Framework.
   2. Schedule 40 galvanized pipe conforming to ASTM F 1083
      a. ASTM F 1043, Material Design Group IA
         1) External and internal coating Type A.
   3. Intermediate Line Posts for fabric heights:
      a. Over 6 feet to 8 feet: 2.375 inch O.D., 3.65 lb/ft.
   4. Terminal (End Pull and Corner) Posts for fabric heights:
      a. Over 6 feet to 8 feet: 2.875 inch O.D., 5.70 lb/ft.
   5. Gate Posts for Swing Gates:
      a. Gate fabric height over 6 feet to 12 feet:

1) Gate Leaf Width:
   a) Up to and including 6 feet: 2.875 inch O.D., 5.79 lb/ft
   b) Over 6 feet to 12 feet: 4.00 inch O.D., 9.11 lb/ft.

B. Top, Bottom, and Brace Rails:
   1. FS RR-F-191/3, Type II, Class 1.
   2. Size: 1.660 inch O.D., 1.806 lb. per ft.

C. Bottom Tension Wire:
   1. Coiled spring tension wire:
      a. 7 gage.
      b. Galvanized.

D. Fabric Connections:
   1. Tension Bars:
      a. 3/16 by 3/4 inch mild steel flats.
      b. Galvanized.
   2. Steel Bands:
      a. Mild steel:
         1) 1/8 by 1 inch, except where otherwise indicated.
         2) Use 1/8 by 3/4 inch for gates.
      b. Galvanized.
   3. Bolts:
      a. Minimum 3/16 inch diameter.
      b. Cadmium plated.
   4. Fabric Ties:
      a. No.9 or No. 11 gage wire at line posts.
      b. No.14 wire for top and brace rails.
      c. Galvanized.

E. Post Caps:
   1. Provide following:
      a. Steel, wrought iron, or malleable iron, designed as weathertight closure cap.
      b. One cap for each post.
   2. Finish:
      a. Galvanized, same as specified for posts.

2.03 GATES

A. General:
   1. Fabricate gate perimeter frames of tubular members.
   2. Provide additional horizontal and vertical members to assure proper operation of gate, and for attachment of fabric, hardware, and accessories.
   3. Space so frame members are not more than 8 feet apart.
   4. Fabricate gate frames from galvanized pipe, 1.90 inch O.D., 2.72 lb. per ft.

B. Fabrication:
   1. Assemble gate frames by welding with special malleable or pressed steel fittings and rivets for rigid connections.
   2. Use same fabric as used for fence.
   3. Install fabric with stretcher bars at vertical edges as minimum.

4. Attach hardware with rivets or by other means which will provide security against removal and breakage.
5. Provide diagonal cross-bracing consisting of 3/8 inch diameter adjustable length truss rods on gates where required to provide frame rigidity without sag or twist.

C. Swing Gate Hardware:
1. Hinges:
   a. Pressed or forged steel, or malleable iron, to suit gate size; non-lift-off type, offset to permit 180 degree opening.
   b. Provide 1-1/2 pair of hinges for each leaf over 6 feet in nominal height.
2. Latches:
   a. Capable of retaining gate in closed position
   b. Provide forked type or plunger-bar type to permit operation from either side of gate.
      1) Provide padlock eye as integral part of latch.
3. Additional Hardware for Double Gates:
   a. Provide locking device and padlock eyes as an integral part of latch, requiring one padlock for locking both gate leaves.
      1) Complete Drop Rod Set:
         a) Model CL-DROP-ROD-COM by Hoover Fence Company, or approved equal.
         b) Include guides and components necessary for complete installation.
   b. Provide Centerstop secured to slab, to engage center drop rod.
      1) Chain Link Centerstop:
         a) Model CL-CS-M by Hoover Fence Company, or approved equal.
         b) Provide one for gates in closed position.
   c. Swivel Wheels:
      1) Provide for gate leaves exceeding 5 feet in width.
      2) Model SGW-P by Hoover Fence Company, or approved equal.
4. Padlocks: Furnished by Owner.

2.04 MISCELLANEOUS MATERIALS

A. Concrete for Footings:
1. Comply with requirements of Section 03 3000.

B. Nonshrink Nonmetallic Grout: Factory premixed, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107.
1. Provide one of following or grout specifically recommended by manufacturer for types of applications indicated.
   a. Masterflow 713 Plus; Master Builders Div., BASF Building Systems
   b. Five Star Grout; Five Star Products, Inc.
   c. SikaGrout 212; Sika Corporation.

2.05 GALVANIZING

A. Provide galvanized finish on steel framework and appurtenances, with not less than following weight of zinc per square foot:
1. Zinc-Coated Steel Fabric:
   a. Generally 1.2 oz. per square foot, complying with ASTM A 392, Class 1.

b. For 6 and 9 Gage Wire: 2.0 oz. per square foot, complying with ASTM A 392, Class 2.
2. Pipe: 1.8 oz. per square foot, complying with ASTM A 392, Class 1.
3. Hardware and Accessories: Comply with Table 1 of ASTM A 153.

B. Galvanizing Repair Paint:
1. SSPC-Paint 20, with dry film containing minimum of 94 percent zinc dust by weight, conforming to ASTM A 780.

2.06 PERFORMANCE

A. Wind Load:
1. General:
a. Comply with CLFMI WLG2445 – Chain Link Fence Wind Load Guide
2. Design of chain link fence with privacy slats is based on Wind Speed of 70 miles per hour, Exposure B.

PART 3 EXECUTION

3.01 INSPECTION BY INSTALLER

A. Examine conditions, with installer present, under which fence and gates are to be installed.
1. Notify Contractor in writing of conditions detrimental to proper and timely completion of Work.
2. Do not proceed with Work until unsatisfactory conditions have been corrected in manner acceptable to installer.

3.02 INSTALLATION – GENERAL

A. General:
1. Install fence to comply with ASTM F 567.
2. Do not begin installation and erection before final grading is completed, unless otherwise permitted.

B. Setting Posts:
1. General:
a. Install posts at maximum 10 feet on centers unless otherwise indicated.
b. Set posts so that top of eye is level with top of fabric, with twist and selvage above rail.
2. Setting Posts in Concrete Footings:
a. 12 inch diameter for corner, angle and terminal posts.
b. 10 inch diameter for intermediate line posts.
c. Overall Depth of Concrete: Minimum 36 inches.
d. Post Embedment: Minimum 30 inches.
e. Maintain footings minimum of 1 inch clear of property lines or as indicated.
f. Unless otherwise indicated, extend concrete footings 2 inches above grade and trowel to crown to shed water.
3. Setting Posts in Sleeves:
a. Fill space between post and sleeve solid with non-metallic, non-shrink grout, mixed and placed complying with grout manufacturer's directions.

C. Fabric:
   1. Install fabric on security side of posts unless otherwise indicated.
   2. Set bottom of fabric to clear ground or paving by 1/2 inch.
      a. Fence heights given are to top of fabric.
   3. Secure fabric to posts with ties spaced at 16 inches maximum.
      a. Hook tie at both ends with 9 gage wire
      b. Wrap tie around fabric at both ends, not less than two turns with 11 gage wire.
      c. Hooked ties with links not permitted.
   4. Secure fabric to top rail with 14 gage ties not more than 18 inches on center, wrapped not less than two turns.
   5. Secure tie ends with not less than two full twists
      a. Turn ends so as not to be a hazard.

D. Rails:
   1. Top Rail:
      a. Provide top rail for fencing.
   2. Brace Rails:
      a. Provide horizontal brace rails adjacent to terminal, angle, gate and corner posts, for fencing 6 feet high or higher.
         1) Secure brace rails to posts with rail end fittings and rail end bands.

E. Tension Wire and Tension Bars:
   1. Provide bottom tension wire throughout.
   2. Secure tension wire to fabric with 14 gage wire at 18 inches on center, double wrapped.
   3. Secure fabric at end, corner, angle and gate posts with tension bars extending full height of fence, attached to posts with bands spaced at 14 inches maximum.

3.03 GATE INSTALLATION

A. General:
   1. Provide gates of sizes and types indicated.
   2. Install gates plumb, level, and secure for full opening without interference.
   3. Set gate posts in accordance with spacing shown on Drawings in concrete footings having minimum depth of 42 inches and held 6 inches from bottom of footing.
   4. Install ground-set items in concrete for anchorage in accordance with fence manufacturer's recommendations as approved by Architect.

B. Gate Hardware:
   1. Install specified hardware.
      a. Include guides and components necessary for complete installation.

3.04 REPAIR

A. Galvanized Surfaces:
   1. Clean field welds, bolted connections, and abraded areas.
      a. Repair galvanizing to comply with ASTM A 780.

3.05 CLEANING

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

3.06 PROTECTION

A. Protect Work until Substantial Completion

END OF SECTION 32 3113

SECTION 32 3313

BICYCLE RACKS

PART 1 GENERAL

1.01 SUMMARY

A. Section Includes:
   1.
   2. Bicycle Racks:
      a. Wall Mounted – **Type A**
      b. In-Ground Mounted – **Type B**

B. Related Sections:
   1. Section 03 3000: Cast-in-Place Concrete
   2. Section 32 0523: Concrete for Exterior Improvements; concrete for items other than paving or cast-in-place concrete.
   3. Section 32 1313: Concrete Paving

1.02 REFERENCES

A. ASTM International (ASTM):
   1. ASTM A 53 – Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   2. ASTM B 686 – Standard Specification for Aluminum Alloy Castings, High-Strength

B. National Association of Architectural Metal Manufacturers (NAAMM):
   1. AMP 500 – Metal Finishes Manual

C. Aluminum Association (AA):
   1. CA-92 – Care of Aluminum
   2. DAF-45 – Designation System for Aluminum Finishes.

1.03 SUBMITTALS

A. Product Data:
   1. Manufacturer's specifications installation instructions for:
   2. Bicycle Racks:
      a. Furnish physical characteristics including:
         1) Shape, dimensions, materials, parking capacity, and finish for each bicycle rack

B. Shop Drawings:
   1. Show installation details for each bicycle rack
   2. Furnish setting drawings, templates, instructions, and directions for installation of anchorage devices.

C. Samples:
   1. Finish samples of each finish specified on same material as product, for review and verification.

D. Maintenance Data:
   1. Include recommended methods for each type of bicycle rack for repairing damage to finish.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Firm experienced in manufacturing bicycle racks similar to those required for this Project, with record of successful in-service performance.

B. Installer Qualifications:
   1. Experienced installer who has completed installation of bicycle racks similar in material, design, to extent indicated for this Project, whose work has resulted in construction with record of successful in-service performance.

C. Product Options:
   1. Drawings indicate size, shape and dimensional requirements of bicycle racks and are based on specific systems indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Upon delivery, inspect for damages and notate on Bill of Lading before signing for shipment,

B. Store bicycle racks in original undamaged packages and containers until ready for installation.
   1. Handle bicycle racks with sufficient care to prevent scratches or damage to finish.

1.06 COORDINATION

A. Inserts and Anchorages:
   1. Furnish inserts and anchoring devices which must be set in concrete for installation of site furnishings Work.
   2. Provide setting drawings, templates, instructions and directions for installation of anchorage devices.
   3. Coordinate delivery with other work to avoid delay.

1.07 WARRANTY

A. Manufacturer’s limited warranty against defects in materials and workmanship.
   1. Warranty Period:
      a. One year from date of Substantial Completion and acceptance by Owner.

PART 2 PRODUCTS

2.01 BICYCLE RACKS

A. Manufacturers:
   1. Basis-of-Design:
      a. Designs for Bicycle Rack are based on products as manufactured by Dero Bike Rack Company, Minneapolis, MN

B. Bicycle Rack **Type A**:
   1. Wall Mounted.
   2. Materials:
      a. Arm: 1 inch by 11 gage square tube with 11 gage plate and 1/2 inch round steel bar.
      b. Upright: 2 inches by 2 inches by 11 gage square tube.
      c. Feet: AISC C3 x 4.1 galvanized steel channel.
      d. Crossbeams: 1.25 inches (1.660 inch O.D.) Schedule 40 galvanized pipe
   3. Finish:
      a. Body: TGIC, UV resistant polyester powder coat consisting of preparation with hard sandblasting, electrostatically applied epoxy primer, and application of final TGIC, UV resistant polyester powder coat.
      a. Color: Light Gray
   4. Space Use:
      a. Bikes hang vertically from rack.
      b. Each rack uses a range of lateral space (13 inches to 24 inches typical) and 44 inches of depth/bike.
      c. Allow minimum of 36 inches access aisle between occupied racks.
   5. Installation Method:
      a. Floor Mounted: Floor mounted Ultra Space Saver Squared has holes in feet through which to attach 3/8 inch x 3.75 inches wedge anchors.
      b. Except for feet, connections and mounting parts have pre-threaded mounting holes.
         1) No drilling or tapping is required.
      c. It is responsibility of installer to ensure that base materials into which rack will be installed can support rack and will not be damaged by required installation procedures.
   6. Product and Manufacturer:
      a. Ultra Space Saver Squared Bike Rack, single-sided, as manufactured by Dero Bike Rack Company
         1) Furnish with optional wheel stops.
         2) Number of Units:2
         3) Bikes parked per unit: 1.

C. Bicycle Rack **Type B**:
   1. In-Ground Mounted.
   2. Materials:
      a. Pipe: 2.375 inches O.D., Schedule 40.
      b. Conforming to ASTM A 53.
      c. Provide in-ground Rolling Racks with 3/8 inch x 3 inches steel rod welded to bottom to ensure rack doesn’t pull out after concrete cures.
   3. Installation Method:
      a. In-ground mount embedded into concrete base.
   4. Finish:
      a. TGIC, UV resistant polyester powder coat consisting of preparation with hard sandblasting, electrostatically applied epoxy primer, and application of final TGIC, UV resistant polyester powder coat.
      b. Final Coating Thickness: Not less than 6 mils.
      c. Color: Light Gray
   5. Product and Manufacturer:
      a. Rolling Rack Model RR4H as manufactured by Dero Bike Rack Company
         1) Bikes parked per unit: 9.

2.02 SOURCE QUALITY CONTROL

A. Source Limitations:
   1. Obtain each color, finish, shape, and type of bicycle rack from single source with resources to provide components of consistent quality in appearance and physical properties.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation Method for Bicycle Racks:
   1. Install bicycle racks in locations shown, complying with manufacturer's specifications and recommendations for setbacks and anchoring.
   2. Installation Method:
      a. Wall Mounted:
         1) Secured to wall through holes in mounting plate.
            a) Include mounting hardware.
      b. In-Ground Mounted:
         1) Embedded into cast-in-place concrete base.
   3. Installer's Responsibilities:
      a. Ensure that base materials into which racks will be installed can support rack and will not be damaged by required installation procedures.

END OF SECTION 32 3313

SECTION 33 1116

SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 GENERAL *~~[Coordinate w/ Project Civil Engineer]~~*

1.01 SUMMARY

A. Section Includes:
1. Pipe and fittings for site water lines including domestic water lines.
2. Valves.
3. Pipeline flushing and disinfecting.

B. Related Sections:
~~1. Section 01 3119: Project Meetings; preinstallation meeting.~~
~~2. Section 01 5000: Temporary Facilities and Controls; barricades~~
~~3.~~1. Section 01 5713: Temporary Erosion and Sediment Controls
~~4. Section 01 7419: Construction Waste Management and Disposal~~
~~5. Section 01 7423: Cleaning; site cleaning.~~
~~6. Section 01 7839: Project Record Documents~~
~~7.~~2. Section 31 0000: Earthwork; excavating and backfilling of trenches.

1.02 REFERENCES

A. ASTM International (ASTM):
1. ASTM D 3139 – Standard Specification for Joints for Plastic Pressure Pipes using Flexible Elastomeric Seals.

B. American Water Works Association (AWWA):
1. ANSI/AWWA C105/A21.5 – Polyethylene Encasement for Ductile-Iron Pipe Systems.
2. ANSI/AWWA C111/A21.11 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
3. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast.
4. ANSI/AWWA C509 – Resilient-Seated Gate Valves for Water Supply Service.
5. AWWA C510 – Double Check Valve Backflow-Prevention Assembly.
6. AWWA C511 – Reduced-Pressure Principle Backflow-Prevention Assembly.
7. AWWA C606 – Grooved and Shouldered Joints
8. AWWA C651 – Disinfecting Water Mains
9. ANSI/AWWA C900/C900a – Polyvinyl Chloride (PVC) Pressure Pipe, 4 In. through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution.

C. Public Works Standards, Inc.:
1. Standard Specifications for Public Works Construction (SSPWC):
a. The "Greenbook"; current edition.
2. Standard Plans for Public Works Construction (SPPWC); current edition.

1.03 SUBMITTALS

A. Product Data:
   1. Provide data on pipe materials, pipe fittings, valves and accessories.

B. Manufacturer's Certificate:
   1. Certify that products meet or exceed specified requirements.

C. Project Record Documents:
   1. Record actual locations of piping mains, valves, connections, thrust restraints, and invert elevations.
   2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
   3. Comply with additional requirements specified in Section 01 7839.

1.04 QUALITY ASSURANCE

A. Perform Work in accordance with utility company requirements.

B. Preinstallation Meeting:
   1. Conduct meeting one week prior to start of Work of this Section in accordance with requirements of Section 01 3119.
      a. Require attendance by affected installers.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers with labeling in place.

1.06 SEQUENCING

A. Sequencing:
   1. Ensure that utility connections are achieved in an orderly and expeditious manner.

PART 2 PRODUCTS

2.01 WATER PIPE

~~A. Ductile Iron Pipe:~~
   ~~1. Conforming to AWWA C151:~~
   ~~2. Fittings:~~
      ~~a. Ductile Iron: Standard thickness.~~
   ~~3. Joints:~~
      ~~a. Rubber gasket with rods.~~
         ~~1) Conforming to AWWA C111,~~
   ~~4. Jackets:~~
      ~~a. Polyethylene jacket.~~
         ~~1) Conforming to AWWA C105/A21.5~~

~~B.~~A. PVC Pipe:
   1. Conforming to AWWA C900 Class 200:
      a. Fittings:

1) Conforming to AWWA C111, cast iron.

b. Joints:

~~C.~~ Conforming to ASTM D 3139 compression gasket ring.

1)

T

~~D.~~c. ~~T~~race Wire:

1) Magnetic detectable conductor, brightly colored plastic covering, imprinted with "Water Service " in large letters.

2. Underground water service pipe sizes up to 3-inch shall be high density polyethylene pipe (HDPE) with tracer wire. Pipe and fitting system shall be pressure class 333 (DR7). All material shall be manufactured from a PE 4710 resin listed with the Plastic Pipe Institute (PPI) as TR-4. The resin material shall meet the specifications of ASTM D3350 with a minimum cell classification of 445474C. HDPE pipe and fittings shall contain no recycled compounds except that generated in the manufacturer's own plant from resin of the same specification from the same raw material. HDPE products shall be homogeneous throughout and free of visible cracks, holes, foreign inclusions, voids, or other injurious defects.
Pipe sizes smaller than 3" shall be manufactured to the dimensional requirements listed in ASTM D3035, and 3" Pipes shall have a manufacturing standard of ASTM F714. Pipes and fittings shall meet AWWA C901 and shall be listed as meeting NSF-61.
Installer shall be certified by manufacturer for HDPE pipe and joint installation.
Manufacturer: ISCO, JM Eagle or equal.

a: Butt Fusion HDPE Fittings shall meet the following requirement:

1) Molded fittings shall comply with the requirements of ASTM D 3261.

2) All fabricated elbows, tees, reducing tees and end caps shall be produced and meet the requirements of ASTM F2206.

3) Socket fittings shall meet ASTM D 2683.

4) Installer shall be certified by manufacturer for this type of joint installation.

Manufacturer: ISCO, JM Eagle or equal.

b: Bolted Connections- Flanges and MJ Adapters shall be fused onto the pipe and have a minimum pressure rating equal to or greater than the pipe and shall meet the following requirement:

1) Metallic back-up rings (Van-Stone style lap joint flanges), shall have a radius on the inside diameter of the bore so as to be compatible with HDPE Flanges. Back up rings shall have bolt pattern that will mate with AWWA C207 Class D (generically known as 150 pound patterns).

2) Flange assemblies shall be assembled and torqued according to PPI TN-38.

3) Installer shall be certified by manufacturer for this type of joint installation.

~~1.~~

2.02 VALVES

A. Valves:
   1. Manufacturer's name and pressure rating marked on valve body.

B. Gate Valves 3 Inches and Over:
   1. Conforming to AWWA C509:
      a. Iron body, bronze trim, non-rising stem with square nut, single wedge, resilient seat, flanged ends, control rod, post indicator, valve key, and extension box.
   2. Acceptable Products:
      a. Mueller 2360 Series
      b. Clow F-6100 Series
      c. U.S. Pipe Metroseal 250
      d. Approved equal.

C. Ball Valves Up To 2 Inches:
   1. Brass body, Teflon coated brass ball, rubber seats and stem seals, Tee stem pre-drilled for control rod, AWWA inlet end, compression outlet with electrical ground connector, with control rod, valve key, and extension box.
   2. Acceptable Manufacturers:
      a. Ford, Jones, or Mueller.

D. Check Valves,
   1. Post Indicator Valves, and Backflow Preventers:
      a. In accordance with local Water District/Company Requirements.
   2. Double Check Detector Assemblies (DCDA):
      a. Conforming to AWWA C510 and LA County DHS Approved Backflow Prevention Devices.

2.03 BEDDING AND COVER MATERIALS

A. Bedding and Cover:
   1. As specified in Section 31 0000.

2.04 ACCESSORIES

A. Thrust Blocking:
   1. Conforming to NFPA 24 A.10.8.2
      a. Factor of Safety: 1.5
      b. Water Pressure: 200 psi
      c. Soil Bearing: 2,000 pounds per square foot.

B. Backflow Preventer:
   1. In accordance with local Water District/Company and Fire Department Requirements.
   2. Product and Manufacturer:
      a. Model 975XL Reduced Pressure Principle Assembly by Zurn Wilkins or approved equal.

C. Meters:

1. Provide in accordance with local Water District/Company Requirements.
2. Product and Manufacturer:
    a. Recordall Disc Meters Model 70 by Badger Meter.

D. Fire Department Connection (FDC):
1. Provide with sign t indicating type of system, address served by FDC, and pumping if greater than 150 psi.
2. Lettering:
    a. Minimum 1 inch, color contrasting to background.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.02 PREPARATION

A. Cut pipe ends square, ream pipe and tube ends to full pipe diameter, remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare pipe connections to equipment with flanges or unions.

3.03 TRENCHING

A. Refer to Section 31 0000 for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Form and place concrete for pipe thrust restraints at each change of pipe direction.
1. Place concrete to permit full access to pipe and pipe accessories.

D. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.04 INSTALLATION - PIPE

A. Maintain separation of water main from sewer piping in accordance with Temecula Water and Health Department code.

B. Group piping with other site piping work whenever practical.

C. Establish elevations of buried piping to ensure not less than 3 feet of cover.

D. Install grooved and shouldered pipe joints Complying with AWWA C606.

E. Route pipe in straight line.

F. Install pipe to allow for expansion and contraction without stressing pipe or joints.

G. Slope water pipe and position drains at low points.

H. Install trace wire 12 inches above top of pipe;
   1. To read: "Water Line Below" in large blue letters.

3.05 INSTALLATION – VALVES

A. Set valves on solid bearing.

B. Center and plumb valve box over valve:
   1. Set box cover flush with finished grade.

3.06 SERVICE CONNECTIONS

A. Provide water service to utility company requirements.

3.07 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with SSPWC Standards, unless indicated or directed otherwise.

B. Pressure test water piping in accordance with Water District/Company standards.

C. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.

3.08 PIPELINE DISINFECTING

A. General Requirements:
   1. Perform disinfecting (chlorination and flushing) of site water distribution piping in accordance with AWWA C651, and as follows:
      a. Complete disinfecting of newly laid or repaired pipelines and appurtenances before pipelines are connected to existing water distribution system.
      b. Isolate pipelines and appurtenances from existing water distribution system during disinfecting.
      c. Disinfect services, air release valves, and other appurtenances connected to newly laid pipeline at same time as that of pipeline.
      d. Exercise care to expel air from pipeline and services during filling operation.

B. Contractor Responsibilities:
   1. Temporary Piping and Appurtenances for Disinfecting:
      a. Supply temporary piping, corporation and curb stops, bulkheads, plugs, pipe end caps, valves, fittings, equipment, labor and method necessary for flushing and disinfecting newly laid pipeline.
      b. Provide temporary piping, backflow devices, and appurtenances needed to carry potable water to section of pipeline being flushed and disinfected.
      c. Corporation and curb stop taps:
         1) When used for flushing and disinfecting:

a) Comply with service tap requirements for ductile iron pipe.

2) Unless specified otherwise, make tap at top of pipe.

3.09 DISPOSAL OF FLUSHED WATER

A. Disposal of water used in flushing and disinfecting sections of pipeline is sole responsibility of Contractor.

B. Dispose of flushed water from Project Site complying with following procedures:
   1. Perform disposal of water in strict observance of water pollution control requirements of California Regional Water Quality Control Board.
   2. Obtain National Pollutant Discharge Elimination System (NPDES) permit.
      a. Comply with permit in discharge of flushing water.

C. Apply reducing agent to disinfecting solution to neutralize residual chlorine or chloramines remaining in water.
   1. Take precautions necessary in providing for adequate drainage from Project Site.
   2. Control flow of water from sections of pipeline to prevent erosion of surrounding soil, damage to vegetation, altering of ecological conditions in area, and damage to construction or maintenance activity occurring in ditch or storm drain downstream of discharge.

3.10 CONNECTING TO EXISTING DISTRIBUTION SYSTEM

A. After disinfecting has been completed and demonstrated to comply with Specifications, connect newly laid pipeline to existing distribution system.

B. Where connections are to be made to existing potable water system, swab or spray interior surfaces of pipe and fittings used in making connections with five percent or greater hypochlorite solution as directed by Inspector.

C. When connection is completed, thorough flushing is required until discolored water is removed.

3.11 REMOVAL OF TEMPORARY PIPING AND APPURTENANCES

A. After newly laid section of pipeline has been approved by Inspector for connection to existing distribution system, disconnect and remove temporary piping, fittings, backflow devices, and other appurtenances used for flushing and disinfecting.

B. Remove and replace stops used for disinfecting of pipeline with stainless steel repair clamps.

END OF SECTION 33 1116

SECTION 33 3100

SANITARY UTILITY SEWERAGE PIPING

PART 1 GENERAL

~~*[Coordinate w/ Project Civil Engineer]*~~

1.01 SUMMARY

A. Section Includes:
1. Sanitary sewerage drainage piping, fittings, and accessories.
2. Connection site sanitary drainage system to municipal sewers.
3. Cleanout Access.

B. Related Sections:
~~1. Section 01 3119: Project Meetings; preinstallation meeting.~~
~~2. Section 01 5000: Temporary Facilities and Controls; barricades~~
~~3.~~1. Section 01 5713: Temporary Erosion and Sediment Controls
~~4. Section 01 7419: Construction Waste Management and Disposal~~
~~5. Section 01 7423: Cleaning; site cleaning.~~
~~6. Section 01 7839: Project Record Documents~~
~~7.~~2. Section 31 0000: Earthwork; excavating and backfilling of trenches.

1.02 REFERENCES

A. ASTM International (ASTM):
1. ASTM D 2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
2. ASTM D 2729 – Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings.

B. Public Works Standards, Inc.:
1. Standard Specifications for Public Works Construction (SSPWC):
a. The "Greenbook"; current edition.
2. Standard Plans for Public Works Construction (SPPWC); current edition.

1.03 DEFINITIONS

A. Bedding:
1. Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

B. Manufacturer's Installation Instructions:
1. Indicate special procedures required to install Products specified.

C. Project Record Documents:
1. Record location of pipe runs, connections, cleanouts, and invert elevations.
2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.
~~3. Comply with additional requirements specified in Section 01 7839~~

NEW 2-STORY CLASSROOM BUILDING
WILL ROGERS MIDDLE SCHOOL
LAWNDALE ELEMENTARY SCHOOL DISTRICT
~~[PROJECT NAME]~~
~~[PROJECT LOCATION]~~
~~[SCHOOL / COLLEGE DISTRICT]~~

1.04 SUBMITTALS

A. Product Data:
   1. Provide data indicating pipe, pipe accessories.

1.05 QUALITY ASSURANCE

A. Preinstallation Meeting:
   1. Conduct meeting one week prior to start of Work of this Section ~~in accordance with requirements of Section 01 3119.~~
      a. Require attendance by affected installers.

1.06 SEQUENCING

A. Sequencing:
   1. Ensure that utility connections are achieved in orderly and expeditious manner.

PART 2 PRODUCTS

2.01 SEWER PIPE MATERIALS

A. Provide products that comply with applicable codes.

B. Plastic Pipe:
   1. Poly(Vinyl Chloride) (PVC) material:
      a. Diameter as indicated.
   2. Conforming to ASTM D 2729.

C. Fittings:
   1. Same material as pipe.
      a. Molded or formed to suit pipe size and end design:
         1) In required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

D. Lubricant:
   1. Suitable for lubricating joint components:
      a. With no deteriorating effects on gasket or pipe material
      b. Will not support growth of fungi or bacteria.
      c. Furnish type as recommended by gasket manufacturer.

2.02 PIPE ACCESSORIES

A. Trace Wire:
   1. Magnetic detectable conductor:
      a. Brightly colored plastic covering.
      b. Imprinted with "Sanitary Sewer Service " in large letters.

2.03 CLEANOUT MANHOLE

A. Manholes:

1. Provide in accordance with SSPWC requirements.
2. Lid and Frame:
   a. Provide in accordance with SSPWC requirements.
3. Shaft Construction:
   a. Cast iron, of internal diameter as indicated.
      1) With 4,000 psi concrete (Type II cement):
      2) Maximum 0.50 Water/Cement Ratio
   b. Provide with collar for cleanouts.

2.04 BEDDING AND COVER MATERIALS

A. Pipe Bedding and Cover Material:
   1. As specified in Section 31 0000.

PART 3 EXECUTION

3.01 GENERAL

A. Perform work in accordance with applicable codes.

3.02 TRENCHING

A. Refer to Section 31 0000 for additional requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.03 INSTALLATION – PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on Drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions.
   1. Seal watertight.
   2. Plastic Pipe:
      a. Complying with ASTM D 2321.

C. Lay pipe to slope gradients noted on layout drawings:
   1. With maximum variation from true slope of 1/8 inch in 10 feet.

D. Install trace wire 6 inches above top of pipe:
   1. Coordinate with Section 31 0000.

3.04 INSTALLATION – CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

C. Establish elevations and pipe inverts for inlets and outlets as indicated.

D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.05 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with SSPWC Standards, unless indicated or directed otherwise.

3.06 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 33 3100

SECTION 33 4200

STORMWATER CONVEYANCE

PART 1 GENERAL

~~*[Coordinate w/ Project Civil Engineer]*~~

1.01 SUMMARY

A. Section Includes:
1. Storm drainage piping, fittings, and accessories.
2. Connection of drainage system to municipal sewers.
3. Catch basins
4. Trench drains
5. Plant area drains
6. Paved area drainage
7. Site surface drainage

B. Related Sections:
~~1. Section 01 3119: Project Meetings; preinstallation meeting.~~
~~2. Section 01 5000: Temporary Facilities and Controls; barricades~~
~~3.~~1. Section 01 5713: Temporary Erosion and Sediment Controls
~~4. Section 01 7419: Construction Waste Management and Disposal~~
~~5. Section 01 7423: Cleaning; site cleaning.~~
~~6. Section 01 7839: Project Record Documents~~
~~7.~~2. Section 31 0000: Earthwork; excavating and backfilling of trenches.

1.02 REFERENCES

A. ASTM International (ASTM):
1. ASTM C 76 – Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
2. ASTM C 443 – Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
3. ASTM C 969 – Standard Practice for Infiltration and Exfiltration Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines.
4. ASTM D 1785 – Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
5. ASTM D 2729 – Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fitting.

B. American Association of State Highway and Transportation Officials (AASHTO):
1. AASHTO M 252 – Standard Specification for Corrugated Polyethylene Drainage Pipe.
2. AASHTO M 294 – Standard Specification for Corrugated Polyethylene Pipe, 300- to 1500 MM (12- to 60- in.) Diameter.

A. Public Works Standards, Inc.:
1. Standard Specifications for Public Works Construction (SSPWC):
a. The "Greenbook"; current edition.

2. Standard Plans for Public Works Construction (SPPWC); current edition.

C. American Water Works Association Standards, current edition.

1.03 DEFINITIONS

A. Bedding:
1. Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.04 SUBMITTALS

A. Product Data:
1. Provide data indicating pipe, pipe accessories, and inlets.

B. Manufacturer's Certificates:
1. Certify that products meet or exceed municipal requirements.

C. Manufacturer's Installation Instructions:
1. Indicate special procedures required to install products specified.

D. Field Quality Control Submittals:
1. Document results of field quality control testing.

E. Project Record Documents:
1. Record location of pipe runs, connections, catch basins, cleanouts, manholes, and invert elevations.
   a. Comply with requirements of Section 01 7839.
2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

1.05 QUALITY ASSURANCE

A. Coordination:
1. Coordinate installation of storm drain with size, location and installation of service utilities.

B. Preinstallation Meeting:
1. Conduct meeting one week prior to start of Work of this Section ~~in accordance with requirements of Section 01 3119.~~
   a. Require attendance by affected installers.

1.06 SEQUENCING

A. Sequencing:
1. Ensure that utility connections are achieved in an orderly and expeditious manner.

1.07 REGULATORY REQUIREMENTS

A. Conform to SSPWC code for materials and installation of Work.

PART 2 PRODUCTS

2.01 STORM DRAIN PIPE MATERIALS

A. Provide products that comply with applicable codes.

~~B. Concrete Pipe:~~
~~1. Reinforced, with Wall Type A~~
~~a. Mesh reinforcement~~
~~b. Bell and Spigot end joints.~~
~~2. Conforming to ASTM C 76, Class II~~

~~C. Reinforced Concrete Pipe Joint Device:~~
~~1. Rubber compression gasket joint.~~
~~a. Conforming to ASTM C 443~~

~~D.~~B. Plastic Pipe:
1. Poly Vinyl Chloride (PVC) material:
   a. Diameter as indicated
   b. Bell and Spigot style
   c. Solvent sealed joint end.
2. Conforming to ASTM D 1785, Schedule 40

2.02 PIPE ACCESSORIES

A. Fittings:
1. Same material as pipe:
   a. Molded or formed to suit pipe size and end design.
   b. In required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

B. Trace Wire:
1. Magnetic detectable conductor.
   a. With clear plastic covering.
   b. Imprinted with "Storm Drain" in large letters.

2.03 CATCH BASIN, CLEANOUT, AND AREA DRAIN COMPONENTS

A. Catch Basin:
1. Size and type as indicated.
2. Materials and installation in accordance with manufacturer's specifications.
3. Filter insert as indicated.

B. Area Drain:
1. Size and type in accordance with Drawings.
2. Materials and installation in accordance with manufacturer's specifications.

C. Filter Insert:

1. Model and size as indicated.
2. Materials and installation in accordance with manufacturer's specifications.

D. Precast Storm Filter Manhole:
1. Model and size as indicated.
2. Materials and installation in accordance with manufacturer's specifications.

2.04 BEDDING AND COVER MATERIALS

A. Bedding and Cover:
1. As specified in Section 31 0000.

PART 3 EXECUTION

3.01 TRENCHING

A. Refer to Section 31 0000 for additional trenching requirements.

B. Hand trim excavation for accurate placement of pipe to elevations indicated.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.02 INSTALLATION – PIPE

A. Verify that trench cut is ready to receive Work and excavations, dimensions, and elevations are as indicated.

B. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

C. Connect to building storm drainage system, foundation drainage system, and utility/municipal sewer system.

D. Make connections through walls through sleeved openings, as provided.

E. Install continuous trace wire 12 inches above top of pipe.
   1. Coordinate with Section 31 0000.

3.03 INSTALLATION – CATCH BASINS, TRENCH DRAINS, AND CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

C. Level top surface of base pad:
   1. Sleeve concrete shaft sections to receive storm sewer pipe sections.

D. Establish elevations and pipe inverts for inlets and outlets as indicated.

E. Mount lid and frame level in grout, secured to top cone section at elevation indicated.

3.04 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with SSPWC Standards, unless indicated or directed otherwise.

3.05 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 33 4200